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Brazilian Policies that Encourage Deforestation in the Amazon

HANS P. BINSWANGER*
The World Bank, Washington, DC

Summary. — This paper shows that general tax policies, special tax incentives, the rules of land allocation, and the agricultural credit system all accelerate deforestation in the Amazon. These policies increase the size of land holdings and reduce the chances of the poor to become farmers. The key provisions include: the virtual exemption of agricultural income from income taxation; rules of public land allocation that provide incentives for deforestation because the security of a claim is determined by land clearing; a progressive land tax that contains provisions that encourage the conversion of forest to crop land or pasture; a tax credit scheme aimed toward corporate livestock ranches that subsidizes inefficient ranches established on cleared forest land; and subsidized credit available for SUDAM-approved ranches.

These distorting provisions must be removed before afforestation projects and programs can succeed. Afforestation and settlement projects should take into account the effect of these distortions, and the projects should thus have modest expectations. While reducing perverse economic incentives for deforestation will slow down the destruction of the Amazon forest, incentive policies alone are not enough. A coherent system of land use planning that sets aside more marginal lands in forest reserves and establishes biological reserves is also required. Even under the best incentive regimes, these reserves, as well as Indian reservations, will have to be protected by the power of the law and its enforcement agents. As part of this strategy, forest guards must be given greater incentives to enforce forest preservation laws currently in place.

1. INTRODUCTION

Some fiscal and legal provisions in Brazil encourage the Amazon's deforestation by increasing the demand for farm, pasture, and ranch land — thereby increasing deforestation at the frontier of settlement and accelerating the conversion of forest to farm land in already settled areas. This report focuses on six sets of such provisions:

- Taxes on agricultural income
- Rules of land allocation
- Land taxes
- Capital gains and commodity taxes
- Regional and sectoral taxes
- Provisions for credit

The provisions distort settlement and increase deforestation, thwarting programs and projects to preserve forest areas.

2. TAXES ON AGRICULTURAL INCOME

Brazil's income tax laws virtually exempt agriculture and convert it into a tax shelter. This

exemption adds to the demand for land and makes urban investors and corporations compete aggressively for land at the frontiers of settlement and in areas of well-established settlements. This competition results in unequal land ownership holdings (as large farms buy up smaller ones) and increases the rate of conversion of forest to crop land or pasture.

Corporations and individuals can exclude up to 80% and 90%, respectively, of agricultural pro-

*This paper is based on a 1987 Discussion Paper of the Research Unit of the World Bank's Agriculture and Rural Development Department: "Fiscal and legal incentives with environmental effects on the Brazilian Amazon." It covers some of the same issues discussed in Dennis J. Mahar (1989), "Government policies and deforestation in Brazil's Amazon region." In this paper, however, more attention is given to the general regime of taxation and its impact on land markets and migration in the Amazon.

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fits from their taxable income by using a variety of special provisions of the income tax code. The tax code contains very favorable treatments for agricultural expenditures and investments. Landholders can choose between two tax policies. They can elect to be taxed on 10% of their gross agricultural revenues, or the cost of modern inputs or investments can be subtracted from gross agricultural income.

Fixed investments, animals, buildings, and machines and vehicles can not only be depreciated completely in the first year, but depreciated several times over by using a multiplication factor which ranges from two to six. Up to 80% of farm profits can be sheltered in this way. If the resulting multiples of expenditures and investments exceed current income, they can be carried forward to reduce the tax liabilities of the next four years. The net effect is that almost all agricultural income escapes taxation.

Neither corporations nor individuals can offset agricultural losses against nonagricultural taxable incomes. Some consumer expenditures, however, can be disguised as agricultural costs and it is thereby possible to shelter some nonagricultural income as well.

Corporate agricultural profits are taxed at a rate of only 6%. Combined with the depreciation provisions, the tax on corporate agricultural profits can be as low as 1.2%. Corporate profits from other sources are subject to a tax rate of 35–45%.¹

The implication of this tax treatment is that private and corporate investors will undertake projects in agriculture, even though the projects have a lower economic rate of return than nonagricultural projects. Therefore, the demand for land by corporations and by individuals in high income tax brackets increases, resulting in a faster expansion of agriculture into frontier areas. It also provides incentives for the accumulation of large land holdings.

