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# The Social and Economic Causes of Deforestation in the Peruvian Amazon Basin: Natives and Colonists

by

Eduardo Bedoya Garland

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## Introduction

The accelerated deforestation presently occurring in the Amazon basin has inspired literature from multiple perspectives ranging from the forest sciences and ecology to the social sciences. This literature, diverse as it is, offers no consensus on the criteria we should use to evaluate a problem of such magnitude. Some authors attempt to explain deforestation as a function of the technological characteristics of swidden agriculture (Myers 1980). Others seek the structural causes in the impact of state economic policies on the Amazonian region (Hecht 1984), in models of capital accumulation applied to each region and state (Schmink and Wood 1987; Collins 1986; Collins and Painter 1986), in the unequal rates of exchange between country and city (Painter 1987), in territorial conflicts (Foweraker 1981; Martine 1980), or in the propagation of inadequate technologies for peasant agriculturalists by state agencies (Todaro 1977). Some academics focus their analysis on specific institutional aspects of the problem, such as the legal system of land tenure, or the government colonization programs that enable settlers to relocate to the ecological and demographic frontiers (Moran 1984).

In this paper we demonstrate that the natural resources of various production systems are managed in specific ways that in turn influence the rate of deforestation. An analysis of the *colonos* (colonists) and indigenous groups of the Amazon reveals that the rate of deforestation by colonists is greatly affected by a high level of market integration; their relative access to land, labor, and capital; and the formal land tenure system. For the Peruvian indigenous groups the significant factors are the degree of access to land, the size of the productive unit, and the availability of family labor.

The discussion is divided into four parts. The first briefly describes the agricultural expansion in the Peruvian Amazon Basin and its relation to deforestation. The second discusses the relationship between intensification, deforestation, and the limits of the institutional changes brought about by the deeding of land titles; here we determine the impact of coca expansion and its relation to deforestation and agricultural intensification in the Upper Huallaga (the principal coca producing region in the world), using information from a 1981 survey of settlers. Part Three compares settler production systems with those of three native groups, and the conclusions are presented in Part Four.

## I. Agricultural Expansion and the Family Economy in the Upper Peruvian Rain Forest

As a result of increasing migration by highland peasants and the expansion of urban demand for foodstuffs, the Amazon Basin — particularly the upper rain forest — has become the second most productive agricultural zone in Perú, and in some respects the most important. Data collected by the National Survey of Rural Families in 1984 (INE 1987) indicates that hard yellow corn and rice harvested in the Amazon region account for 67.5 percent and 48.3 percent, respectively, of the total national acreage planted in these species. Sixty percent of the family farming units in this region produce corn, while 71.2 percent plant rice.

When we analyze the yields per hectare of these crops in the Amazon, however, we find that corn yields are 20 percent below the national average and rice is 32 percent below average (Verdera 1984:181-183). Almost all of the yellow corn and two-thirds of the rice in the Amazon is cultivated using slash-and-burn agriculture. Slash-and-burn techniques rely on crop rotation and lengthy fallow periods, utilize planting cycles that correspond to the rainy seasons, and incorporate little in the way of modern technology (INE 1987). Only 10 percent of the family units in the rain forest actually use modern inputs (ibid.). Irrigated rice has average yields below those for the Pacific coast because irrigation techniques in the Amazon are still rudimentary.

The ever-increasing importance of tropical agriculture in the overall national economy comes at great ecological cost. An average of 350,000 hectares per year are cleared for shifting agriculture. Sustained utilization of these lands is extremely low. Given current trends, only 20 percent of the total 11,000,000 deforested hectares in the Peruvian Amazon will actually be in use for agricultural or animal production by the year 2000, while the remaining 80 percent will be in fallow. Even though slash-and-burn is diminishing because of the diffusion of more stable and intensive types of soil management, up to 50 percent of the lands in some valleys, such as that of the Central Huallaga, are still cultivated under this system (Dourojeanni 1982). A better understanding of the causes of these ecological and migrational phenomena requires a special analysis of the settlers who continue to practice shifting agriculture and deforest the region at steadily increasing rates.

Sixty-one percent of the family farming units in the rain forest lack legal title to the lands they work (INE 1987). Although slash-and-burn agriculture demands continuous migration, which influences and complicates the process of land deeding, the existence of such a high percentage of farmers without legal title to their land has social, economic, and political origins.

It is in the context of the low agricultural productivity of this region and a prolonged national economic crisis that we see, especially in the Upper Huallaga valley, an increase in the response to the illicit demand for cocaine that expanded in the U.S. and Western Europe from the mid-1970s through most of the 1980s. Coca production in this region has soared from less than 5,000 hectares in 1975 to at least 60,000 in 1986 (Bedoya 1987; ECONSULT 1986). Approximately $840 million per year is circulating in the upper rain forest from the processing of coca leaf into cocaine paste and its later sale (ECONSULT 1986). This sum represented 35.4

percent of the legal agricultural national product of Perú for 1985 ($2.372 billion), a percentage that has undoubtedly not diminished in the past six years.

Dourojeanni (1989) indicates that approximately 200,000 hectares in Perú are planted in coca, that coca production has resulted in the deforestation of nearly 700,000 hectares since the 1970s, when the number of coca producers began to increase, and that coca is responsible for 10 percent of the total deforestation of the Peruvian Amazon this century. The figure of 700,000 hectares includes lands planted in coca, lands planted in subsistence crops to support the coca producers, lands that have been abandoned as a result of decreasing coca yields, and lands cleared for the construction of landing strips necessary for the transport of the coca paste (ibid.). Dourojeanni also notes that the increasing number of coca producers has indirectly increased deforestation by pushing farmers growing crops for legal markets farther and farther away from the zones of terrorism and narcotrafficking. The program of manual eradication aimed at reducing the amount of coca production also aggravates the destruction of the rain forest (Bedoya 1990). When the peasants in the Upper Huallaga region learned of the eradication program, they moved to more remote areas of the valley or to such regions as the Central Huallaga and Aguaytía zone of Pucallpa. The dynamics surrounding the coca eradication program has led to a general dispersion of coca plantations throughout the entire tropical rain forest.

Because the cultigen is illegal, two-thirds of coca producers in the Department of San Martín are settled outside the boundaries of the Special Project of the Upper Huallaga. The Project's boundaries were created to implement a program for cultivating substitutes for coca production (see Figure 1). Coca producers, both inside and outside the boundaries, to avoid police repression have chosen locations remote from the main highways. One such site, the Tingo María region of the Upper Huallaga Valley, is officially considered a National Park. Other National Parks, like that in Abiseo located in the Department of San Martín, and National Forests, like that of Von Humboldt located in Ucayali and Huánuco, or Biabo in San Martín and Ucayali, have also been invaded by coca producing peasants. If the economic crisis in which Perú currently finds itself continues to worsen and the terms of exchange between city and countryside remain unfavorable to farmers, and if the international demand for cocaine continues to increase, the expansion of coca production will persist. If the market shifts in favor of another drug, however, coca production will cease to be a tool for dealing with the economic crisis, or at least it will become a less important one.

The export of cocaine paste parallels in many respects the export of rubber and other tropical products — coffee and cocoa — except that this processed commodity is not legal. Rasnake and Painter (1989) argue that the impact of cocaine export on social life — on the mobilization of labor, the distribution of wealth, and the creation of enclaves — is analogous to the impact of legal export industries that have dominated Bolivia's national economy. For example, export commodity production often relies on labor migrants as a work force. Indeed, coffee and coca in the Upper Huallaga have shown many of the same relations of production: temporary labor force and relatively high salaries. In other words, coca production for the international market is a replacement for coffee, cocoa, lumber, and rubber.

## Colonization and Shifting Agriculture

Although colonists were pulled by the market into the tropical zones for local cash crops (Durham 1977), one of the primary reasons underlying the migratory movements is the continuing impoverishment of peasant populations of the Andean highlands. In 1973, an important study of migratory colonists in the Tingo María, Campanilla, and Tocache regions found that 42 percent of the settlers in this zone had migrated because of acute shortages of land in the highlands, while another 26 percent had moved because of the lack of available work. In other words, 68 percent of colonists in this region relocated for explicitly economic reasons (CENCIRA 1973).

