

PN-ABD-763

63598

E50

SMALLHOLDER SETTLEMENT OF TROPICAL SOUTH  
AMERICA: THE SOCIAL CAUSES OF ECOLOGICAL  
DESTRUCTION

by Jane L. COLLINS

# *Smallholder Settlement of Tropical South America: The Social Causes of Ecological Destruction<sup>1</sup>*

JANE L. COLLINS

001421

This paper examines the relationship between social cycles of indebtedness and differentiation and cycles of ecological destruction and decline in three newly settled regions of Latin America. In contrasting the case of colonization along the Transamazon Highway in Brazil with that of the Lago Agrío colonization in northeastern Ecuador and with seasonal migration into the Tambopata Valley of southern Peru, significant patterns of interaction between social context, producer decisions and environmental deterioration emerge. Structural incentives to produce for short-term gain are described in each case, as are the ways in which these factors work against sustained yield production systems. Identification of the complex interactions between ecological and social processes in each area challenges assumptions that the failure of many efforts to open new lands in the tropics can be attributed to the unsuitability of the soils or to the inefficiency of small producers in these environments.

**Key words:** settlement, ecology, producer decisions

**R**ECENT YEARS HAVE WITNESSED the emergence of a highly charged debate over the appropriate use of easily degradable tropical lands. As one observer has commented, tropical soils have either been represented as a "chimerical vision, liable to disappear in a puff the first time a spade is set into them, or a super-exploitation zone that can be mined constantly with little or no negative consequence" (Stouffer 1984:6). In the context of this debate, smallholder agriculture has alternately been promoted as the most efficient way to bring fragile lands into production, or has been downplayed as economically unsustainable.

Understanding of the ecological issues related to land use in the humid tropics has increased sufficiently in the past decade to allow us to move beyond such either/or propositions. Much has been learned about the variable properties of tropical soils and their relative susceptibility to deterioration.<sup>2</sup> Research on cropping practices has revealed both the

appropriateness and limitations of slash and burn agricultural techniques and has given rise to a growing concern for agroforestry and other innovative cropping models that seek to work with, rather than against, the soil properties and productive characteristics of tropical environments. At the same time there has been a growing awareness that more sophisticated knowledge of a region's ecology and an increased repertoire of productive techniques do not guarantee sustained and successful resource management. Environmental deterioration cannot be understood without considering the ways in which land tenure, credit policies, titling and other institutional factors condition the resource management strategies of the producers who work the land.

The discussion that follows focuses on links between social processes and cycles of environmental decline in newly settled regions of tropical Latin America. It begins with the recognition that different land use patterns have different environmental impacts, and raises the question of how factors in the larger social environment affect these patterns. Examples from three areas are used to show how land tenure and related aspects of agrarian structure, access to capital and labor, market processes, technology, productive knowledge and a range of other variables affect the land use decisions of small producers in their new environment.

These examples reveal that unfavorable market integration, high levels of surplus extraction, and policies that engender indebtedness have double consequences. Not only do they perpetuate poverty and underdevelopment, but the strategies smallholders adopt to insure their survival under such circumstances are frequently incompatible with sustained, environmentally appropriate land use and lead to

---

*Jane L. Collins is an Assistant Professor in the Department of Anthropology at the State University of New York at Binghamton, New York 13901. The author thanks Michael Painter, Peter Little, Thayer Scudder and an anonymous reviewer for Human Organization for their helpful comments in the preparation of this paper. Funding for the Peruvian research presented was provided by the Inter-American Foundation Doctoral Fellowship Program. The Institute for Development Anthropology, through their Cooperative Agreement on Settlement and Resource Systems Analysis, provided support for the author to attend the Land Tenure/Common Theme Workshop (USAID/University of Wisconsin Land Tenure Center) where an initial version of this paper was presented.*

## Social and Ecological Cycles in the Brazilian Amazon

deterioration of soils and other natural resources. Declining yields make it more difficult to meet external obligations and subsistence needs, and where competition for land is strong, may result in loss of holdings. In order to formulate adequate policies for land use and resource management in newly settled areas, the links between social and ecological dynamics must be made explicit, and social factors must be incorporated into models of ecosystem change in ways that go beyond simple descriptions of behavior and reflect a more sophisticated understanding of the contexts within which land use decisions are made.

