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LAND-TENURE ISSUES AS FACTORS IN ENVIRONMENTAL DESTRUCTION IN BRAZILIAN AMAZONIA: THE CASE OF SOUTHERN PARÁ

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Summary:

Land-tenure issues have been prominent forces driving deforestation and the spread of extensive ranching as the dominant land use in Brazilian Amazonia. Southern Pará is the part of Amazonia where these issues are most explosive, and an examination of this region in terms of its land-tenure issues, their environmental consequences and measures needed provides potentially valuable information for formulating policies that promote more socially and environmentally sound development. The problems of southern Pará are likely to spread to increasingly broader sections of Amazonia. The present paper reviews the current land-tenure situation in southern Pará and attempts to identify policy changes that would reduce its environmental impact.

KEYWORDS: Amazonia, Brazil, Land Tenure, Agrarian Reform, Deforestation, Settlements

1. INTRODUCTION

Land-tenure issues affect virtually every decision in Brazilian Amazonia, from the investments of labor and capital by landholders of all sizes to the migration of populations, the formation and action of social movements and the launching of government and international programs. Deforestation and logging are direct outcomes of these decisions. Changes in land-tenure procedures will be central to all efforts to redirect development to paths that are more sustainable, socially beneficial and environmentally sound than the present ones. The current pattern of land occupation unfolds as an environmental symptom of the absence of rule-of-law, including woefully inadequate property law and a system of financing that is characterized by routine fraud.

Alston et al. (2000) have recently provided a game-theoretic conceptual framework for interpreting the frequency of land conflicts in Pará in terms of the interests of landholders and of the landless migrants who invade their holdings. Deforestation is in the interests of both groups of actors as a means of increasing the probability of an outcome favorable to the group in question and as a factor reducing the probability of violent conflicts. Ironically, Alston et al. (2000) find that the resettlement efforts of the National Institute for Colonization and Agrarian Reform (INCRA) serve to increase the probability of violent conflicts. The same logic would apply to other means by which INCRA efforts induce the two sides to increase the effort they devote to securing land claims, including speeding deforestation activity.

As in any part of the Earth, the number of people who can be supported in rural areas of Amazonia is limited by such factors as the area available for settlement, the average per-hectare level of agricultural productivity that can be sustained, the level of consumption of the population and limitations on environmental impacts such as deforestation (Fearnside, 1986a). In Amazonia, the total area that can be cleared is constrained by potentially grave impacts of large-scale deforestation, while the area on which agriculture or ranching can be intensified is limited by physical resources such as phosphates (Fearnside, 1997a,b).

The uneven distribution of land tenure in Brazilian Amazonia represents a severe limitation on the area allocated for family agriculture because most of the private land is currently held by large landholders; of the total area of private land (including forests) in the Amazonian states, 62% was in holdings 1000 ha or larger as of the last full agricultural census in 1986 (Brazil, IBGE, 1989). Of the 4 million km^2 portion of Brazilian Amazonia that was originally forested (an area the size of Western Europe), the area deforested by 1998 totaled 551,782 km^2 (Brazil, INPE, 2000), an area larger than France. At least 80% of this is now under cattle pasture or under secondary forest in pastures that have been degraded and abandoned (Fearnside, 1996). Much of the pasture area is in the hands of large landholders. Redistributing pasture now held in large ranches to the region's landless population and converting these areas to family agriculture would represent a significant advance in reducing the extreme social inequalities that predominate today.

Despite Amazonia's vast size, Brazil's landless population of 4.8 million families (Langevin and Rosset, 2000) is too large to be supported by distributing land in Amazonia (Fearnside, 1985). Solutions must be found outside of Amazonia to

support the landless populations in the non-Amazonian states. The continuing migration of this population to Amazonia renders inviable any plan to support the region's present rural population through "agrarian reform," which, as the term is used in Brazil, includes both redistributing large private landholdings and distributing forest areas still in the public domain. Nowhere is this more evident than in southern Pará. The problems of southern Pará are likely to spread to increasingly broader sections of Amazonia, making the lessons that can be learned in this area valuable inputs to decisions throughout the Amazon region. The present paper reviews the current land-tenure situation in southern Pará and attempts to identify policy changes that would reduce its environmental impact.

2. LAND-TENURE ISSUES

(a) Legal status of land

The majority of the land in Brazil's 5 million km^2 Legal Amazon region (Fig. 1) has, until quite recently, been in the public domain, either under the federal or state governments. Land is incorporated into private properties by a variety of mechanisms. Legally, public land can pass to large private owners through occasional offers of land for sale through sealed tenders (licitações), while small plots of land called "lots" (lotes) are sold to colonists in government-sponsored settlement areas. The areas of lots distributed to settler families decreased from 100 ha in the 1970s to 50 ha in the 1980s. The land was sold under favorable terms with five-year grace periods and 6% annual interest—far below the rate of inflation at the time. In practice, opportunities have usually been rare and are now nonexistent for obtaining public land through these legally correct avenues: while large areas of public land were distributed in this way in the 1970s, such distributions have not occurred since 1987. Instead, a long tradition dating from colonial times has carried out most transfers to private ownership through illegal invasions, both by large and small actors, the role of the government being a later "regularization" (regularização) or "legalization" (legalização) of the land holdings that exist on the ground (e.g., Rosenn, 1971).