Small farmers and other poor individuals cannot benefit from the tax breaks because they do not pay income tax. The income tax treatment not only provides no benefits to the poor, it also affects the poor negatively. If agricultural income is taxed at lower rates than nonagricultural income and agriculture is a tax shelter, the market price of land will contain a component capitalizing these tax preferences. The market price for land becomes too high for the poor to buy, even if given credit.

In a perfect market, the value of land reflects the present value of agricultural profits, capitalized at the opportunity cost of capital. If the poor have to use credit to buy land at its present value, the only income stream they have available for

consumption is the imputed value of family labor. They must use the remaining profits to pay for the loan. If the poor can get the same wage in the labor market, they are no better off as landowners than they would be as workers. This example is, moreover, an ideal situation where the interest rate paid by the poor is equal to the interest rate that the most creditworthy borrowers can get. The poor generally have to pay higher interest rates and therefore have to reduce consumption below what they could have earned in the labor market.

If the value of land exceeds the capitalized agricultural profits, the poor must cut consumption below the imputed value of family labor to pay for the land. Anything that drives the land price above the capitalized value of the agricultural income stream thus makes it impossible for the poor to buy land without reducing consumption.

The income tax shelter is not the only distortion capitalized into the land value. With the size of populations growing and the demand for land increasing, some of the expected future appreciation of the land price is capitalized into the current land price. The only way a poor person could have access to that income stream is by selling off a small parcel of land every year to pay for his or her interest costs. This is clearly infeasible for small landholders. In addition, Brandão and Rezende (1988) show that high and unstable inflation rates in Brazil have clearly increased the land price — that credit subsidies, discussed further below, have also been partly capitalized into the land price. These factors further increase the difficulties of poor people in buying land. This encourages them to move to the frontier in search of unclaimed land.

3. THE RULES OF LAND ALLOCATION²

It is a mistake to assume that there are large areas of unclaimed land in the Amazon. By the time roads are constructed, most federal or state land is claimed by some individual or corporation, however doubtful the claim may be. These claims are bought and sold. Case-specific procedures convert individual claims into legal titles. In addition, 'regularization' is a process that will confer titles to all holders of claims in a given region. All land disputes in a given region are solved by regularization, an administrative and legal process that results in a complete cadaster and secure title. Corporate projects approved by SUDAM (Superintendência do Desenvolvimento da Amazonia) or the Grande Carajás program receive special preferences in land titling.

How do individuals show that they have a solid claim on land? They do this most effectively by squatting. The right known as *direito de posse* has been formally recognized since 1850, but goes back to criteria of settling land disputes in colonial times (Nascimento, 1985). This right states that a squatter, or *posseiro*, who lives on unclaimed public land (*terra devoluta*) and has used it 'effectively' for at least one year and one day, has a usufruct right over 100 hectares. If the *posseiro* fulfills the condition of living on and effectively using the land (*cultura efetiva e morada habitual*) for more than five years, he or she has the right to acquire a title. Land can also be acquired by squatting on private land for a time without being challenged by the owner.

These rights may appear to favor the establishment of relatively small farms. But in lands under federal control, up to 3,000 hectares may be claimed by using the *direito de posse* and the attendant administrative and regulative procedures. In the Grande Carajás area, for example, INCRA (Instituto Nacional de Colonização e Reforma Agrária) uses the following rules. A claimant who lives on the land gets preference to obtain a title for up to three times the area which he or she cleared of forest.³ Therefore, squatters have an incentive to rapidly deforest large areas, even if their agricultural operations do not justify it.

In Mato Grosso, Goiás, Para, and Maranhão, these or similar rules have resulted in the allocation of most public land to individually owned ranches or to large corporations. The reason is that corporations and large ranches have a major advantage over poor individuals in the rush for land: they have the capital to build their own access roads into the forest. This advantage enables them to lay claim on land much farther from major highways than could poor settlers. Small farmers have difficulties in finding land for squatting. They can typically only claim land a few kilometres from public roads, as they could neither market products nor have access to health or education facilities if they ventured further. Often, their only alternative is to invade land that already is clearly privately claimed, leading to land disputes.

Most World Bank-sponsored projects are in Rondônia. This region differs from other areas of the Amazon. In Rondônia, in areas that INCRA allocates land for settlement projects, all agricultural land is divided into small plots. Nevertheless, for most of the legal Amazon area, large private and corporate ranches account for most of the area covered by allocations.