Most recent anthropological work on peasants and small farmers has emphasized their rationality and adaptive behavior (Schultz 1964; Wharton 1971; Netting 1968; Bennett 1969; Johnson 1971; Brush 1977; Barlett 1980). While variability in knowledge and skills among local populations has been recognized, much attention has been given to the ways in which people alter their behavior to make best use of available social and ecological resources. Yet the destruction of tropical lands has often been attributed to the poor decisions of small producers. Colonists have been shown to pose a threat to the survival of indigenous populations (Whitten 1978; Vickers 1982). More frequently they have been accused of causing the wasteful and premature depletion of natural resources (Guppy 1984). A recent survey of development of lands in the humid tropics concludes that:

The preference of most cultivators is to manage toward a steady state, but their trial-and-error means of adapting traditional agricultural practices in a gradually changing environment is inadequate to deal with the rapid environmental change brought about by increasing population and externally created market pressures (National Research Council 1982:99).

Intensification of shifting cultivation, a frontier attitude toward new lands that leads to an ongoing pattern of exploitation and abandonment of fields, and failure to consider the long-term effects of cultivation practices are all problems that have been attributed to small farm colonists in new settlement areas.

In the following sections, explanations for what would seem to be poor and self-destructive management practices by small producers are sought in case studies of colonization areas where environmental degradation is occurring. The mechanisms of social and ecological change will be identified in published accounts of colonization efforts along the Brazilian Transamazon Highway, in northeastern Ecuador, and in research conducted by the author in a Peruvian valley on the eastern slopes of the Andes.<sup>3</sup> In extracting these cases from their original presentations much detail is omitted and the full context of events cannot be conveyed. Growing numbers of well-documented local studies pose a challenge, however, to social scientists who wish to bring them to bear on policy decisions or social action. In comparing such studies, one can determine whether there are patterns in the interaction of variables in different cases. It becomes possible to ask whether the processes of environmental degradation, that almost without exception have accompanied the settlement of new regions, must be explained on the basis of idiosyncrasies of climate and culture, or whether significant patterns of interaction between the social context, producer decisions and environmental deterioration can be identified.

The Brazilian Transamazon Highway, built in the 1970 was one of the largest and most ambitious attempts ever made to open tropical lands to a variety of uses. It was widely viewed as a test of the proposition that the humid tropics of South America were a frontier for agriculture. In its initial stages it was also a test of a small farm model of colonization. Beginning in 1970, the Brazilian government provided support for homesteading programs directed toward small-to-medium-sized farmers. After four years, however, it reversed its policy—proclaiming the failure of the small farm mode and shifting its support to large-scale developers.

The successes and failures of the Transamazon colonization program have been the subject of an extensive literature contributed by scholars from a wide range of disciplines. Some have argued that the problems encountered are evidence that the skills and knowledge necessary to effectively exploit the Amazon are not yet available, with the implication that further attempts at agricultural development in the region should be halted until such knowledge is acquired (Goodland 1980). Detailed studies have revealed, however, that failure was related to the inadequacy of knowledge far less frequently than to the fact that the knowledge possessed was not implemented in particular settings.

Moran (1981) has provided a detailed analysis of the experiences of colonists along the Transamazon Highway. His research was conducted during the initial stages of the colonization in Altamira—a *município*, or county, of the state of Pará. Moran suggests that the Brazilian government may have been premature in its declaration that small farm colonization was a failure. While he describes the difficulties encountered by many colonists, his analysis reveals that nearly 40% of the population he studied was able to achieve “respectable levels” of income and productivity during their first few years of residence in the zone (1981:224).

The soils in the region Moran studied did not conform to the popular image of the Amazon as characterized by easily degradable “laterite.” While considerable variety existed within the region, there were significant areas of alfisols or *terra roxa*, which were high in nutrients, neutral in pH, and which possessed an excellent structure. Moran found that most of the problems that colonists encountered were related not to poor resources or an inability to sustain yields, but to their own poor management practices and an inattentiveness on the part of government agencies and other institutions to the local realities of the colonization context.