[Figure 1 here]

Agrarian reform is now predominantly done through redistribution of large private holdings rather than public lands. The legal procedure for this redistribution has, until now, been one of expropriation and indemnification (compensation) of the landowners, as specified by Brazil's Land Statute (Law 4330 of 30 Nov. 1964). Since 1985, indemnification has been paid in Agrarian Debt Bonds (TDAs) rather than cash, thus allowing more rapid expropriations. The TDAs mature at varying times depending on the size of the area expropriated, most commonly in 20 years. Land is distributed to settlers by INCRA. Expropriation and distribution of land proceeded very slowly until after 1994, when the pace quickened markedly as a direct result of land occupation by various grassroots organizations, especially the Landless Rural Workers' Movement (MST). In the five years from 1995 to 1999, 372,866 families were settled in Brazil, more than the 218,000 families settled in the preceding 30 years since the 1964 Land Statute (Schwartzman, 2000).

Since 1997 a system of "market-driven" agrarian reform has been under testing in five states in semi-arid Northeast Brazil in the "Land Certificate" (Cédula da Terra)

program financed by the World Bank. Land is bought by cash payments to landowners at market prices and financed with loans to the settlers with three-year grace periods and 18% annual interest. The program is resisted by the MST, which sees it (probably correctly) as an effort to undercut its role in initiating land reform; the program is also criticized for the unfavorable terms of the loans, which are unlikely to be payable from agricultural production in the lots (Schwartzman, 2000). This program is being extended to the rest of the country as the World Bank's US$2 billion six-year "Land Bank" (Banco da Terra) project. As of July 2000, the expropriation and indemnification model still predominated in the eastern Amazonian state of Pará.

Before road transport reached areas in the interior of Amazonia in the early 1970s, large tracts of land were granted as long-term concessions (aforamentos) for harvesting products such as rubber (Hevea brasiliensis) or Brazil nuts (Bertholletia excelsa). Land has often been captured by "land grabbers" (grileiros) who use forged deeds, often in combination with bribery, threats and violence, to obtain areas illicitly. In Brazil as a whole today, 75% of the properties with over 10,000 ha (latifúndios) have invalid titles, according to the Minister of Land-Tenure Policy (de Souza, 2000). A substantial part of the land in Pará is registered in the name of "ghosts" (fantasmas), or fictitious people (Pinto, 1999). These irregularities are facilitated by Brazil's Byzantine system of land-title registration, with a multitude of different registry offices (cartórios) where documents may be filed and a variety of types of documents dating from different historical periods. Land claims frequently overlap and, until Brazil's planned national land registry (cadastro) is implemented, most land documents do not have georeferenced information on property boundaries.

In July 2000 the Ministry of Land-Tenure Development cancelled the registrations of 1899 large holdings (77% of the total number) as part of an effort to check the documentation of large landholdings throughout the country (Brazil, MDF, 2000). In Pará, 344 registries were cancelled, or 88% of the latifúndios in the state. Landholdings with cancelled registries cannot be sold, subdivided, rented or mortgaged unless and until a valid title is presented to INCRA. The prevalence of irregular titles means that the land-tenure situation in the area could change radically if land that is now in the hands of "land grabbers" is actually expropriated.

In South and Southeast Pará, hereafter referred to simply as "southern Pará" (Fig. 1), the initiative for settling small farmers comes primarily from a variety of social movements that organize landless migrants. While the MST is the largest of these movements at a national scale and is the one that exerts the most political pressure on the federal government, in southern Pará the Federation of Workers in Agriculture (FETAGRI) is the largest. Social movements establish camps (acampamentos), either in private land or on roadsides in front of properties that the movements wish to press the government to expropriate. If the government accedes to these demands, then the camps are either transformed into INCRA settlements (assentamentos) or the people are offered plots of land in settlements elsewhere in the area.

As of July 2000, INCRA had 276 settlements in southern Pará, containing 46,000 legally recognized families (plus a substantial floating population). An additional 5000 families were waiting in 29 camps. The camps established by social movements receive a food dole (cesta básica) from INCRA provided they do not enter private

land. Entry of migrants into private land, referred to as "invasion" by the government and as "occupation" by the migrants, is still common, despite INCRA's policy beginning in 1999 of not inspecting and expropriating properties that have been invaded. Attention is currently focused on Fazenda Cabaceiras (35 km south of Marabá); the MST has been camped in this ranch since April 1999 (the occupiers temporarily withdrew to the roadside in July 2000 to allow the INCRA inspection that is required for a decision on expropriation).

Vast areas of pasture dominate land use in the area, stretching beyond the range of sight from the major roads. Most of the land is held in large cattle ranches, often with absentee owners. At least nine large ranches (each with approximately 10,000 ha) are held by the Mutran family, which obtained 99-year concessions for Brazil nut exploitation before the area was accessible to road transport (e.g., Bunker, 1985; de Almeida, 1995; Emmi, 1988). The legal status of these concessions is a key point to be settled in the current land disputes: the MST claims that the concessions only allow harvest of Brazil nuts, not deforestation or logging. These concessions are handled by the state-level Institute for Lands of Pará (ITERPA), rather than by the federal agency (INCRA). Likely legal complications include the possibility of ranchers claiming that concession terms had been violated "in good faith" (de boa fé) and the great difficulty of removing anyone, large or small, who has occupied land unopposed for over one year, according to Brazilian law. The existence of pasture serves as the ranchers' proof that the land is "occupied." Pasture also counts as an "improvement" (benfeitoria) on the land that must be compensated if the land is expropriated, thus imposing practical limits on the amount of pasture land that the government can afford to expropriate.