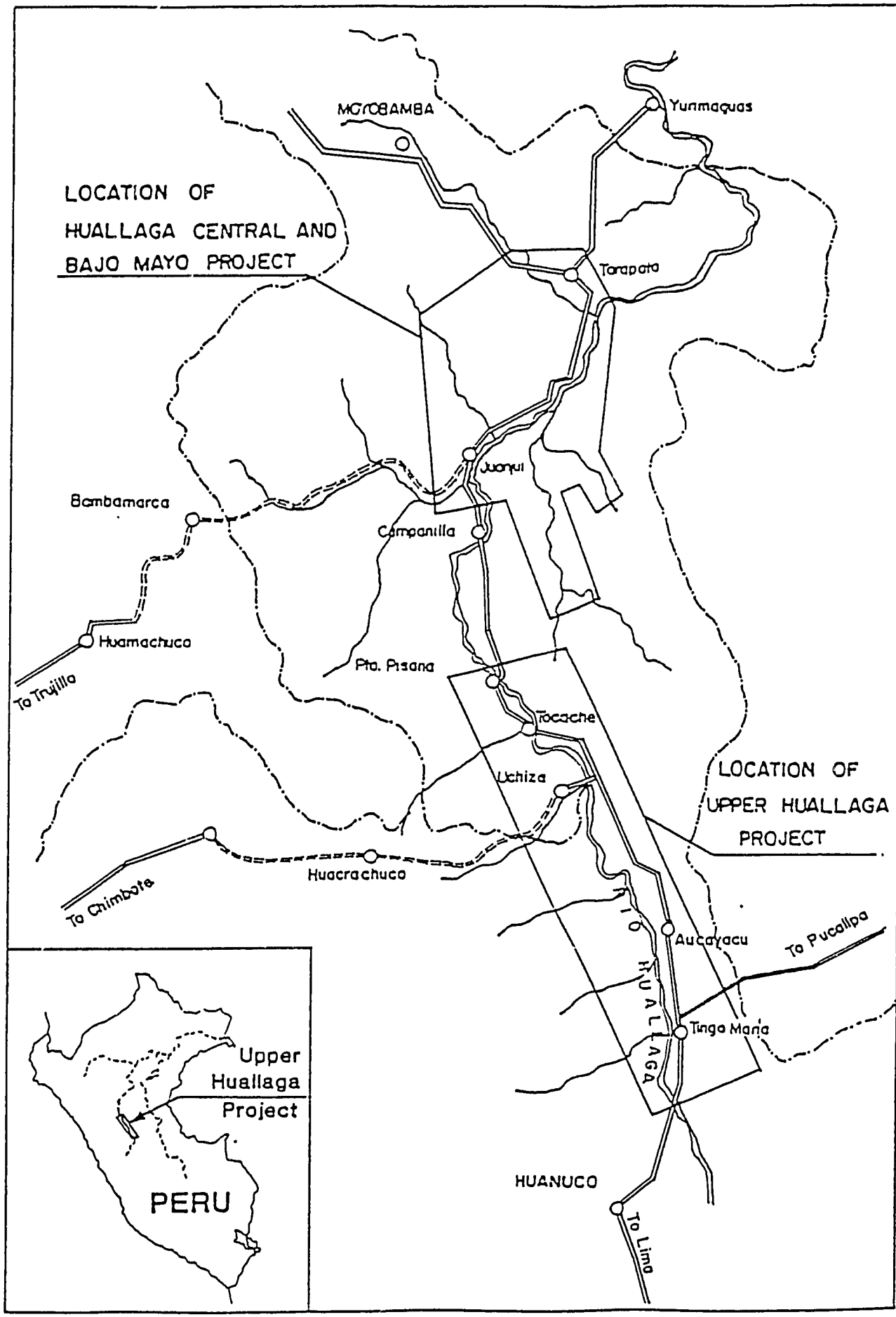
These economic forces shape the perceptions and expectations that Andean farmers bring to the region. The highland peasants view the rain forest as a place where they will always be able to satiate their "hunger for land." Shoemaker summarizes the attitude of the migrant from the sierra to the Satipo settlement area:

> What the peasant migrant sees in the mountain is, in a word, land. They come from areas in the sierra, or highlands, where they might have possessed a few plots of land that altogether would not add up to more than one or two hectares. The opportunity to acquire 20 hectares, the average size of a tenant farmer's land holding in the forest, is a strong incentive to move. Looking back, they always say that the rich people in their original communities only owned five hectares, therefore 20 hectares appears to be practically a state (1981:96).

In the highland population's concept of the rain forest as a zone of limitless potential and inexhaustible lands, however, the fragility of the tropical ecosystem is rarely considered. The real availability of land suited for agriculture is significantly less than the initial perception of the Andean colonists. Within this context of land scarcity in the Andean zone and the illusion of an abundance of land in the Amazon region, it is not surprising that settlers utilize extensive agriculture as the main form of soil management in the tropical lowlands.

Even apart from the fact that this perception of an abundance of land is false, it is an insufficient explanation for the Andean farmer's use of extensive agriculture as a farming technique. When a settler from the highlands decides to cultivate a plot in the Amazon basin, he is beginning a new phase in his life. After four to six years, he is able to send for his family, with the goal of reproducing the traditional scheme of the peasant economy based on nonremunerated work. The migrants begin to raise such food as corn, manioc, and bananas, most of them annual crops, with the dual objectives of providing for their own needs and selling the remainder. One of the major errors in the various settlement programs has been the initial assumption that agriculture in settlement areas would be based largely on intensive capitalist farming and that production would be organized in terms of profit maximization. Several studies indicate that during the initial phases of resettlement most peasants are unable to organize their production in this manner (CENCIRA 1973; Bedoya 1981). In the early years, the pioneer settlers lack basic resources and must therefore grow crops for their own consumption. State

Figure 1. Map of Huallaga Valley




Source: Survey FDN 1981.

agencies do not usually lend money for producing subsistence crops (Schuurman 1980). The lack of available capital for buying such necessary inputs as fertilizers encourages extensive agriculture as a way to harvest enough food for family survival. At any rate, in the upper rain forest as a whole, colonists rely on crop rotation and fallow periods to regenerate their lands during the initial phases of settlement.

The lack of money further impedes agricultural intensification, by restricting the colonists' ability to contract wage labor. Labor scarcity is one of the most serious difficulties the colonists confront. Because settler families recently arrived in the tropical zone are young and thus have few members, their greatest constraint is labor. According to a 1981 survey among the colonists of Alto Huallaga, more than half of the families with less than four years in the area had problems of insufficient labor, while for those families who had been in the zone for eight years or longer the problem was relatively insignificant (FDN 1981). Because recent immigrants prefer working their own lands before hiring themselves out to neighbors and other farmers, the opportunity cost of colonists in recently settled areas is quite high. In other words, labor scarcity is a function of the size of the family, the abundance of land, and the price of labor. In the Tingo María region during the 1950s, 1960s, and the first half of the 1970s, there was intense competition for labor between family farms, on the one hand, and large coffee and tea plantations, on the other (Bedoya 1981). The two most profitable crops during this period were coffee for export and tea for domestic consumption. This meant increased labor scarcity for the colonists, as they were not able to pay equivalent salaries for work on crops that were not as lucrative.

This whole group of factors has implications for the use of natural resources, in particular the use of extensive agriculture in the upper Huallaga region. To the extent that new lands continue to be available and labor and money scarce, the lowland colonists prefer to open new plots rather than regenerate the soils with modern inputs. Furthermore, weeding is extremely laborious. Field surveys and estimates by the state agencies indicate that the amount of labor needed to clear virgin forest is less than that needed for weeding, which tends to increase labor demand as the years pass. For example, a study on coffee growing in Tingo María in 1962, a period of relative land abundance, indicated that from the second year on, a parcel of land planted in coffee, bananas, and manioc required 175 percent more man-days for weeding than the initial land clearing of the virgin forest (SIPA 1962:114).