The rules of land allocation encourage rapid deforestation on individually owned ranches,

because the final amount of land that receives title under regularization is a multiple of the area converted to pasture. In addition, clearing land provides protection against small squatters and land invasion, as squatters do not invade land already converted to pasture. Some people allege that it may be enough to clear land of the original forest, only to let secondary forest grow back, as irrevocable user certificates are issued after one year of occupation. The importance of this phenomenon, however, is not easy to assess.

Small-scale squatters are often accused of greatly contributing to deforestation. While they may be responsible for deforestation in some regions, as in Rondônia, they are less of a problem than ranchers. If small farmers want to claim one *módulo* of land (a plot large enough to support a family), they have no legal or procedural incentive to clear land beyond the area needed for their slash-and-burn agriculture. Yet within their allocated plots, the system will reduce forest area rapidly. Primary forests are destroyed in the process of slash-and-burn agriculture, replaced by pasture or secondary forest. Soil degradation is minimal because soils are covered by vegetation for all but short periods during the first few growing seasons, and because initially the highest quality soils are chosen. But as under all shifting cultivation systems, soil fertility declines, and weed infestations become a serious problem after the first one or two seasons.

In land-abundant conditions, shifting cultivation is the most cost-effective way of producing subsistence crops, whether cost is measured by labor, purchased inputs, or total cost (Pingali, Bigot and Binswanger, 1987). Because shifting cultivation is so cost-effective, it is unrealistic to assume that small farmers can be induced to keep a proportion of their land under forest and work only a smaller area of land. The only way to reduce forest destruction is to reduce plot sizes allocated to small farmers and set land aside elsewhere in large, well-guarded forest reserves. The World Bank projects in Rondônia now attempt to do this by creating small reserves near the settlers. Small local forest reserves, however, will be invaded by other squatters, and are difficult for the forest service to guard.

4. LAND TAXES

In principle, a progressive land tax on the size of the ownership holding could offset the effects of the favorable income tax treatment on the land market by making it less profitable to have land in large holdings. Brazil's land tax code, though

progressive in principle, now contains many exceptions so that effective tax rates are not progressive in practice.

The Estatuto da Terra and other legislation provide for a progressive land tax. Farms smaller than two *modulos* pay no land taxes, while farms larger than 100 *modulos* pay 3.5% of the unimproved value of their land (*terra nua*). Apart from direct evasion, the land tax can be reduced by a factor of up to 90%, depending on the intensity of land use and the productivity of the farm. Both tax formulas use reduction factors directly and positively related to the use of the land (da Silva, 1986).

The key point is that forest land is considered unused. A farm containing forests is therefore taxed at higher rates than one containing pastures or crop land. Converting forest to pasture on larger farms will therefore reduce the land tax, providing incentives for deforestation. The major impact of this legislation is likely to be felt in settled areas where the enforcement of the land tax is fairly strict.

The major changes needed in allocation and tax rules are as follows:

- (a) Lowering the ceiling of land that can be allocated to a single owner under regularization from 3,000 hectares to perhaps 100 or 200 hectares. This will still enable families to establish larger ranches by distributing ownership among several members.
- (b) Introducing a land ceiling on corporate land holdings or reducing it where it exists.
- (c) Changing the definition of land use (*cultura efetiva*) for the regularization process and including forms of forest management.

5. OTHER FEDERAL TAXES

No other federal tax regulations, such as capital gains or commodity taxes, appear to contain provisions that affect deforestation.⁴ There are, however, a number of regional and sectoral tax breaks that encourage investment in enterprises using cleared forest land.

6. REGIONAL AND SECTORAL TAX PREFERENCES

SUDAM, the Grande Carajás Program, and the IBDF (Instituto Brasileiro de Desenvolvimento Florestal) can single out a corporate enterprise and provide it with special tax incentives. Of all the incentives discussed below, the SUDAM'S tax credit scheme for corporate live-

stock ranches in the legal Amazon has the largest effect on deforestation. Another tax credit scheme is provided by the IBDF to corporations that agree to undertake afforestation. Reports of these tax credit schemes show that the recipients are far better at receiving tax credits than at producing beef or planting trees (Brazil, 1987; Gasques and Yokomizo, 1986).