The MST claims that pasture is not "productive land" (classification as "unproductive" allows expropriation). The MST argues that pasture does not fulfill the "social function of the land" required by Brazil's 1988 constitution (Article 184). MST's interpretation of "social function" is that the land must produce both food and employment. While the extensive pasture systems that predominate in the ranches provide both beef and jobs, the amounts of each produced per hectare are miniscule (Hecht, 1993). INCRA classifies productivity based on a point system that includes points for pasture based on the density of cattle stocked and the economic return of the operation. In the case of the Fazenda Cabaceiras, an INCRA team with two MST observers began inspecting the ranch in July 2000 to decide its classification as "productive" or "unproductive."

(b) Land conflicts

Southern Pará is a 40-municipality region covering 49 million hectares, and is periodically proposed as a separate "state of Carajás" with its capital at Marabá. This area is infamous as the part of Amazonia where land-tenure issues are most explosive, and has had a continuing series of violent land conflicts between small farmers and large landholders since the early 1970s (e.g., Foweraker, 1981; Schmink, 1982). It was here that 19 members of the MST were shot by federal police in April 1996 in the Eldorado dos Carajás massacre, an event that resulted in abrupt changes in public policies in the area. Colonization during the 1970s followed the heavily subsidized Integrated Colonization Project (PIC) model of the Transamazon Highway (Smith, 1982). In the 1980s, the flux of migrants increased dramatically, and the response

here was replacement of INCRA in the area in 1980 by the Executive Group for Lands of the Araguaia and Tocantins (GETAT), a military agency that carried out summary expropriations of private land that was "unimproved" (i.e., forested) and rapid distribution of the land as lots in settlement areas with minimal infrastructure. The land bordering the Carajás mining area was of highest priority (e.g., Fearnside, 1986b).

GETAT was abolished in 1987, after which an 11-year hiatus ensued during which agrarian reform remained at a standstill until INCRA reinitiated activities in the area in November 1996 in the aftermath of the Eldorado dos Carajás massacre. In the meantime, the unemployed urban and rural populations had swollen tremendously with the exhaustion of the Serra Pelada gold mine at the end of the 1980s and major layoffs by the company running the Carajás iron mine (Companhia Vale do Rio Doce: CVRD), privatized in 1997. Inadequacies in the resettlement of the 23,871 people displaced by the Tucuruí Dam in 1984 contribute to the backlog of social problems (Fearnside, 1999a). For example, in the Rio Moju resettlement area, 60% of the families who were moved from the reservoir area sold or abandoned their lots in the first six years of settlement (Magalhães, 1994, p. 454).

Conflicts between ranchers and squatters have long been common, but now conflicts are arising between squatters and settled colonists who have lots of 20-25 ha in INCRA settlement areas such as the Progresso area established in 1987. Areas such as these contain significant floating populations, composed both of individual migrants who have not joined organized squatter movements, including migrants who have received lots from INCRA previously and are disqualified from being settled again.

(c) Failure and turnover of settlers

The difficulty of implanting and maintaining sustainable production systems in Amazonian settlement areas is apparent. Among other deficiencies, settlers often have little knowledge of how to manage a farm, including both basic administrative skills and knowledge of the special problems of Amazonian agriculture. In some cases, such as the Palmares-I and -II projects, settlers were brought from shantytowns on the outskirts of Marabá. Urban slum dwellers make notoriously poor farmers, a profession that requires at least as much specialized knowledge as urban jobs (Moran, 1981). It should be emphasized that lack of success of many migrants in government settlement projects is not the result of any inherent defect in the people who are settled, as sometimes is claimed by officials (see de Almeida, 1994). Failure often results from lack of timely and appropriate material support, as well as from a combination of information and attitudes that need to be acquired.

Lot turnover is a perennial problem inhibiting a reduction in deforestation rates. When lots are abandoned or sold, the former owners move on to deforest elsewhere. If abandoned, the lot left behind remains unchanged for a period of time but may be invaded by landless migrants. If the lot is purchased by a second wave of settlers, it is likely to be consolidated with neighboring lots to form a small ranch. The bank debts, including those from the National Program for Family Agriculture (PRONAF), are tied to the lots rather than to the persons who received the loans. This serves as a strong stimulus to abandoning lots once the financing funds are received. It also

makes it difficult for others to buy abandoned lots, since the purchaser would have to inherit the former owner's debts. Because those abandoning the lots are often absconding with the loan money, the subsequent purchaser would be taking on the debt without a corresponding level of improvements on the lot from investment of the financing funds. The result is that banks are left with an inventory of lots, which are then exposed to subsequent invasions by the floating population.