Moreover, since higher crop yields do not necessarily guarantee greater future income, the settlers cannot justify spending scarce financial resources on modern inputs. During the initial stages of resettlement in the frontier region, therefore, colonists combine a strategy of reducing the requirements for labor with that of minimizing risk. Such an approach leads to a pattern of extensive land management and continuing deforestation.

## II. Availability of Lands, Intensification, and Deforestation

The Foundation for National Development (FDN, Fundación para el Desarrollo Nacional) in 1981 reported on the family economy of 352 agriculturalists living in the Upper Huallaga region in an area delimited by the Upper Huallaga Special Project. The principal characteristic of this region is that although the area in perennial crops is slightly greater than that actually cultivated in annual crops — 52 percent and 48 percent, respectively — fallow agriculture in 1981 covered the bulk of lands in the interior of the Upper Huallaga Special Project, and 79 percent of the farmers had holdings of which the total area in annual crops plus fallow took up more space than did permanent crops. Furthermore, 75 percent of the colonists who predominantly use the fallow land system (which is in reality a migratory agriculture) had holdings that were larger than 15 hectares, while 55 percent of the colonists who practice migratory agriculture without fallow had holdings of less than 15 hectares.

FDN's figure that around 50 percent of the colonists used modern inputs is misleading. The farmers of the region may use improved seed, fungicides, pesticides, or fertilizers, but almost never all simultaneously. In the context of relative land availability, the use of modern inputs seems to be a last-minute decision. After having covered his labor needs the colonist might decide to buy fertilizers or some other input (Bedoya 1987). Generally, in 1981 the area in the Upper Huallaga Special Project was characterized by extensive land use. The larger the holding the more extensive the means of cultivation. Economic orientation and lower population density in some parts of Upper Huallaga affected the decision to use land extensively (Bedoya 1987; Aramburú and Bedoya 1987).

The practice of extensive agriculture in this region is also significantly one of the impacts of coca production on legal agriculture in Upper Huallaga. Land, capital, and labor have been directed since the 1980s to coca production, more profitable than any legal crop. In the interior of the Upper Huallaga Special Project such crops as rice and yellow maize, cultivated using a fallow system, have been jeopardized by increasing production costs brought about by the expansion of coca cultivation. For example, the wages paid by coca producers are at least 125% higher than the salaries paid by legitimate farmers. In order to compete with coca producers the latter group needs to increase the wages. This can be done, however, only for short periods of time and the rest of agricultural tasks remain uncovered. Statistics referring to land use in 1986 show that this tendency towards extensive land use continues (ECONSULT 1986). The intensification of land use was concentrated above all in the areas outside the boundaries of the Special Project, where the greatest number of monocrop coca producers exist.

FDN's report also permits us to determine accurately how the rate of deforestation (number of hectares under permanent crops + annual crops + fallow grass divided by the number of years a plot is occupied) correlates with the total amount of land available per colonist. In Table 1 we see that the rate of deforestation produced by agriculturalists who utilize

the soils least intensively — 0.1 to 0.2 — is 1.88 hectares per year.[1] This is in contrast to areas that receive more intensive use — 0.7 to 1.0 — where the annual rate of deforestation involves 0.97 hectares, almost half that produced by lower intensity use. In general terms, we can see from Table 1 that the higher the intensity of soil use, the lower the rate of deforestation. If we consider intensity as a variable that corresponds primarily to plot size, we can formulate a relationship between the size of the agricultural unit and the rate of deforestation.

Table 1 also illustrates the surprising amount of damage caused to the forest by the low intensity usage of soils. As shown in the table, peasants must clear 18.93 hectares of land in order to provide 3.52 hectares for cultivation at a level of intensity of 0.1 to 0.2. At levels of 0.3 to 0.4, a total of 15.16 hectares must be cleared in order to cultivate 6.19 hectares. In the former case, the proportion of the effective area to be cultivated to the total area deforested (fallow + cultivated areas) is 5.37. In other words, those following a course of extensive soil management must clear five hectares of land for every one hectare in production. These data show the enormous amount of forest lands being consumed as a direct result of extensive agricultural land use practices. Moreover, in the most extensive patterns of soil use, the annual increase in the number of hectares in fallow is higher than the annual increase in the number of cultivated hectares (see Table 1).

The newest settlement areas of the upper rain forest have low population densities and relatively available land in comparison to the Andean highlands. This relative abundance of land has promoted a return to less intensive agricultural systems in the tropical areas, in contrast to the more intensive farming systems characteristic of the highlands. Such a response is a technological regression, a phenomenon most commonly associated with agricultural and demographic frontiers (Boserup 1984).

In every valley of the Peruvian upper rain forest except that of Alto Mayo, the more recently settled areas tend to develop extensive patterns of cultivation and have lower population densities (Aramburú and Bedoya 1987:160-161; Bedoya 1987). In the Upper Huallaga region, the area most recently settled and with the lowest population density is Tocache-Uchiza where in 1981 approximately 68 percent of the plots had land use intensities oscillating between 0.1 and 0.2, and where around two-thirds of the colonists did not use modern inputs. In contrast, in the Tingo María region, the area settled the longest and with the highest population density, 66 percent of the plots had land use intensities between 0.6 and 1.0, and the majority of the farmers used modern inputs, although very unsystematically (Aramburú and Bedoya 1987). The Upper Huallaga case confirms Boserup's hypothesis, but we must qualify the argument. In contrast to the colonists from the Upper Mayo region, the farmers from Upper Huallaga had

[1] Soil use intensity is calculated by a formula that measures the relative weight of the fallow areas: Soil Use Intensity of a given plot = (number of hectares under permanent crops + number of hectares under annual crops) divided by (number of hectares under permanent crops + number of hectares under annual crops + number of hectares under fallow).

**Table 1. Annual Rate of Deforestation and Annual Increase of Agricultural and Fallow Hectares, by Intensity of Soil Use in Alto Huallaga in 1981**

| Intensity of Soil Use (*) | # of Family Units | (1) Average Size of Plots | (2) Average of Cultivated Hectares | (3) Average of Fallow Hectares | (4) Total Agricultural Area (2+3) | (5) Average Number of Years Occupying the Plot | (6) Annual Rate of Deforestation (4:5) | (7) Annual Increase of Agricultural Hectares (2:5) | (8) Annual Increase of Fallow Hectares (3:5) | Annual Rate of Deforestation (4:5) or (7+8) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.1 - 0.2 | 86 | 36.94 | 3.52 | 15.41 | 18.93 | 10.05 | 1.88 | 0.35 | 1.53 | 1.88 |
| 0.3 - 0.4 | 87 | 26.40 | 6.19 | 8.97 | 15.16 | 10.31 | 1.47 | 0.60 | 0.87 | 1.47 |
| 0.5 - 0.6 | 59 | 20.82 | 7.45 | 5.14 | 12.59 | 9.43 | 1.34 | 0.79 | 0.55 | 1.34 |
| 0.7 - 1.0 | 54 | 15.69 | 8.02 | 1.84 | 9.86 | 10.15 | 0.97 | 0.79 | 0.18 | 0.97 |

$$(*)\ \text{Intensity of Soil Use} = \frac{\text{(Annual Crops + Permanent Crops)}}{\text{(Annual Crops + Permanent Crops + Fallow Area)}}$$

Source: We have elaborated this taole from data in FDN (1981).

migrated from the Andean provinces of Huánuco without any previous experience in tropical intensive crops such as irrigated rice, and with less disposable capital (Bedoya 1987). In Upper Huallaga the extensive use of land in the recently settled areas is a consequence not only of lower population pressure, but also of the technical background of the colonists and their relatively limited resources.