Moran gives numerous examples of these problems. Extension workers sent to the regions were frequently inexperienced, had little knowledge of the demands of local production, and could not seem to work effectively with individuals they perceived as being of lower social status. The bureaucracies of the Colonization Institute (INCRA—Instituto Nacional de Colonização e Reforma Agrária), the banks and other institutions were inflexible. This meant that it was frequently impossible to obtain inputs at the time they were required, or to acquire credit, tools, seed or extension services.

Moran (1981), Smith (1982), and Wood and Schmink

(1979) all emphasize the failure of government agencies to provide services they had promised settlers as a factor affecting colonist performance in the initial colonization period. Jobs, food subsidies, housing and educational and health services never materialized in some cases, and were late or inadequate in others. These problems only exacerbated the difficulties of undertaking production in a new environment.

In discussing adaptation to the zone, Moran emphasizes the value of the knowledge of the *caboclos*, or Amazonian peasants, in suggesting effective patterns of resource use for the region (Moran 1974). The *caboclos* were particularly adept at recognizing the best soils of the area on the basis of the type of vegetation they supported, but they also possessed a wealth of knowledge about the exploitation of local game and wild products, the cultivation of native food crops, and medicinal practices. Smith (1982), whose work in the zone is contemporaneous and includes additional data from a later period, has questioned whether these skills were fully transferable to the demands of a cash-cropping, market-oriented agricultural system. He found that over time the incomes of *caboclos* declined relative to the income of migrants from other regions, a fact that he feels may have been related to their lack of management skills and their subsistence orientation.

Failure may also have been linked to the ways in which the exercise of the productive knowledge of the *caboclos* was constrained by credit and marketing policies. In particular, the maintenance of a diversified production system was made difficult by the active promotion of rice cultivation by government agencies and banks. Credit was not provided for traditional crops such as manioc, despite their high value on the local market. High costs of fertilizer for cacao and of transport for bananas made these crops somewhat risky. Knowledge of appropriate crops and diversified cropping strategies were effectively undermined by the sets of constraints and incentives provided by institutions associated with colonization.

Moran makes it clear that colonists did not enter the region with equivalent skills, experience and capital. He divided the colonist population of the initial colonization period into two groups: brokers and clients. Brokers were entrepreneurs or independent farmers who were able to generate their own capital and to reinvest in their enterprises. Clients depended on brokers for their access to cash and produced mainly for subsistence rather than reinvestment. Clients were subdivided by Moran into laborers and artisans depending on their antecedent economic activities.

This social differentiation was in part imported to the Amazon along with the migrants themselves. Brokers frequently possessed management experience and small but significant savings upon their arrival, while clients did not. Nevertheless, a system of patronage and class distinction quickly took root in the colonization context. Brokers emerged as market intermediaries and transporters; they moved into cattle ranching; they supplemented household labor resources with hired hands. Clients worked off-farm as well, but in wage labor, and became increasingly dependent on brokers and in many cases abandoned or sold their lands. The 40% of colonists Moran identified as successful were in the broker category. Even in the early period of the colonization covered by this study, the region appears to have been characterized

by social groups standing in diverse relationships to productive resources and with differing capacities for capital accumulation.

Schmink (1982), Wood and Schmink (1979), Smith (1982) and Tandler (1980) all indicate that inequalities increase after the government's shift to an emphasis on larger enterprises in 1974. The indebtedness of farmers was exacerbated. Smith (1982) indicated that colonists in the late 1970s were often making payments on as many as four loans at the same time: they owed INCRA for their lots and frequently for their homes and the initial six-month start-up loans, the Banco do Brasil for short-term loans for rice cultivation and long term loans for power saws, pumps, barbed wire, livestock and perennial crops. Those who could not earn enough to repay their loans and meet subsistence needs sold their plots to other colonists and left the region, or became hired workers on the lands of others. Land conflicts also became more prevalent. Violence increased in regions where large cattle ranchers began to establish claims (Schmink 1982; Fowleraker 1981; Souza Martins 1980).