Agricultural extension (including educational services) is essential to implanting sustainable systems. EMATER, the federal agency for agricultural extension has, in recent years, limited its activities to serving as an intermediary for agricultural credit rather than acting as an extension agency. In 1997 INCRA established an independent extension program called the "Lumiar Project," which, until it was abolished in June 2000 due to legal difficulties, paid agricultural extension agents to attend settlers in 29 of the 276 settlement projects (11%) in southern Pará. The agents were thinly spread in the favored projects; for example, in the Palmares-II project, three agents covered 517 families in a 15,000-ha area. Financing through PRONAF grants up to R$9500 (US$5135) per family for projects appropriate to the land they have, such as milk cows for those with pasture and irrigated cupuassu (Theobroma grandiflorum) and coconut seedlings for those with forest. The association that organizes the colonists in a given settlement area can deduct 2% of the PRONAF funds for the purpose of contracting a private firm to provide extension services. The colonist associations have often not been wise in their choice of extension firms. For example, the Progresso settlement area chose a firm (AGROPAN) without qualified extension agents; the money was paid and the firm effectively disappeared.

Chronic problems include corruption in government agencies and sometimes also among association officers, who have on a number of occasions absconded with funds obtained for their associations through PRONAF financing (e.g., the Progresso settlement area). Untenable financial decisions also abound. An example is provided by the MST-led association at the Palmares-II settlement area, which jumped at the opportunity of generous financing offered in the wake of the Eldorado dos Carajás massacre to obtain a mechanized manioc flour mill, a chicken-feed mill, a milk-cooling facility, a chicken slaughterhouse, as well as a pool of trucks and tractors. With the exception of the vehicles and occasional use of the chicken-feed mill, all of these facilities stand idle. The 10-year financing has a two-year grace period, which expires in 2001 before any significant agricultural production is expected.

It is important to understand that agriculture in Brazil receives government subsidies of many types, including frequent "amnesties" (anistías) in which unpaid debts are forgiven. This applies both to large ranchers and agribusinesses and to small farmers. The situation in the US during the "dust bowl" of the 1930s, when bank foreclosures expelled thousands of small farmers from their land, would be politically inconceivable in contemporary Brazil. Instead, the normal course of events is for extensions of loan periods to be granted when crop yields are poor, often ending in a default (calote).

The experiences of the Progresso and Palmares-II settlements indicate that material support by itself is not sufficient to overcome the barriers to establishing successful agriculture. The success of both individual colonists and of colonist associations depends heavily on individual initiative. An example is provided by the

CORRENTAO cooperative in Nova Ipixuna, where material support and local leadership coincided in setting up a processing plant for cupuassu, assai (Euterpe oleracea) and other nontimber products extracted from the forest. While limited resources for material support can always most effectively be used by selecting only those projects with strong leadership, this does not solve the problem of what to do with the rest of the settlements. Means of actively fostering initiative are needed.

(d) Industry of expropriation

Generous compensation of ranchers for expropriated land has made some ranchers who are in economic difficulty eager to have their land taken for agrarian reform. INCRA frequently pays more per hectare as compensation for the "improvements" (mostly pasture) on the land than the expropriated ranches would fetch on the open market (corruption is often alleged in the process of setting values for compensation). In some cases, favorable terms have led to a form of collusion between squatters' organizations, ranchers and Brazil's federal bank, the Banco do Brasil. A rancher with heavy debts can invite a squatters' organization to invade the property (or, alternatively, to establish a roadside camp in front of the property without invading it). When INCRA expropriates the property, the compensation allows payment of the bank debt, which is advantageous to the bank because of the high probability of the rancher defaulting on the loan had the invasion and expropriation not occurred. The squatters are benefited by obtaining land with little risk of violent resistance. In environmental terms, this situation results in further deforestation, since invasion virtually always occurs in the forested portion of the properties. Invasion of indebted properties is apparently common in Mato Grosso, but in the Marabá area, INCRA estimates that it represents only about 10% of cases.

Compensation for expropriated land is largely paid in the form of TDAs, which can be used at face value to pay debts owed to the Banco do Brasil. On the open market, these bonds have traditionally been sold for only a fraction of their face value, and are often referred to as "rotten bonds" (títulos podres). Since 1996, however, the federal government has been privatizing a series of large state-run enterprises, and the (usually multinational) consortia that purchase these can pay for them using TDAs at face value. The result is that the secondary market for TDAs has bid their value to unprecedentedly high levels. This makes it especially attractive for ranchers to have their land expropriated at the present time, thus contributing to the motivation for collusion between landless migrant organizations and the owners of the ranches they choose to occupy. This leads to more rapid deforestation.

(e) Industry of invasion

A frequent accusation by INCRA is the existence of an "industry of invasion" in which migrants receive land from INCRA, sell it, and get land again in other INCRA settlements. Often they register the second lot in the name of a spouse or child. At least in theory, INCRA disqualifies those who are detected in this process (a rare occurrence in practice). INCRA officials are emphatic that in some of the camps, particularly those organized by the Movement for Struggle for the Land (MLT), most of the migrants are subsidized by urban patrons such as shopkeepers in neighboring towns like Curionópolis and Parauapebas, and that the migrants will pass the land to their patrons once they receive it from INCRA. Part of the problem of reselling lots

might be solved by applying heavy taxes to land sales, possibly in conjunction with increasing the bureaucratic barriers to transferring land titles. Lack of an adequate nationwide registry of settled migrants impedes effective measures to halt the "industry of invasion."