## III. Land Tenure, Deforestation, and Intensification

Table 2 relates the system of land tenure to the deforestation rate. The deforestation rate among squatters is 2.72 hectares annually, a figure more than double the rate of deforestation on the lands belonging to legal tenants. This fact suggests that the system of land tenure also influences the rate of deforestation, but other explanations must be considered. First, squatters would have higher rates of deforestation because they had only recently begun to cultivate their lands, in comparison to legal tenants or grantees who had been farming their plots for more years (see Table 2). Second, squatters clear the forest at a higher rate because they cultivate predominantly annual crops (Bedoya 1987). Of course, it is the insecurity of tenure that leads the squatters to cultivate annual rather than perennial crops. In Upper Huallaga, the deforestation rate diminishes among those agriculturalists with legal title to lands only when these families begin to focus on the production of more permanent crops, which are strictly commercial.

As Table 2 illustrates, the index of intensity of soil use is almost the same for both legal tenants and squatters. In other words, agriculturalists possessing titles to their property rely on forms of extensive soil management. The deeding of property in the Upper Huallaga has not resulted in more intensive use of land because the expanding coca-producing plantations in the valley create a chronic labor shortage. The majority of the agriculturalists who have title to their land do not manage coca plantations. As we have mentioned, the coca producers have the profits to be able to pay daily workers substantially higher wages than legitimate farmers in the region can afford (Bedoya and Verdera 1987). Without a reliable work force, the settlers are unable to intensify agricultural production. The banks, in authorizing credits for legal producers, fail to take into account the high costs of labor generated by the coca crop and underestimate the costs of seasonal labor. Within the context of such an unfavorable cost structure, the possibilities of increasing and intensifying legal agricultural production are minimal.

The expansion of the coca economy in the region has also powerfully deterred the development of technology specifically related to the production of legal crops, and thus has impeded the intensification of agriculture and thereby increased deforestation. Our field experience and the data found in the FDN study (FDN 1981) indicate that the annual rate of deforestation from coca production is less than that of holdings cultivated predominantly in annuals. The problem of deforestation caused by coca production does not seem to be as serious when it is analyzed plot by plot, until we look at the large number of farmers, both inside and

**Table 2.** **Annual Rate of Deforestation and Annual Increase of Agricultural and Fallow Hectares, by Land Tenure in Alto Huallaga in 1981**

| Land Tenure | # of Family Units | (1) Average Size of Plots | (2) Average of Cultivated Hectares | (3) Average of Fallow Hectares | (4) Total Agricultural Area (2+3) | (5) Intensity of Soil Use (*) | (6) Average Number of Years Occupying the Plot | (7) Annual Rate of Deforestation (4:6) | (8) Annual Increase of Agricultural Hectares (2:6) | (9) Annual Increase of Fallow Hectares (3:6) | Annual Rate of Deforestation (4:6) or (8+9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Legal Tenants | 187 | 25.87 | 6.8 | 9.39 | 16.19 | 0.42 | 12.61 | 1.28 | 0.54 | 0.74 | 1.28 |
| Precarious Without Legal Title | 155 | 24.57 | 5.84 | 7.74 | 13.58 | 0.43 | 7.49 | 1.81 | 0.78 | 1.03 | 1.81 |
| -By Purchase | 125 | 24.33 | 5.70 | 7.25 | 12.95 | 0.44 | 8.03 | 1.61 | 0.71 | 0.90 | 1.61 |
| -Squatters | 30 | 25.61 | 5.72 | 8.58 | 14.3 | 0.40 | 5.25 | 2.72 | 1.09 | 1.63 | 2.72 |

$$(*)\ \text{Intensity of Soil Use} = \frac{\text{Annual Crops} + \text{Permanent Crops}}{\text{Annual Crops} + \text{Permanent Crops} + \text{Fallow Area}}$$

Source: We have elaborated this table from data in FDN (1981).

outside the borders of the Upper Huallaga Special Project, who have cleared steep slopes to cultivate coca.

Structural factors that directly affect the level of intensity of soil use and therefore also the rate of deforestation are plot size, the market price of different crops, the cost of modern inputs, and other variables such as regional population densities. In Upper Huallaga a simple change in the legal system is no guarantee that a change in the pattern of soil use will follow. Finally, because the Upper Huallaga region is profoundly influenced by the expansion of coca production, we cannot generalize from it to all of the upper rain forest region. Without such profound price distortions as are found in coca production, changes in the legal land tenure system probably could modify soil use intensity.

Our focus on family economies should not give the erroneous impression that Upper Huallaga is an aggregate of traditional peasant units. The income of a coca producer can be as much as ten times that of a dry rice farmer, and there is a notable difference in income between a colonist who has recently migrated to Upper Huallaga and whose crops are mostly annuals, and a long term producer of coca, cafe, cacao, or tea. Moreover, among the coca producers themselves there is a clear economic gap between the recently migrated colonists who plant coca from the first year of clearing a plot — now a fairly common phenomenon because of the national economic crisis — and those coca producers who came to the region in the fifties and sixties. Years of association with the narcotics trade has allowed the latter to attain a certain level of capital accumulation and annual income.

Differentiation between family units occurs in this way: after a certain number of years, a group of colonists, often families with a larger number of working members, starts to cultivate cash crops that are favored by higher national and international prices and bring in greater revenues. The transition from a pioneer peasant economy to a simple commodity production — or even to petty bourgeois production, using Friedmann's (1980) classification — represents a significant step toward higher incomes and a greater articulation with the market economy. The colonists in the early stages tend to orient their survival strategies according to a peasant economy, while in the later stages they tend to orient their economic strategies according to a petty bourgeois production. In the early stage, agricultural activities are basically covered by family labor, and even though most of the produce is sold on the market, subsistence consumption may reach 35 to 40 percent of the harvest. In the later stage, wage labor constitutes the principal relation of production, and produce is almost totally sold on the market (Aramburú and Bedoya 1987).

Not all Andean colonists will move toward the same level of capitalization. In Upper Huallaga, the producer of legal crops faces a series of difficulties. Market conditions and the pricing structure often impede the transformation toward an economy of commercial agriculture. While these poor peasants are not strictly guided by the principles of use values, they do not follow a simple economic rationale of self-sufficiency either. Rather, their subsistence strategies are structured around very restricted patterns of maximization. In quantitative terms, the level of consumption within this sector is extremely limited. Levels of accumulation are similarly

low. These agriculturalists, striving to reach a specific level of consumption each year, which varies according to both the regional and national economies, come more and more to resemble settlers in the initial stages of colonization. They also begin to resemble the poorer, non-coca producing population who practice a migratory agriculture far from roads and other commercial urban centers, a group with high annual rates of deforestation. Social differentiation accelerates in the colonized zones of the upper rain forest because of the specific conditions of articulation with the market economy.

Briefly stated, the relatively longer duration of the colonists in the settled regions has allowed a greater degree of capitalization among some of the farmers; with others the outcome at the end of a certain number of years has been unfavorable market relations. In each case the management of natural resources is different, but it always closely relates to the dynamic of the external economy.

## IV. Indigenous Peoples and Deforestation

Different ethnic groups in the lowlands manage natural resources differently. A study conducted between 1984 and 1985 by the Center for the Investigation and Promotion of the Amazon (CIPA 1986b) provides baseline comparative data for examining this issue. The recently published reports of anthropologists and geographers who have been conducting research in various regions of the Amazonian lowlands offer more information.

The purpose of the CIPA project, which involved approximately a dozen investigators, was to examine the impact of the market economy on the indigenous communities of Satipo, Lower Urubamba, and Madre de Dios.[2] The study included 94 family units from Satipo, 65 from Urubamba, and 67 from Madre de Dios.[3] The size of the samples was calculated according to the size of the population in each region. The indigenous population of Satipo occupies the upper rain forest zone of central Peru, the communities of Lower Urubamba are in the south-central Peruvian rain forests, and those of Madre de Dios in the Amazonian lowlands.

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[2] Several investigators participated in the CIPA study, among them Carlos Mora, Efraín Gonzales, Francisco Verdera, Carlos Aramburú, Thomas Moore, Luis Román, and Eduardo Fernandez. The composition of the final document was my responsibility.