Special programs for regional tax incentives exist for enterprises in specific locations or subsectors. These programs aim to improve the economic development of the region or subsector through such means as investment, agricultural development, generation of employment, industrial decentralization, and use of appropriate technology. The following regions and sectors receive special incentives that affect deforestation:

- (a) The legal Amazon (administered by FIDAM — (Fundo de Investimentos de Amazonia) — and SUDAM).
- (b) The Grande Carajás area, which contains portions of the states of Maranhão, Para, and Goiás (administered by the Grande Carajás Council).
- (c) The Northeast (administered by SUDENE (Superintendência de Desenvolvimento do Nordeste) and FINOR (Fundo de Investimentos do Nordeste)).
- (d) The forestry, fisheries, and tourism sectors (administered by FISET — Fundo de Investimentos Setoriais).

There are five classes of incentives:

- (i) Income tax holidays of up to 10 years (Grande Carajás only).
- (ii) Reinvestment tax credits that approved enterprises can use for expansion or modernization investments (limited to 50% of a corporation's liabilities).
- (iii) Generalized tax credits that any corporation in Brazil can use to set up, invest in, or participate in approved enterprises (limited to 25% of a corporation's tax liabilities).
- (iv) Tax credits for individuals for 45% of their investments into stocks of FIDAM, FINOR and FISET (limited to a maximum of 6% of an individual's tax liabilities).
- (v) Exemptions from import tariffs, export taxes, and commodity taxes for imports or exports of approved enterprises (Grande Carajás program only).

Each of these incentive programs is available to firms whose projects have been approved by the administering entity. The approval process contains a variety of safeguards, some of which are intended to protect the environment.⁵

Only to the extent that forest or agricultural products are used by nonagricultural corporations will measures (i) and (ii) have an impact on deforestation. Examples are the expansion of charcoal production for a tax-exempt pig iron factory, or production of logs for a tax-exempt lumber company. In the nonagricultural sectors, income tax holidays are perhaps the least distortionary form of tax incentives. Unlike tax credits they cannot induce investments into enterprises which are not expected to produce a pretax profit.

Income tax holidays and tax credits for modernization are not relevant for agriculture and livestock corporations, as these corporations already escape the income tax via the general provisions for agricultural income described above. It is therefore incorrect to assume that these provisions are an additional factor for speeding up deforestation at the frontier.

Tax credits, measures (ii), (iii), and (iv), can induce investments with a negative expected profit. Measure (iii), generalized tax credits available to corporations all over Brazil, is the most important. The system is described clearly in Browder (1986) and in Nascimento (1985) and will not be discussed in detail here. The tax credit system allows any corporation in Brazil to use up to 25% of its tax liabilities to invest directly in approved enterprises or to acquire equity in such corporations. An approved enterprise located in the Amazon can finance up to 75% of its planned investments in this way. The balance of 25% of total investment must come from the parent company's own resources. Corporations will therefore invest in approved enterprises even if the enterprises have negative rates of return to overall invested resources. Attempts at policy reform should focus sharply on this set of tax credits.

Reinvestment tax credits are only relevant for nonagricultural enterprises which have taxable profits. Tax credits for individuals to invest in stocks of the investment funds FIDAM, FINOR, and Fiset, measure (iv), appear to be less important because few investors appear to take advantage of the provision.⁶

These regional tax credits have a great impact on deforestation through their encouragement of uneconomic livestock production. Many authors have studied the effects of the tax credits and the economics of livestock production, and their findings are summarized here. By September 1985, SUDAM had approved 527 livestock projects (Gasques and Yokomizo, 1986). By 1983, the total investment in the SUDAM-approved ranches had already reached nearly US\$1 billion (in 1982 US dollars) (Nascimento, 1985). The

average size of the already implemented ranches is 23,600 hectares, meaning that the incentives program favored large enterprises. These enterprises occupy 8.4 million hectares, of which half was to be developed as pasture. This is the upper bound estimate of the deforestation caused by the incentive program in the Cerrado and semi-humid forest land. The ranches have already abandoned much of the pasture area created and some of the land is reverting to secondary forest (all data from Gasques and Yokomizo, 1986).