More effective identification of those who have had lots before is only part of the problem. While it would relieve the government of the endless expense of repeatedly resettling the same people, the problem does not end there. A floating population of landless migrants who are ineligible for settlement already exists and is part of the growing level of conflict between already settled smallholders and individual squatters. This floating population will grow substantially if an improved registry system begins to function. It is also worth noting that the underlying assumption that any person has the right to one opportunity to be settled in an INCRA project is itself open to question. If, for example, the proposal of some actors (such as FETAGRI) for an ecological-economic zoning in this part of Pará is adopted, this implies a limit to the amount of land that will be assigned to agrarian reform, and therefore to the number of families that can be settled in the area. The message for the migrants who arrive after the areas zoned for settlement have been distributed as lots would therefore be that they have no right to receive an INCRA lot in the region.

(f) Escalating demands

One of the hallmarks of the MST is the central role of ideology, other political goals being important to the movement beyond gaining land and assistance for the migrants themselves (Silveira, 2000). The MST is divided between groups demanding additional expropriations for new settlements and those representing migrants who have already obtained land and now want financing, agricultural extension and other government benefits (e.g., Figueiredo, 2000). Once land is granted, settlers often shift their demands to financing, roads and technical assistance. This transition can lead either to an evolution of demands or to splitting into groups with different emphases; for example the Palmares project split into the less-ideological Palmares-I and the more-ideological Palmares-II settlements. Different organizations cover a spectrum of different orientations. For example, FETAGRI focuses on the needs of sustaining agriculture for those who have already been granted a plot of land.

In the case of MST settlements and camps, the families are expected to provide a subsidy to invasions in private ranches (such as Fazenda Cabaceiras). This is done by sharing the monthly food allotment given by INCRA until the first PRONAF financing arrives (these sources of government support are, of course, not available to occupants on private land). Later, the farmers in established settlements are expected to share part of the production from their lots. This poses an obvious problem for a settlement such as Palmares-II, which does not have nearly enough agricultural production to pay for the financing already granted. On the other hand, MST's system of financing its activities adds an important element of independence to the initial stages of its land-occupation initiatives. In later stages the demand for sources of government support increases, as is also often the case with non-MST settlements.

Dependence on government assistance tends to become an endless spiral of escalating demands from which the settlers must sooner or later be weaned. An example is provided by the former Fazenda Bamerindus, where those settlers in the Progresso

settlement area who received 20-ha lots with cacao are now clamoring for money to pay others to prune the cacao trees for them (personal observation). For settlers in most areas, receiving a lot with healthy cacao trees already producing would be a dream rather than a reason for complaints.

(g) Migration flows

New migrants arrive in the region in a continuous flow, especially those from the state of Maranhão who arrive on the Carajás railway. Maranhão is a state known for its extreme poverty, rapid population growth and highly skewed land-tenure distribution. Migrants are expelled from Maranhão by a development pattern that continues to increase the concentration of wealth in the hands of a small elite while impoverishing the majority of the population. According to INCRA, an average of 100 families arrive per week on the train. INCRA officials are emphatic that municipal governments in Maranhão regularly pay the trainfare to export population.

The most basic barrier to solution of land-tenure problems in southern Pará is the continued flow of migrants. The great majority come from Maranhão, although some come from other source areas. If the flow of population from Maranhão is to be stopped by means of efforts to improve the organization of settlements in the Marabá area and by closing of the frontier through zoning coupled with enforcement of restrictions on settling in forest areas, then the conditions faced by migrants who arrive on the train would have to be substantially worse than they are at present in order to stem the influx. Since migrants currently face dramatic hardships, including a substantial risk of being killed in violent conflicts with landholders, this option for discouraging potential migration is unacceptable.

The continual arrival of landless population, particularly from Maranhão, is an aspect of the situation that is qualitatively different from the already great backlog of unsettled migrants in southern Pará. Migration to the area is an aspect of the situation for which a solution must be found if the spiral of social and environmental degradation in the region is to be contained. Provision of passenger service plays a public-relations role for CVRD, which is understandably eager to show that the company provides social benefits to the region rather than merely removing iron ore from the Carajás mine, the world's largest high-grade iron-ore deposit. The environmental cost of facilitating population movement to rainforest areas is, of course, not emphasized in company advertising.

The Carajás railway, completed in 1984, was financed by the World Bank, the European Economic Community and the Japanese Import-Export Bank. At the time it was considered a "model of environmental progress" (Goodland, 1985). However, only direct impacts were evaluated in the World Bank's environmental assessment, and the area of influence considered was confined to a 100-km strip along the railway plus the mine and port areas (Fearnside, 1989). . The Pilot Program to Conserve the Brazilian Rainforest (PPG-7) now provides a framework through which efforts to contain environmental destruction in this part of Amazonia might be funded by the same sources that originally financed the railway (Brazil, MMA, 2000).