How was this process of social differentiation and land consolidation related to ecological occurrences? A partial answer is provided by Wood and Schmink's (1979) discussion of one particular type of land conflict that emerged in the colonization zone. In the years after 1974, numerous claims of "predatory burning" were brought against small producers by large landowners. These claims were based on the fact that official colonists were allotted 100 hectare plots by the government, on the condition that 50% of the land remain in forest reserve. This allowance was meant to include sufficient land for rotation and fallowing. When more than the prescribed amount of land was brought under cultivation, claims of predatory burning or predatory occupation could be brought against the landholder. Wood and Schmink note that there is little evidence that official colonists overstepped limits on clearing and suggest that this practice may have been more of a problem among spontaneous migrants who cleared land outside the officially allocated colonization areas. In any event, when proven, these claims usually resulted in a heavy fine being levied against the offender. If this could not be paid, the family had no alternative but to abandon their plot.

Clearly these claims were used by large farmers as a means of expanding their holdings. They provide an insight into colonist response to indebtedness, however, that might otherwise escape our attention. The pattern that emerges appears to be of more than local significance, since claims that small farmers clear too much of their land have also been used in this manner by ranchers in Bolivian colonization zones as well (Rivière d'Arc 1980).

Hecht (1981) provides information that helps to explain why the overexploitation of land by small producers may be an easy target for large landowners seeking to expand their holdings. In an article describing the impact of deforestation on Amazonian soils she makes the following point:

Although small farmers could cultivate in a manner to reduce the environmental impact of agriculture (and possibly their own economic vulnerability), most tilling and agricultural credit is linked to rice production. Rice yield declines without fertilizers are almost inevitable given current production technologies in the Amazon. The small holders with few assets are usually highly leveraged either to

official organs or informal money lenders . . . . Given decreasing yields, the small colonist must often relinquish his land to richer, medium-sized farmers, *grileiros* (land grabbers), or ranchers when loans fall due, titles are contested or power clashes occur (1981:79).

Hecht notes that while the immediate causes of failure for the small farmer are soil nutrient changes and weed invasion, these phenomena are linked to credit policies that encourage rice production. The jeopardy in which they find themselves when yields begin to decline is a product of intensifying competition over land in the region. Ecological deterioration and land loss is not an inevitable feature of the ecology of the region, but is tied to institutional constraints and land economics.

The claims of predatory burning launched against small producers become easier to comprehend in the context of the ecological and economic pressures just described. Smallholders responded to indebtedness and the declining yields associated with a heavy emphasis on rice by intensification or expansion of their productive strategies. By shortening the fallow period, depleting forest reserves, or moving toward monoculture, families barter the short-term against the long. Predatory burning, to the extent that it existed and was not a fabrication of land-hungry enterprises, reflected this trade-off. Whether land was lost immediately, through legal proceedings in which small farmers could not effectively defend themselves, or came slowly through abandonment or foreclosure in the face of declining yields, the impact was the same. The social and ecological results, like the social and ecological causes, were intertwined.

The literature on agricultural intensification suggests that farmers will not intensify in the face of declining returns to labor unless faced with external pressures (Boserup 1965; Barlett 1976). Population growth and declining yields are processes that can induce such intensification. All evidence indicates that in the absence of significant inputs, yield declines are inevitable with the annual monocultivation of rice. In emphasizing this practice, the Colonization Institute virtually guaranteed that colonists would face this dilemma. The existence of heavy liens on production is an additional source of pressure that forces the smallholder to take some action. New land may be cleared to insure a good harvest undiminished by lowered soil fertility and weeds. There is no evidence that colonists intensified or expanded land area cultivated as a basis for accumulation. As Moran points out, most successful colonists accumulated on the basis of cattle or transport. It appears that in many cases smallholders engaged in environmentally destructive activities as a last resort in order to meet their obligations and to hold on to their lands.

Recent literature has reflected an increasing optimism about the potential role of agriculture in some parts of the Amazon basin. Moran, Smith and others make it clear that the ecological barriers once thought to preclude production in the region are not absolute. Low productivity and ecological deterioration along the Transamazon Highway are not so much the results of the exploitation of ecosystems that should not be used, but of the creation of incentives for improper use of land in an environment of strong competition. As Durham (1979) has pointed out for Central America, events that are profoundly tied to social structure—the accumulation of resources by one class at the expense of another—may be attributed to ecological causes. As the “soccer war” between

El Salvador and Honduras was attributed to overpopulation, the failure of smallholding colonists in the Amazon has been called the inevitable result of exploitation of tropical soils. Closer analysis reveals that it was not inevitable, but a result of the interaction of social and ecological processes (a schematic version of these processes is presented in Figure 1). Whether this is an isolated case of resource mismanagement or one that has broader implications requires the analysis of other settings.