The SUDAM program failed to create viable livestock enterprises in the region. Gasques and Yokomizo carried out a sample survey of enterprises and show that:

- Realized livestock production is less than 16% of anticipated production.

- The average rate of implementation of the project was high enough to enable the projects to receive certificates allowing them continued access to tax incentives.

- While actual implementation has been less than 40%, disbursement of the tax incentives has been close to 100% or higher on many ranches.

- The commodity taxation (ICM) revenue realized from the ranches is less than 4% of tax credit funds received in all cases studied.

The reasons for the poor performance of ranching in the Amazon have been analyzed by Browder, based on a sample survey of ranches. Total invested resources in the ranches had a negative net present value. An analysis by Hecht, Norgaard and Possio (1988) of cattle ranches in the Eastern Amazon (based on coefficients assembled from the literature) shows similar results:

- Without real appreciation of land, no form of traditional ranching has a positive real rate of return in Eastern Amazon.

- Without overgrazing, real land values must appreciate at the rate of 30% before the investments become economically viable.

- Even with improved pasture technologies, a real appreciation of land of 15–30% a year is required to make a positive rate of return to overall investments.

- Ranches receiving the SUDAM incentives can have a positive return to private investment resources in the absence of real appreciation of land.

- Investors can maximize their private returns by overgrazing. They cannot improve their returns by pasture improvement.

The results are fully consistent with the low rate of implementation of the projects and with the high rate of abandonment of pasture within projects. Recent legislation limits eligibility for

SUDAM approval to ranches established in the Cerrado, where deforestation could be minimal. These regulations, however, are not usually fully enforced.

Tax credit funds from Fiset have also been available for afforestation. IBDF-approved firms are eligible to receive tax credit funds for afforestation similar to those granted to SUDAM-approved firms. As discussed in Brazil (1987), the Fiset program suffers from severe implementation difficulties as well, and has not been successful in reaching its afforestation objectives.

Neither the fiscal incentives for cattle ranches nor those for afforestation are cost-effective in achieving the stated goals of increasing livestock production and the rate of afforestation. FIDAM's subsidy program for ranches has reduced forest area by far more than the area the Fiset incentives have afforested.

The combined effect of the incentive programs is more rapid deforestation in the Amazon, very modest afforestation in areas of old settlement, and a very large fiscal cost. This cost exceeded US\$1 billion in 1975-86 for the livestock ranches alone. Policy must abolish the tax credit programs, review other components of the special incentive packages and eligibility criteria, and design a better afforestation program.

7. THE SYSTEM OF CREDIT

Agricultural credit policies have been exceptionally favorable. Until recently, real interest rates on official credit were negative. Current policies imply that real interest on loans for agriculture are lower than in the nonagricultural sector, as Brandão and Rezende (1988) have shown. This difference of credit terms between sectors is also capitalized into the land price. If credit is not equally available to farmers at different income levels, the subsidies will make it more difficult for poor people to buy land. To get access to subsidized credit requires some form of land title or certificate of land occupancy. Thus land with acceptable papers as collateral has a higher value than land without title documentation. An increase in the credit subsidy will increase the demand for titled land and provide its owners with a capital gain. It will also reduce the demand for untitled land and lead to capital losses for owners of untitled land. It will also increase the flow of investments from the non-agricultural sector into farms with titled land and thereby provide an additional force toward increased ownership holdings. The reverse occurs when credits are reduced.

Since the poor are less likely to have titles or certificates of occupancy, or are more likely to be tenants, sharecroppers, or workers and therefore not eligible for subsidized credit, an increase in the credit subsidy will worsen the distribution of income and ownership and operational holdings in rural areas.

Subsidized credit is available to SUDAM-approved ranchers and private farmers who have titles or other land documents recognized by the credit institutions. While the amount of credit disbursed in the Amazon is small compared to the total agricultural credit volume, it is a significant factor accelerating deforestation. Similar to the effect of income tax preference for agriculture, subsidized rural credit tends to increase the demand for land, leading to a more rapid expansion of crop and pasture land. The subsidies are partly capitalized into land values, reinforcing the regressive impact of the income tax system analyzed above. In addition, subsidized credit, by encouraging mechanization, has reduced employment and tenancy opportunities in agriculture. The system thus increases the movement of settlers to frontier areas.