3. LAND TENURE AND THE ENVIRONMENT

(a) Deforestation

For many years ranchers have considered themselves to be "obliged" to clear forest to guarantee their tenure because, despite prohibitions of deforestation, any landowner who did not clear would, in practice, lose the land either to expropriation or to invasion. Land-tenure problems are leading to environmental destruction through both direct and indirect effects, speeding deforestation by both large and small landholders. It should be emphasized that the bulk of deforestation is done by large and medium ranches (Fearnside, 1993, 1997c). LANDSAT satellite imagery for 1998 indicates that slightly over half of the clearing done over the 1997-1998 period in Brazilian Amazonia was in the form of continuous patches at least 100 ha in area (Brazil, INPE, 2000), a scale of activity that exceeds by at least a factor of 20 what a small farmer can clear in a single year using family labor.

The current invasion of large ranches by organized landless peasants occurs almost exclusively in the forested portions of the properties (e.g., Fazenda Cabaceiras). This is undoubtedly partly due to the greater likelihood of ranchers reacting with armed resistance if the pasture areas of the properties are invaded. Another important factor is the difficulty of planting annual crops such as rice and maize in pasture areas because of the compacted soil, the thick mat of pasture grass roots, and the propensity of the grass to resprout as a weed after crops are planted. Converting pasture to crops is a task that, using manual tools, would be daunting to even the strongest migrants.

Maintaining productivity as pasture also faces impediments, either for small settlers or for large ranchers. Pasture degrades after about ten years, but can be "recuperated" if the logs and stumps are mechanically removed and the land is plowed, fertilized, limed and replanted (Faminow, 1998; Mattos and Uhl, 1994). These operations cost approximately R$1500 (US$811) per hectare, much more than the average cost of R$350/ha (US$180/ha) to buy pasture land or R$80/ha (US$43/ha) for forest land. This discourages intensification of pasture as long as land is available for purchase.

The settlement process leads to clearing of additional forest even for the portion of the population that is settled in already cleared areas. For example, in the Palmares-I settlement area (begun in 1993), colonists who received pasture land plant annual crops in the lots of their neighbors who received land still under forest. The settlements lead inexorably to a landscape dominated by pasture that, except for the greater density of houses, has the same general aspect as the vast areas of pasture in the neighboring large landholdings. The Boca do Cardoso settlement area, begun by GETAT in 1986 in an area of continuous forest dominated by Brazil nut trees, provides a sad example. The impermanence of the colonist population is as apparent today as it has been since the 1970s in the PICs along the Transamazon Highway (Highway BR-230), where almost all of the original colonists have sold out and gone away. In Boca do Cardoso, one of the second wave of lot owners has bought 11 lots, which he manages as a small cattle ranch (personal observation). The pattern of lot turnover and consolidation repeats the experience of the Transamazon Highway (Fearnside, 1986a).

The process of establishing settlement areas leads to infrastructure investments that induce further deforestation. INCRA wants to build 25,000 km of access roads for the 276 currently existing settlements (however, as of July 2000 the agency only had

funds for 1200 km). While road access is essential for viable commercial agriculture, it is also well known as a key factor in accelerating deforestation (Fearnside, 1987).

INCRA has not been initiating new settlements in forested areas in Amazonia since 1996. In November 1999 this practice was formalized by an operating directive (INCRA/ IBAMA Portaria 88/98), requiring only non-forested areas to be selected for new INCRA settlements. While this has frequently been cited by government officials as indicating that new settlements do not cause deforestation, this conclusion could not be further from the truth. In reality, virtually all new settlement areas have continued to be established in forested land, even though it is true that INCRA does not itself select these locations. This is because INCRA, in practice, no longer selects the sites for new settlement areas at all. Rather, the MST or other squatters' organizations select the locations by choosing the ranches to be invaded, and INCRA's role is confined to subsequent "legalization" of these faits accomplis. In addition, previously established settlements in forest areas are frequently expanded.

(b) Logging

The role of logging may contribute to the selection of forested areas for invasion, since squatters often sell logs. The Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), which is responsible for regulating logging, is only sporadically present. Intense logging in the forested portions of settlement areas (such as the Progresso settlement area) is evident; settlers may receive a small payment for allowing the logging, although some undoubtedly takes place as simple theft. Loggers cut the Brazilnut trees for which the region is famous as the "Brazil nut polygon" (polígono dos castanhais). This species is legally protected by Brazil's forestry code (Law 4771 of 15 September 1965). Isolated trees have therefore been left standing in pastures, where the trees often die when pastures are burned to control invading woody vegetation. In 1995 a loophole was opened in the protection of Brazil nut trees, allowing trees to be cut that are already dead or dying (desvitalizados) (IBAMA Portaria 048/95 of 10 July 1995). This loophole expires at the end of the year 2000, but may be renewed. Rampant cutting of live Brazil nut trees is everywhere apparent (personal observation). The absence of IBAMA enforcement of logging regulations strikes at the basis for sustainable forest management: protection from unfair competition from unsustainable logging.