### *Credit, Titles and Social Differentiation in Northeastern Ecuador*

Hiraoka and Yamamoto (1980) have described spontaneous and planned colonization schemes in northeastern Ecuador. They have focused on the area around Lago Agrio opened to colonization largely as a result of road building and a demand for labor resulting from petroleum exploitation activities. In the early 1970s approximately 10,000 workers were brought in the region to work on a variety of projects related to the oil boom. After the projects were completed, some 5 to 10% of the individuals chose to remain as farmers. At the same time the Ecuadorian Agrarian Reform Institute (IERAC—Instituto Ecuatoriano de Reforma Agraria y Colonización) began recruiting and transporting settlers to the region. While this planned resettlement was short-lived, the opening of roads attracted spontaneous migrants. At the time of the study conducted by Hiraoka and Yamamoto (1975–1978) some 37,500 people had settled in the zone.

Two farming systems competed for land in the region. A form of slash-mulch polyculture was practiced by most small farmers. Because there is no distinct dry season in this part of the Ecuadorian lowlands, felled vegetation is not burned, but allowed to remain as mulch for cultivated plants. Times for clearing and planting are not climatically determined and may be spread throughout the year. Annual crops (rice, maize and sweet potatoes) are intercropped with semi-perennials (*papa china*, plantains, bananas and yuca) and perennials such as coffee, cacao and citrus. Soil cover and shade are maintained in a way that is ecologically beneficial. Hiraoka and Yamamoto report that plots managed under such a system provide sustained yields for 10–15 years. The techniques of slash-mulch polyculture represent an amalgam of the previous farming practices of migrants and of local practices.

The second major farming system in the region is cattle ranching. While most pastureland is controlled by large holders, Hiraoka and Yamamoto emphasize that ranching is an activity to which all colonists aspire. The climate of the region is favorable for year-round feeding, making it popular as a beef-fattening area. The advantages presented by cattle (their limited labor requirement, high value, relative lack of problems with overproduction, storage or transport, and their relative price stability) create strong pressures for their production. There are no studies that indicate what the long-term impact of conversion to pasture will be on the soils of this area. Several pasture diseases have presented problems in recent years, and siltation of rivers has been cited as a major negative impact of pasture formation (Hiraoka and Yamamoto 1980).

As in the Brazilian case, however, Hiraoka and Yamamoto found that institutional rather than ecological factors posed the most immediate challenges to small producers. The costs of obtaining a plot were high, and included mandatory membership in an agricultural cooperative, and the surveying, mapping and registration of land, in addition to the cost of the land itself. While this amount could be amortized over as long as 25 years, settlers could not receive permanent title until the amount was paid in full. Without permanent title they could not obtain credit. Legal transfer was also impossible with provisional title so that those farmers forced to sell their lots before their debts were paid in full could only obtain a fraction of its real value.

All of these factors acted to impede capital accumulation among smallholders. Some impatient settlers converted their polycultural plots to pasture before they had amassed the capital to begin ranching. These partially formed grasslands were quickly absorbed by speculators, and those who were forced to dispose of their lots either left for urban centers, moved forward on the settlement frontier, or became part-time laborers for the ranchers, maintaining a small part of the former lot for subsistence purposes. Other colonists lost or abandoned their lands due to inability to make installment payments, inability to cover subsistence needs, or due to a drain on household labor resources as they found it necessary to seek alternate employment.

Hiraoka and Yamamoto identified three types of landowners in the period 1975–1978. Wealthy absentee owners held properties for appreciation and sale, bringing into production with hired labor only as much land as the law required. Landless farmers who had abandoned their plots for reasons beyond their control worked on the lands of others. A third group of small-to-medium-sized farmers had survived initial indebtedness and had established a foothold through cultivation or ranching. This third group faced pressures to expand their holdings to accommodate cattle, and significant land concentration was occurring on the part of larger ranching units at the expense of their smaller neighbors.