The direct impact of the credits on the Amazon itself is hard to estimate. Central Bank data on disbursements of credit do not present information separately for the legal Amazon. The North region, comprising the legal Amazon minus Goiás, Maranhão, and Mato Grosso, receives less than 3% of rural credit. This underestimates, however, the relevant credit volume as settlement has been particularly active in Goiás and Mato Grosso. Nationally, livestock borrowers received about 20% of the credit disbursed. The SUDAM-approved ranches are all eligible for subsidized credit. Through the ranches, the credit subsidies have accelerated the deforestation process.

8. PROJECT INTERVENTION

It was not possible in this study to quantify the impact on deforestation of all the distortions which were found, but the effects of those that have been quantified are large. Moreover, all the distortions appear to work in the same direction. Not a single tax or subsidy provision was found that slows deforestation in the Amazon. There have been attempts, however, to stem the tide of deforestation or at least to confine it to the more fertile land areas not already used by the tribal population. These efforts have been made in a number of settlement projects or programs, such as INCRA's programs and World Bank-supported projects in Mato Grosso and Rond-

ônia. The projects generally allocate high quality land to smallholders and keep poor land under forest. Continuous cultivation of tree crops on small portions of the farms is encouraged to save forests on the rest of the farms.

The projects have come under sharp criticism because small farmers use the messy but economical slash-and-burn agriculture system rather than continuous cultivation, are unable to produce cash crops in the first few years of settlement, and abandon or sell out their plots when they cannot cope with the harsh frontier conditions. Project authorities are faulted for not surmounting the vastly underestimated difficulties of providing basic services, such as roads, health, and education, in these areas of low population density. Most attention focuses on these relatively small projects, while ranching expands at a frantic pace, destroying more forest than the entire area under the projects. Forest services and land authorities are unable to enforce regulations because they are understaffed and can easily be influenced by those interested in land and forest resources.

A new approach is required. Projects cannot succeed in the presence of massive distortions. The distortions must be removed first. Project design must become more realistic and recognize that settlement is a harsh process in which many will fail. In order to reduce infrastructure cost, individual land allocations must be relatively small. Agricultural objectives must initially be modest. Slash-and-burn agriculture should be accepted as a good practice for the first few years despite its messy appearance. It will be replaced by other farming systems once higher population density makes enough labor available for more intensive systems (Pingali, Bigot and Binswanger, 1987).

Even with the best screening methods it is impossible to select only settlers who will succeed in the harsh process. Screening of settlers should therefore be simplified, and failure by some should be accepted as inevitable. Rules of land allocation and land sales have to accommodate failure rather than attempt to resist it.

At the same time, the current emphasis on stronger forest-use planning must be maintained and backed up by enforcement. The enforcement system must be adapted to the extremely harsh conditions of the frontier and include strong incentives for those charged with enforcing the rules.

9. IMPROVING INCENTIVES FOR FOREST GUARDS

Changing the tax incentives and policies de-

scribed above would greatly reduce the pressure on land in the Amazon. Nevertheless, settlement will continue. Settlers must be kept out of forest and biological reserves and logging rules must be more effectively enforced. To do this will require improving the incentives for forest guards to enforce the rules.

The forest guards of the IBDF are few in number, poorly paid, and have to do risky jobs in guarding forest reserves or in enforcing logging regulations. The enormous distances and low population densities impose additional difficulties. It is not surprising therefore, that forest laws and regulations are easily evaded by applying political pressure to the service, or by bribing the forest guards. It would be easy, however, to provide the forest service and the guards with incentives to enforce the rules by giving them a financial stake in the fines levied on violators. For example, letting the guards keep 30% of the fines with the remainder added to the budget of the forest service, rather than the general revenue, would provide positive incentives. Traffic police already operate in a similar way, so a precedent exists.

10. SUMMARY AND CONCLUSIONS

This paper shows that general tax policies, special tax incentives, the rules of land allocation, and the agricultural credit system all accelerate deforestation in the Amazon. These policies increase the size of land holdings and reduce the chances of the poor to become farmers. There are five key aspects of government policy which contribute to deforestation in the Amazon:

The virtual exemption of agricultural income from income taxation makes agriculture a tax shelter. The exemption of agriculture from income tax adds to the demand for land. This greater demand is felt directly at the frontier, where urban investors and corporations compete aggressively for land to establish livestock ranches. But the tax treatment also has indirect effects by making it attractive for wealthy individual farmers to buy land from small farmers in areas of well-established settlement. Because the income tax preference for agriculture, agricultural profits, and other factors are capitalized into the land price, small farmers and other poor individuals cannot buy land in areas of well-integrated land markets. If they want to acquire land, they have to squat on land at the frontier.