[3] The Satipo communities that were included in the investigation were: Yavirani, Santa Rosa de Panaquiari, Cushiviani, Río Berta, San Ramón de Pangoa, and Boca del Kitiari. The Urubamba communities included in the study were: Bufeo Pozo, Pucani, Sensa, Puija, Carpintero, Miaría, Nueva Italia, Nueva Unión, Huao, Segaquiato, and Santa Clara. Finally, the ones from Madre de Dios: Villa Santiago, Santa Rosa, Boca del Inambari, Vuelta Grande, Barranco Chico, Puerto Luz, San Jose del Karene, and El Pilar.

The data collected during the CIPA study allows for a comparative analysis of these three regions. Ways in which the productive strategies of the native population differ from those of the colonists in the Satipo and Upper Huallaga will also be addressed.

### A. Availability of Natural Resources and Deforestation

The formulas used to determine rates of deforestation associated with the colonists are not applicable to the indigenous populations, whose subsistence strategies vary with the amount of natural resources available to them. We determined the rate for the indigenous populations of the three regions by determining the farm area cleared each year to cover household subsistence needs. In spite of differences in resource management among the three, this provides a general comparison.

The Amarakaeris Indians of the Madre de Dios region exercise use rights over vast tracts of land for hunting, fishing, and plant resources. They usually manage three fields in different stages of the productive cycle: one in fallow, one at the peak of its output, and one in its second or third year of production (Moore 1985). Each field is isolated from the others and is under production for an average of three years, the period during which the annual crop yield is more or less optimal. After this period, the field is no longer used for annual crops, though it is maintained for other types of crops such as fruit. Given this production schedule, the Amarakaeris Indians typically open one small field per year. According to the CIPA (1986b) study, these fields average 0.31 hectares in size.[4] This represents the annual rate of deforestation.

According to Sioli (1980:259-260), this technological system of shifting agriculture does not affect the continuity of the virgin forest in space and time. The temporary small clearings may locally interrupt the circulation of nutrients, but they "do not cut a great vein or main artery; they are only like needlepricks in the consistent forest cover, which soon heal again and do not leave permanent wounds" (ibid.). Moreover, since small clearings are surrounded by high virgin forest and deprived of protection only for short periods of time, soil erosion is not strong. The traditional practice of slash-and-burn shifting agriculture is within the limits of the buffering capacity of the tropical forest ecosystem (ibid.).

The natural resources available in the region of Madre de Dios enable the Amarakaeris to continue traditional hunting, fishing, and gathering, but these Indians have also become heavily involved with gold mining. This diversification plus the conservation ethic of the Amarakaeris (Moore 1985) have resulted in a notably slower rate of deforestation.

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[4] In Madre de Dios 92.82 percent of the householdsfarms had between 0.1 and 0.5 hectare at the time of the study.

The Machiguenga of the Urubamba zone, like the Amarakaeris, have available a wide variety of natural resources, though relatively somewhat less abundant. The CIPA study indicates that the Machiguenga typically have two or three fields at different stages in the production cycle under cultivation.[5] The average size of these fields is 0.85 hectares. However, thanks to the development of cacao, a permanent crop that does not require the continual clearing of new lands, the natives of the Urubamba region open one field annually, averaging 0.67 hectares, in order to plant manioc, corn, bananas, beans, etc., and to maintain the agricultural cycle and cover its subsistence requirements (CIPA 1986b; see also Johnson 1983:53-55). If we take into consideration that the Machiguenga have an average of 0.18 hectares of cocoa, and we assume that these fields are renewed every twelve years — because of their extensive type of cultivation — then the overall rate of deforestation is 0.68 hectares per year. This latter figure includes the clearing for annual and permanent crops. The differences observed in terms of average field size and annual deforestation rate with respect to the Amarakaeri of Madre de Dios reflect the fact that the indigenous peoples of the Urubamba region are more dependent on agriculture and less engaged in hunting, fishing, gathering, and mining.

Like the other two groups discussed above, the Ashaninka of Satipo typically utilize an average of three fields per family unit. The average size of these fields is 1.26 hectares.[6] In contrast to the regions of Urubamba and Madre de Dios, the Satipo area, because of the massive colonization of the past forty years, is being cleared of second growth, not virgin forest. The Ashaninka maintain, nevertheless, a number of coffee plantations, which reduces the annual rate of deforestation. The average number of coffee hectares is 0.50 and the average of annual crops is 0.76 hectares. Again, if we assume that the clearing of forests for temporary crops occurs every year, then we have an annual deforestation rate of 0.76 hectares. On the other hand, if we assume that the clearing of forests with the intent of developing plantations for permanent crops occurs only every ten years, then the overall deforestation rate — which entails clearing for temporary and perennial crops — is 0.81 hectares per year. The higher rate of deforestation noted for the Ashaninka of Satipo with respect to the other two ethnic groups reflects their almost exclusive dependence on agriculture and coffee production, for the Satipo region has much less in the way of natural resources than the other two zones.

This figure represents approximately 45 percent less than the current average rate calculated for the slash-and-burn agriculture practiced by colonists in the Upper Huallaga, which is estimated at 1.47 hectares per year. It is 57 percent lower than the global rate of deforestation

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[5] In Urubamba, 27.43 percent of the households had between 0.1 and 0.5 hectares, 39.43 percent between 0.51 and 1.0 hectares, and the remaining 33.14 percent more than 1.1 hectares.

[6] In Satipo, 18.04 percent of the household units had between 0.1 and 0.5 hectares, 23.73 percent between 0.51 and 1.0 hectares, 33.23 percent between 1.1 and 1.5 hectares, and the remaining 25 percent more than 1.51 hectares. In other words, 58.23% had more than 1.1 hectares.

— 1.89 hectares — which includes fallow area, pastures, and agricultural crops, attributed to these same colonists. Likewise, the global rate of deforestation calculated for the colonists in the Satipo region is 2.13 hectares per year, whereas the amount of deforestation associated with the Ashaninka is 62 percent less than this figure (CIPA 1986a, 1986b). In other words, while the Ashaninka have a higher rate of deforestation with respect to the other indigenous Amazonian groups in the CIPA study, it is still considerably less than the rate of destruction attributable to the colonists located in the Upper Huallaga and Satipo.

In summary, the greater the availability of natural resources, the slower the rates of deforestation for the three ethnic groups under consideration. This lower rate of destruction correlates with a diversification of productive activities. Conversely, a greater dependence on agriculture to the exclusion of other types of productive activities leads to higher rates of deforestation. The relationship between natural resources and deforestation rates noted among the indigenous groups is the inverse of that described for the colonists in these regions. Among the colonists, the more land available, the greater the rates of consumption and destruction of the forest. For the native population, the more land available, the greater the number and types of natural resources available, and the more diversified the approach to the exploitation of these zones.

Slash-and-burn agriculture among the indigenous groups is radically different from the migratory agriculture of the colonists. It is the first phase of a prolonged system of agroforestry, as several authors confirm (Irvine 1989:225; Clay 1988; Denevan et al. 1984; Denevan and Padoch 1987). The native populations do not merely restrict the farm's resources to two or three years of annual crop harvests, but maintain the fallow land in fruit trees, and other trees with high commercial timber value or for medicine or construction. Moreover, much of the land that they clear is not exactly a natural forest but a managed forest. These management strategies conserve the structure and composition of the tropical forest. Among the Andean colonists, such a resource management strategy does not exist, particularly for the fallow lands in the tropical zones. All three indigenous populations, while differing from each other, show a lower rate of deforestation than any of the colonists, but the comparison between the two groups must not be limited to the size of the areas deforested, it should also look at resource management in general.