Entry of migrants into private land can stimulate logging in the remainder of the forest reserve by the landowner or by loggers who pay the owner a fee for the timber they remove (e.g., Fazenda Cabaceiras). Timber sale can also provide a form of collusion between the migrants and the landowners. Because current regulations effectively permit 3 ha of deforestation per year per family (MMA Instrução Normativa 07/99 of 17 April 1999), with the right to sell 15 m^3 of logs per hectare cleared, this provides the main mechanism for legal delivery of logs to sawmills and for obtaining documents that give the appearance of legality to deliveries from forbidden sources. In contrast, obtaining approval of a forestry management plan from IBAMA requires at least two years and considerable expense. For ranch owners who have already cleared the legally permitted percentage of their properties, which is the usual case in the Marabá area, the investment of time and money needed to obtain approval of a forest management plan effectively closes the opportunity for the ranch owners to

harvest timber legally from the forested portion ("legal reserve") of their land. The net result is a spur to deforestation by migrants.

(c) Environmental services

Groups on all sides are learning to use an ecological discourse, from the MST to the large landholders represented by the Union of Rural Producers of Marabá (PRORURAL). It is still sometimes unclear whether this discourse is a first step to more environmentally sound development or a means of neutralizing the influence of environmental concerns as an impediment to further destruction.

Most promising is a proposal by FETAGRI called PROAMBIENTE (pro-environment), which calls for granting a percentage of agricultural loan amounts from the Banco da Amazônia (BASA) as a subsidy to cover the incremental costs of sustainable and reduced-impact practices. FETAGRI argues for the subsidy on the basis of the environmental services of the forests left uncut (e.g., Fearnside, 1997d). Much remains to be defined, such as how to monitor the improved practices, how to attribute avoided deforestation and how to deal with cases of non-compliance. A source of funds for a subsidy of this kind would also have to be found, such as international negotiations related to carbon benefits (Fearnside, 1999b).

4. NEEDED MEASURES

National policies are needed to fortify family agriculture, redirecting government priorities from soybeans and other land uses adapted to large landholders. Reclaiming of pasture land for agriculture, sometimes denominated "recuperation of degraded lands," is an essential activity if the large ranches are to be redistributed to small farmers without spurring further deforestation.

Major progress in stabilizing the colonist population is vital to all other goals of development, including limiting environmental destruction. Among other measures, this will require substantial investment in education and health (including family planning). Consideration should be given to the possibility of environmental services as a source of support, as through the PROAMBIENTE proposal.

Effective restrictions are needed on selling of lots and on subsequently receiving lots under the agrarian reform program. This will require a national registry of settled migrants. Changing the terms of financing to tie loans to individuals rather than to plots of land would help reduce colonist turnover. Establishing the rule of law is a prerequisite for other policy tools, such as ecological-economic zoning, which can not be expected to contain environmental destruction unleashed by theft, fraud and corruption.

The severe land-tenure and environmental problems caused by the continuing flux of migrants to the Marabá area are likely to be repeated as transport improves to neighboring frontiers. Paving the Transamazon Highway from Marabá to Altamira, and then westward to Rurópolis (expected under the 2000-2003 Pluriannual Plan, also known as "Avança Brasil"), is likely to funnel this flux into these areas, where larger areas of uncut forest remain. This underlines the need to take action to diminish the flow of people to Marabá, particularly from Maranhão.

Slowing the flow of population from Maranhão requires, at a minimum, an end to some municipal governments in Maranhão paying the fare for migrantsand removing any subsidy by CVRD in providing passenger service on the railway. Terminating passenger servicemay eventually need to be considered . Increased efforts are also needed to achieve agrarian reform and viable family agriculture production within Maranhão. No program to deal with land-tenure and environmental problems in southern Pará can expect to be successful without ending the export of population from source areas. Facing the problem of migration is a prerequisite for successful amelioration of social and environmental problems in Amazonia by establishing the rule of law, redistributing pasture areas in large landholdings and implanting sustainable forms of family agriculture in their place. GLOSSARY OF ACRONYMS

BASA: Banco da Amazônia, S.A. (Bank of Amazonia, Inc.)
CNA: Confederação Nacional de Agricultura (National Confederation of Agriculture)
CORRENTAO: Cooperativa dos Trabalhadores Agro-Extrativistas de Nova Ipixuna (Cooperative of Agro-extractivist Workers of Nova Ipixuna)
CVRD: Companhia Vale do Rio Doce (Rio Doce Valley Company)
EMATER: Empresa de Assistência Técnica e Extensão Rural (Enterprise for Technical Assistance and Rural Extension)
EMBRAPA: Empresa Brasileira de Pesquisa Agropecuária (Brazilian Enterprise for Agricultural and Cattle-Ranching Research)
FETAGRI: Federação dos Trabalhadores na Agricultura (Federation of Workers in Agriculture)
GETAT: Grupo Executivo das Terras do Araguaia-Tocantins (Executive Group for Lands of the Araguaia and Tocantins)
IBAMA: Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute for the Environment and Renewable Natural Resources)
ITERPA: Instituto das Terras do Pará (Institute for Lands of Pará)
INCRA: Instituto Nacional de Colonização e Reforma Agrária (National Institute for Colonization and Agrarian Reform)
MLT: Movimento de Luta pela Terra (Movement for Struggle for the Land)
MMA: Ministério do Meio Ambiente e da Amazônia Legal (Ministry of the Environment and of the Legal Amazon)
MST: Movimento dos Trabalhadores Rurais Sem Terra (Landless Rural Workers' Movement)
PPG-7: Programa Piloto para Conservação das Florestas Tropicais do Brasil (Pilot Program to Conserve the Brazilian Rainforest)
PRONAF: Programa Nacional de Agricultura Familiar (National Program for Family Agriculture)
PRORURAL: Sindicato dos Produtores Rurais de Marabá (Union of Rural Producers of Marabá)
PIC: Projeto Integrado de Colonização (Integrated Colonization Project)
TDA: Títulos da Dívida Agrária (Agrarian Debt Bonds)

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FIGURE LEGEND

Figure 1. Brazil's Legal Amazon region and South and Southeast Pará with locations mentioned in the text.