Rules of public land allocation provide incentives for deforestation because the rules solidifying claims and ensuring maximum land areas encourage land clearing. A claimant is allocated

two to three times the amount of land cleared of forest. In addition, land clearing provides protection against competing claims and against land invasions. To reform these rules will require lowering of land ceilings and changing the rules of land allocation to remove incentives for clearing land simply for purposes of solidifying land claims and increasing the size of allocations.

The tax credit scheme contains provisions that encourage the conversion of forest to crop land or pasture. This provision will lead to excessive deforestation of marginal land areas located within large farms in order to reduce tax liabilities.

The tax credit scheme aimed toward corporate livestock ranches subsidizes inefficient ranches established on cleared forest land. An upper-bound estimate of its effect is 4 million hectares of added deforestation, mostly in the subhumid forest zones of Mato Grosso and Tocantins. Most of these livestock ranches have a negative economic return. A tax credit scheme is provided by IBDF to corporations that agree to afforestation. But the recipients have been as unsuccessful at afforestation as they have been at running economically viable ranches. The combined effect is even faster deforestation in the Amazon, little

afforestation in areas of settlement, and large fiscal costs.

Subsidized credit is available for SUDAM-approved ranches. Although the amount of subsidized credit disbursed in the Amazon is small compared with total agricultural credit, it accelerates deforestation through the support of large ranches.

These distorting provisions must be removed before afforestation projects and programs can succeed. Afforestation and settlement projects must take into account the effect of these distortions, and the projects must thus have modest expectations. While reducing perverse economic incentives for deforestation will slow down the destruction of the Amazon forest, incentive policies alone are not enough. A coherent system of land use planning that sets aside more marginal lands in forest reserves and establishes biological reserves is also required. Even under the best incentive regimes, these reserves, as well as Indian reservations, will have to be protected by the power of the law and its enforcement agents. As part of this strategy, forest guards must be given greater incentives to enforce forest preservation laws currently in place.

NOTES

1. A detailed discussion of these provisions is provided in da Silva (1986).

2. The rules for allocating state or federal land (*terra devoluta*) vary somewhat. Only the rules affecting federal lands are reviewed here.

3. Although the claimant must buy the title in a public auction, bids apparently are never challenged, and the minimum price set by GETAT (Grupo Executivo de Terras do Araguaia/Tocantins) is nothing but a nominal fee.

4. Real estate sales are subject to capital gains taxes while long-term capital gains (more than five years) on financial assets are not. But the real burden of the capital gains tax is low. The taxable amount of the gains is reduced by rebates depending on the length of time the real estate is held. The remainder is taxed at the lower of either a 25% flat rate or the marginal rate of the progressive income tax of the individual concerned. I have not found any exemptions from this tax for individuals or enterprises located in the legal Amazon.

The commodity taxation (ICM) is like a value-added tax on agricultural and nonagricultural commodities. It is levied at 17% of the after-tax receipts (that is, at 20.5% of total sales value) for most states. For sales to

the North and the Northeast the rate is only 12%. But final sales within the North or the Northeast regions restore tax levels to 17% through a mechanism I do not fully understand. Thus, the difference appears to act as a transfer of tax revenue between regions rather than a distortionary differential affecting economic decisions.

The ICM contains a potential distortion against agriculture for commodities which are exported in raw form. While the full ICM is restituted on exports for industrial products, this is not the case for raw agriculture products such as soybeans. But if agricultural products, such as soybean oil, are exported the tax is refunded. The importance of the distortion is further reduced by quantitative trade controls on many agricultural commodities so that domestic price relatives are completely delinked from international price relatives. Additional work would be required to determine whether agricultural price policies discriminate against agriculture.

5. For example, pig iron factories under the Grande Carajás program are required to produce 40% of the charcoal they use from forest they own.

6. Personal communication from Lytha Spinola da Silva.

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