A controversial issue is the conservationist ethic which, according to Moore (1985), manifests itself in a rational system of natural resource management among the Amarakaeri. This argument emerges from Moore's extensive field experience with the Amarakaeri of Madre de Dios. Nevertheless, Johnson (1989) in a recent article on the Machiguenga of Urubamba maintains that this group's judicious nondepleting use of natural resources owes itself to low population density and not to a deliberate conservationist goal. In his fieldwork Johnson did not encounter a conservationist ethic among the Machiguenga. Certainly, among some ethnic groups, like the Amarakaeri for example, the conservationist ethic may constitute an important part of their technological culture, but in other cases reduced demographic pressure on natural resources may determine their management. Likewise, Johnson argues that the Machiguenga approach to their environment reveals an "economizing calculation of self interest" (ibid.:220) by independent small groups that practice a family-centered technology. However, Johnson

(1989) did not sufficiently analyze the higher or lower level of articulation of the Machiguenga to the market economy as a regulating factor in the rational or destructive use of the natural resources. If we take into account the economic relationship of the indigenous groups to the market, Johnson's argument concerning the effect of demographic pressure on natural resources cannot be discounted, but assumes other variables. The population factor is located in a larger context and is not the single element explaining the appropriate or inappropriate use of natural resources. In the next section we will continue developing this theme.

### B. Economic Orientation and Deforestation: Indigenes and Colonists

Different economic rationales underlie the productive activities of each of the three groups. The economic orientation of agriculture in each area was calculated from the volume of harvests in kilograms. The calculations were obtained after a field study that lasted between three and four months under the direction of anthropologists or field technicians who had prolonged experience in the regions being studied, in some cases more than five years. The indigenous people of Madre de Dios actively participated in the investigation. In that Madre de Dios region, which has the slowest rates of deforestation, 72 percent of the family productive units are predominantly oriented toward self-sufficiency, while another 24 percent focus exclusively on this goal (CIPA 1986b:45). This means that 96 percent of nuclear and extended families in the Madre de Dios region organize their agricultural activities around the concept of family self-sufficiency (ibid.:46-47). Among the Amarakaeri, who are heavily involved in gold mining, the average number of hectares under cultivation per domestic unit is 1.04, the main cultigens being manioc, corn, and bananas (CIPA 1986b:39). The income from gold has led to a reduction in the amount of time devoted to agriculture in comparison to previous generations (ibid.).

One of the most remarkable aspects of the Amarakaeri's participation in gold extraction is the high income it generates, yet the results of the CIPA investigation indicate that this money has not disrupted the Amarakaeri's traditional productive organization, characterized by a variety of economic activities. Although they dedicate less time to traditional tasks, they have not abandoned hunting, fishing, or foraging, or modified their nondestructive management of resources. The greater availability of land has allowed the Amarakaeri to maintain their slash-and-burn agriculture, oriented to the unit of production and consumption, and they have continued it utilizing their own techniques characteristic of indigenous Amazonian peoples.

As already indicated, in the Lower Urubamba — which is occupied by the Machiguenga and the Piros — the deforestation rates are higher than in the Madre de Dios region. According to the CIPA report, the relative degree of self-sufficiency in this region is also high. The agricultural activities of 72 percent of the domestic units are primarily oriented toward the goal of economic autonomy, while 9 percent cultivate exclusively for family consumption (CIPA 1986b:47). In other words, 81 percent of the production and consumption units included in the CIPA study utilized their crops to fulfill the dietary requirements of the household. In contrast to the Madre de Dios region, 19 percent of the Machiguengas and Piros of Urubamba market

the majority of their agricultural produce. Even those who are primarily involved in production for domestic consumption sell a larger percentage of their harvest (CIPA 1986b:45).

Likewise, as we have previously indicated, the rates of deforestation among the Ashaninka of Satipo are the highest noted for the three ethnic groups included in the study. A number of economic and social processes have contributed to this situation. In contrast to the other two regions, monetary income and cash crops have become more important for the Ashaninka than subsistence farming, and traditional productive activities have declined in significance (CIPA 1986b:69). In the Satipo region, commercial agriculture centers around cacao and coffee, produced for external markets. This emphasis on one or two crops, together with the influx of peasants from the highlands, has put a great strain on the natural resources of the land. This has in turn led to changes in the logic of economic self-sufficiency associated with the more traditional patterns of the agriculture.

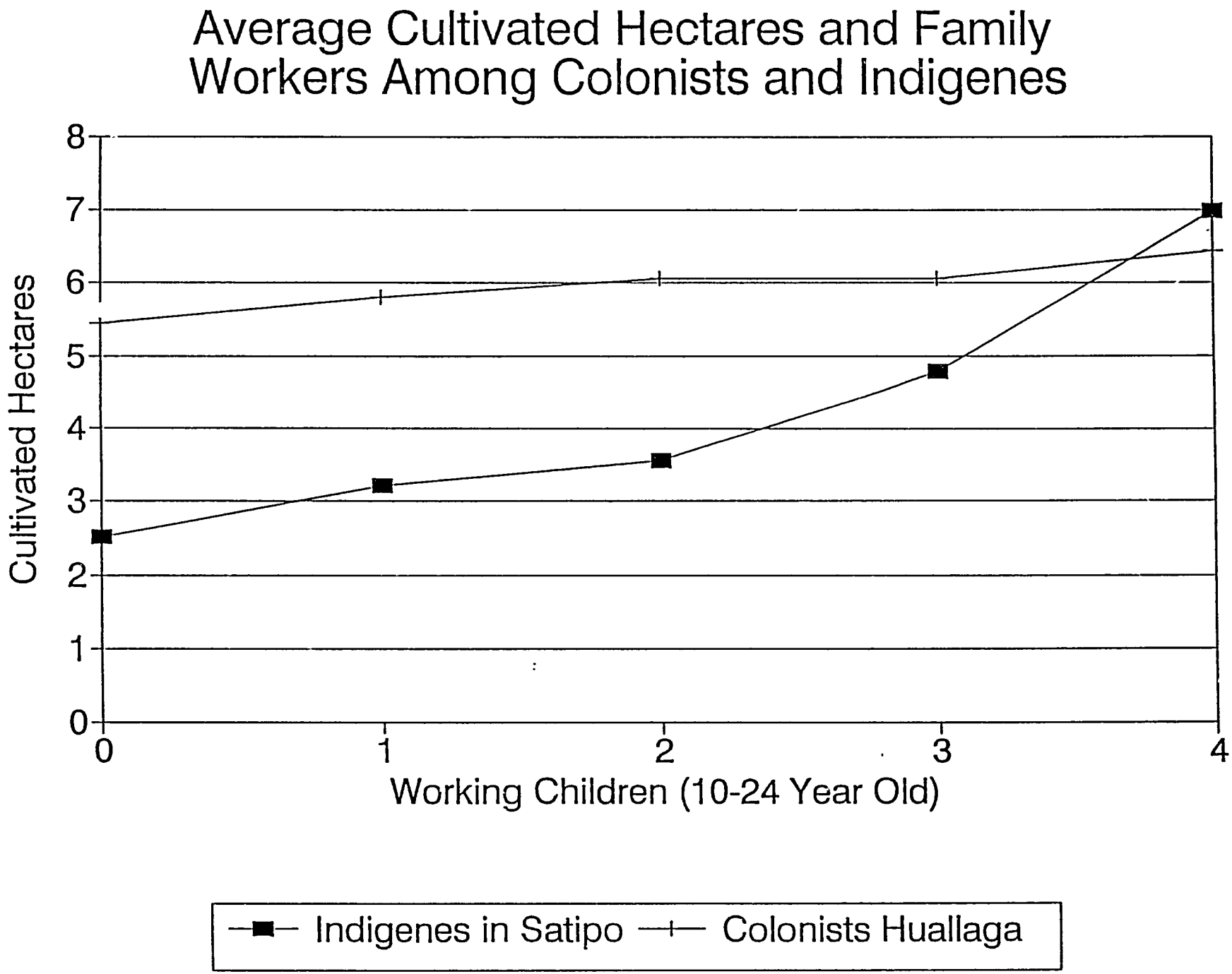
In Satipo, agricultural production is specialized to varying degrees. The degree of specialization appears to correlate with who the intended recipients of the produce are. While coffee, bananas, cacao, and papaya are commercial crops produced for export, other items such as avocados, rice, pitucas, and manioc are primarily for domestic consumption. An estimated two-thirds of the Ashaninka's productive units in the region produce for the market while the remainder produce primarily for domestic use.