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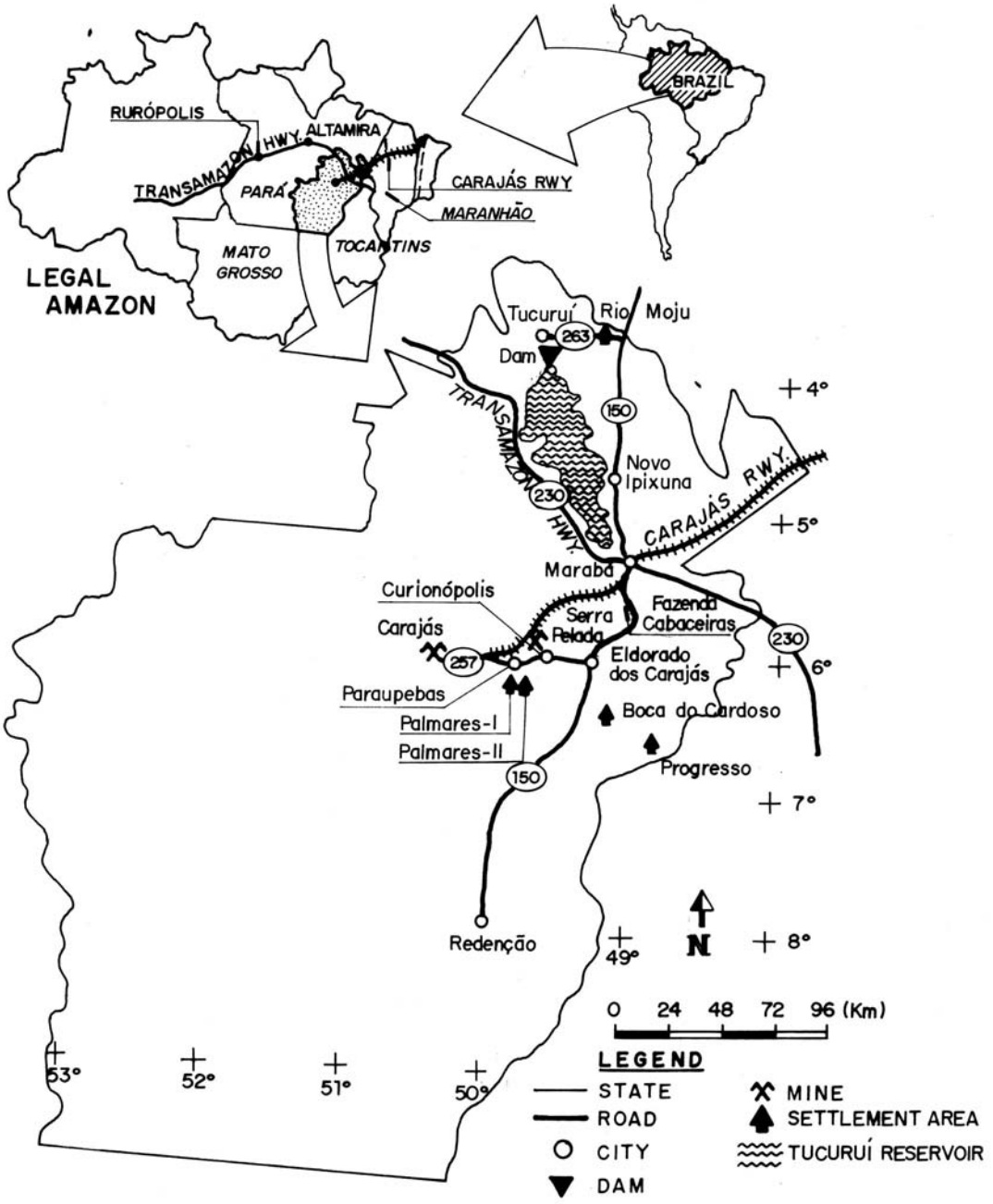
BRAZIL
RURÓPOLIS
ALTAMIRA
TRANSAMAZON HWY.
PARÁ
CARAJÁS RWY
MARANHÃO
TOCANTINS
MATO GROSSO
LEGAL AMAZON
Tucuruí
Rio Moju
263
Dam
150
TRANSAMAZON HWY.
Novo Ipixuna
230
CARAJÁS RWY.
Marabá
Curionópolis
Carajás
Serra Pelada
257
Fazenda Cabaceiras
230
Eldorado dos Carajás
Paraupebas
Palmares-I
Palmares-II
Boca do Cardoso
Progresso
150
Redenção
+4°
+5°
+6°
+7°
+8°
49°
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LEGEND
STATE
ROAD
CITY
DAM
MINE
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