The natives and the settlers also organize and utilize human resources differently, which implies a difference in the management of natural resources. The availability of family labor is more critical for the Ashaninka than for the colonists of Upper Huallaga. According to a study conducted by the Foundation for National Development (FDN 1981), the average increase in the amount of land under cultivation in the Upper Huallaga for each child of working age is 0.24 hectares. This is only 21 percent the rate of increase in new agricultural lands (1.11 hectares) that the Ashaninka experience with the entrance of a ten-year-old son into the productive life of the family. Even though the settlers work a larger number of hectares on average, the contribution of each son of working age is not as significant as in the native population. Figure 2 shows the importance of family labor among the Ashaninka in the strong correlation between the number of children of working age in a family and the number of hectares under cultivation.

Among the colonists in the Upper Huallaga, except in the initial stages of colonization, this correlation is not as significant. While the indigenous population depends heavily on the family labor force, the settlers combine family labor with wage labor to increase the amount of land in agricultural production (CIPA 1986b:43-44). According to one study, 75 percent of the settlers in the Upper Huallaga region contracted seasonal wage labor (Aramburú 1984).

Natives also differ from settlers in the association between the total number of children and the amount of land under cultivation. In the Upper Huallaga, the correlation of these two variables is not as great as in the case for the Ashaninka Indians (Figure 3). The family size of colonists in the Upper Huallaga does influence the processes of agricultural intensification in

Figure 2.




Sources: Survey FDN 1981; CIPA 1986b.

zones of greater population density. In less heavily populated areas, it is the number of sons of working age that is most strongly correlated with the number of hectares under cultivation (Aramburú and Bedoya 1987). Family size never, however, has the same overall importance that it does for the indigenous communities.

The significant revenue the Ashaninka Indians generate by cash crops, which they use for obtaining urban-produced foodstuffs, has reoriented their agricultural production to the market economy. Finding themselves involved in a regime of commercial production, they organize their production strategies accordingly, but, as the CIPA study concludes, their participation in the market economy is motivated by the need to satisfy the basic requirements of the domestic productive unit, not by the logic of accumulation (CIPA 1986b:92). Once the biological and cultural requirements have been met, production declines (ibid.).

In sum, the productive strategies of the indigenous populations that occupy the three regions discussed above operate within a logic of simple reproduction or of a simple commodity production. By looking at the various factors involved more holistically, one learns why the indigenous peoples of the Peruvian Amazonia have strategies of resource management and rates of deforestation that differ significantly from those of recent settlers in the region.

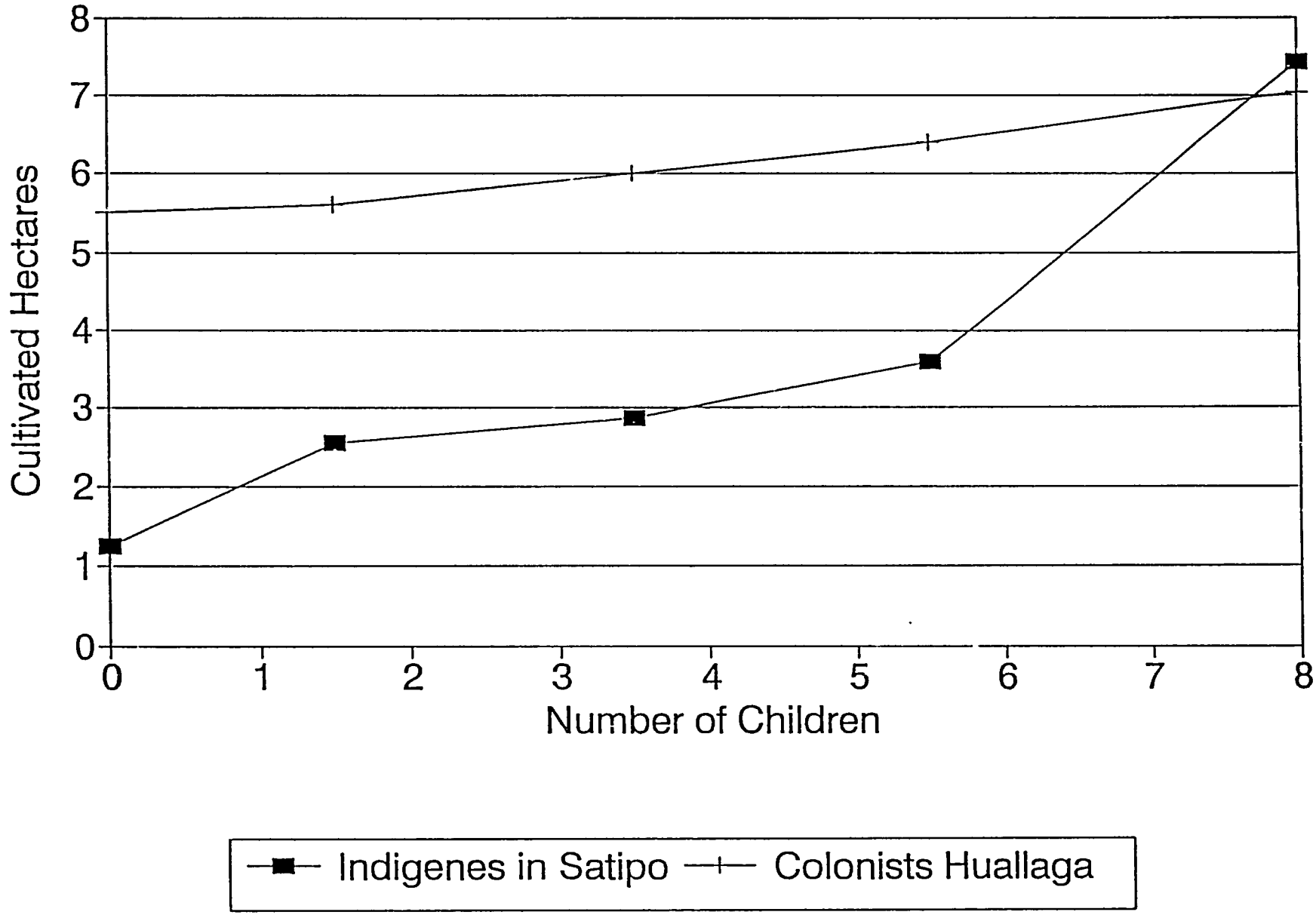
## V. Summary and Theoretical Implications

Agricultural systems, the specific technological methods by which a human society obtains edible crops, will always correspond to its forms of social and economic organizations. Specific economic rationales also result from a particular articulation of forms of production, i.e., urban capitalist economy with peasant economy. Likewise, agricultural systems also have a relation to certain levels of local and regional demographic density, and to the availability of natural resources (Turner and Brush 1987). Such a definition of agricultural systems leads us not to a study solely of social factors involved in a particular technology, but to an understanding that social and economic relations continuously affect technological decisions (Bettelheim 1972).

In the case of the colonists in Upper Huallaga we cannot limit the analysis of the intensification of agriculture and deforestation to a description of the characteristics of slash-and-burn agriculture. The effects of the illegality of coca, its high production costs, and above all the high income it generates, provide eloquent proof that structural factors such as prices for agricultural products and their inputs are determinant variables and even more important than legal land deeding in the process of intensifying land use. The legal system may improve the conditions of production for farmers, but a change in land tenure laws alone is not sufficient to modify land use patterns radically.

Likewise, in the case of the indigenous groups of the three regions under study, the greater or lesser availability of natural resources decidedly influences the level of deforestation in each case, but it is only one factor in a larger group of variables. The greater access to resources, permitted for example in Madre de Dios by lower population pressure, must be

# Average Cultivated Has. by Number of Children among Colonists & Indigenes




Sources: Survey FDN 1981; CIPA 1986b.

viewed in the context of their economic orientation. The analysis of the particular characteristics of soil use does not permit unicausal explanations.

We continue, nevertheless, to blame Andean colonists, Brazilian peasants, and the technological requirements of shifting agriculture for the deforestation of the Amazon. The problem of deforestation does not originate with individuals or systems of extensive agriculture. It is rooted in a determinant class structure that corresponds to the model of regional and national accumulation. The agricultural system and the destructive behavior of the peasants is only an expression of a much more profound problem in the structure of society.

## Bibliography


Aramburú, C.
1984 Problemática Social en las Colonizaciones. In Población y Colonización en la Alta Amazonía Peruana. CNP-CIPA. Lima, Perú.

Aramburú, C., and E. Bedoya
1987 Poblamiento y Uso de los Recursos en la Amazonía Alta: El caso del Alto Huallaga. *In* Desarrollo Amazónico: Una Perspectiva Latinoamericana. Edited by CIPA-INANDEP. Lima, Perú.

Bedoya, E.
1981 La Destrucción del Equilibrio Ecológico en las Cooperativas del Alto Huallaga. Serie Documentos #1. CIPA. Lima, Perú.

1987 Intensification and Degradation in the Agricultural Systems of the Peruvian Upper Jungle. *In* Lands at Risk in the Third World. P. D. Little and M. M Horowitz, eds. Boulder, CO: Westview Press.

1990 Las Causas de la Deforestación en la Amazonía Peruana: un Problema Estructural. Working Paper #46. Binghamton, NY: Institute for Development Anthropology.

Bedoya, E., and F. Verdera
1987 Estudio sobre Mano de Obra en el Alto Huallaga. Ronco Corporation. Lima, Perú.

Bettelheim, Ch.
1972 Cálculo Económico y Formas de Propiedad. Siglo XXI. Buenos Aires.

Boserup, E.
1984 Población y Cambio Tecnológico. Grijalbo Ed. Madrid, Spain.

CENCIRA
1973 Diagnóstico Socio-Económico de la Colonización Tingo María-Tocache-Campanilla. Lima, Perú.

CIPA (Centro de Investigación y Promoción Amazónica)
1986a Informe de Estudio sobre la Leishmaniasis en la selva alta. Internal Document prepared for World Health Organization.

1986b Impacto de la Economía de Mercado en las Comunidades Nativas de Satipo, Bajo Urubamba y Madre de Dios. Internal Document. Lima, Perú.

Clay, J. W.
1988 Indigenous Peoples and Tropical Forests: Models of Land Use and Management from Latin America. Cambridge, MA: Cultural Survival, Inc.

Collins, J.
1986 Smallholder Settlement of Tropical South America: The Social Causes of Ecological Destruction. In Human Organization 45(1):1-10.

Collins, J., and M. Painter
1986 Colonización y Deforestación en America Central: Discusión sobre Asuntos de Desarrollo. Working Paper No. 31. Binghamton, NY: Institute for Development Anthropology and Clark University.

Denevan, W., and C. Padoch
1987 Swidden Agroforestry. New York: New York Botanical Garden.

Denevan, W. M., J. M. Treacy, J. B. Alcorn, C. Padoch, J. Denslow, and P. Flores
1984 Indigenous Agroforestry in the Peruvian Amazon: Bora Indian Management of Swidden Fallows. In Interciencia 9(6):346-357.

Dourojeanni, M.
1982 Posibilidades para un Desarrollo más integral en el Huallaga Central-Bajo Mayo. In Boletín de Lima. No. 16-17. December. Lima, Perú.

1989 Impactos Ambientales de la Coca y la Producción de Cocaína en la Amazonía Peruana. In Coca y Cocaína. CEDRO. Lima, Perú.

Durham, F. Kathleen
1977 Expansion of Agricultural Settlement in the Peruvian Rainforest: The Role of the Market and the Role of the State. Paper presented to the Association of Latin American Studies and the Association of African Studies. November. Houston, Texas.

ECONSULT
1986 Informe Final de la Evaluación del Proyecto. USAID no. 527-0244 Desarrollo Rural del Area del Alto Huallaga.

FDN (Fundación para el Desarrollo Nacional)
1981 Plan de Ejecución del Proyecto de Desarrollo Rural Integral del Alto Huallaga. Social Report. Lima, Perú.

Foweraker, J.
1981 The Struggle for Land. Cambridge: Cambridge University Press.

Friedmann, H.
1980 Household Production and the National Economy: Concepts for the Analysis of Agrarian Formations. Journal of Peasants Studies, Vol. 7, No. 2.

Hecht, S. B.
1984 Cattle Ranching in Amazonia: Political and Ecological Considerations. *In* Frontier Expansion in Amazonia. M. Schmink and Ch. Wood, eds. Gainesville, FL: University of Florida Press.

INE (Instituto Nacional de Estadística)
1987 Encuesta Nacional de Hogares Rurales. Lima, Perú.

Irvine, D.
1989 Succession Management and Resource Distribution in an Amazonian Rainforest. In Advances in Economic Botany 7:223-237.

Johnson, Allen
1983 Machiguenga Gardens. *In* Adaptive Responses of Native Amazonians. Raymond Hames and W. Vickers, eds. Studies in Anthropology. New York: Academic Press.

1989 How the Machiguenga Manage Resources: Conservation on Exploitation or Nature? Advances in Economic Botany, Volume 7:213-222.

Martine, G.
1980 Recent Colonization Experiences in Brazil: Expectations versus Reality. *In* Land, People and Planning in Contemporary Amazonia. F. Barbira-Scazzocchio, ed. Cambridge: Cambridge University Press. Pp. 80-94.

Moore, Thomas
1985 Madre de Dios: Reseña Histórica. Internal Document. Centro de Investigación y Promoción Amazónica (CIPA). Lima, Perú.

Moran, E.
1984 Colonization in the Transamazon and Rondonia. *In* Frontier Expansion in Amazonia. M. Schmink and Ch. Wood, eds. Gainesville, FL: University of Florida Press.

Myers, N.
1980 The Primary Source: Tropical Forests and Our Future. New York: W. W. Norton & Co.

Painter, M.
1987 Intercambio Desigual: La Dinámica de Empobrecimiento de colonos y la Destruccion Ambiental en las Tierras Bajas de Bolivia. Working Paper #9. Lima, Perú.

Rasnake, R., and M. Painter
1989 Rural Development and Crop Substitution in Bolivia: USAID and the Chapare Regional Development Project. Working Paper #45 . Binghamton, NY: Institute for Development Anthropology.

Schmink, M., and C. H. Wood
1987 The "Political Ecology" of Amazonia. *In* Lands at Risk in the Third World. P. D. Little and M. M Horowitz, eds. Boulder, CO: Westview Press. Pp. 38-57.

Schuurman, F.
1980 Colonization Policy and Peasant Economy in the Amazon Basin, Bulletin of Latin American Studies and the Caribbean (Boletín de Estudios Latinoamericanos y del Caribe). December.

Shoemaker, R.
1981 Colonization and Urbanization in Peru: Empirical and Theoretical Perspective. *In* New Approaches to the Study of Migration. D. Uzzel and D. Guillet, eds. Rice University Studies 62(2).

Sioli, H.
1980 Foreseeable Consequences of Development Schemes and Alternative Ideas. *In* Land, People and Planning in Contemporary Amazonia. F. Barbira-Scazzocchio, ed. Cambridge University Press.

SIPA (Servicio de Investigación y Promoción Agraria)
1962 La Actividad Cafetalera en Tingo María. Servicio de Investigación y Promoción Agraria. Ministerio de Agricultura. Lima, Perú.

Todaro, M.
1977 Economic Development in the Third World. Longman. London.

Turner, B., and S. Brush
1987 Comparative Farming Systems. New York: The Guilford Press.

Verdera, F.
1984 Estructura Productiva y Ocupacional en la Selva Alta. In Población y Colonización en la Alta Amazonía Peruana. CNP-CIPA. Lima, Perú.