As in Brazil, the factors related to colonist loss of land in northeastern Ecuador were both social and ecological. The initial debts of colonists made short-term profits desirable, yet credit to improve perennial production or to invest in ranching was unavailable until permanent title was obtained. Frustrated colonists made first efforts at pasture formation or intensified production of perennials to meet their short-term needs. With land taken out of production or worked too intensively, yields dropped sharply. Worse off than before, colonists were often forced to sell their lands. Hiraoka and Yamamoto argue that left unchecked, this process will eventually lead to the recreation of the latifundia-minifundia pattern found in the Ecuadorian highlands (1980:444).

While it is true that the processes of accumulation in the Oriente are linked to class structure in Ecuador as a whole and the interests of national and international capital, a parallel with the processes that have generated inequality in the highlands cannot be too hastily drawn. First, the class interests involved in the colonization zone are quite different from those of the highland agrarian elite and must be interpreted in terms of the international flow of capital rather than simply as an extension of the power of the remnants of the highland

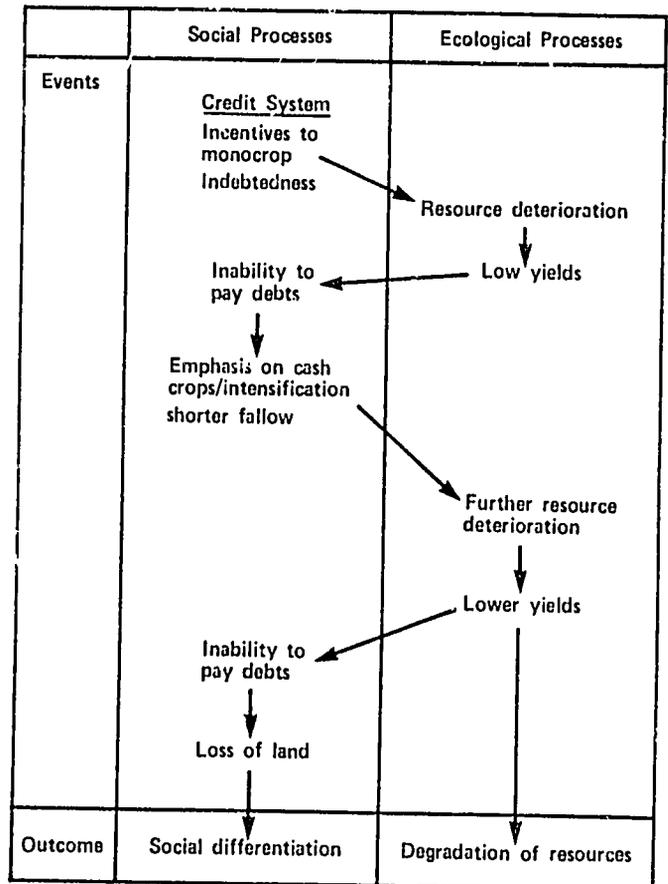


FIGURE 1. SOCIAL AND ECOLOGICAL CYCLES IN BRAZIL

oligarchy. Second, the ecological setting of the colonization zone alters the dynamics of social and economic change. The creation of minifundia and latifundia results from structural disincentives to sustained polyculture in a region where cattle ranching has increased competition for land, and from the rapid destruction of land resources that results when small producers attempt to overcome those disincentives by producing for short-term gain (see Figure 2). Socially created conditions of indebtedness and economic insecurity drive cycles of environmental decline, which in turn accelerate loss of land and social differentiation among settlers.

#### *Seasonal Migration and Labor Constraints in Peru*

The final example to be considered here is that of the Tambopata Valley of southern Peru. Lying in the lush rain shadow on the eastern slopes of the Andes, the valley has been the site of coffee cultivation by seasonal migrants from highland zones since the 1940s. Extremely steep slopes (rarely less than 40 degrees) make the region susceptible to erosion, and environmental degradation in the more accessible upper parts of the valley is already severe (Martínez 1973; Collins 1984).

In addition to being ecologically fragile, the zone is also one of the most isolated coffee zones in Peru. A road did not reach the main settlement area until the early 1970s and the plots of many producers still lie several days beyond its reach. While national and international funds helped build a school

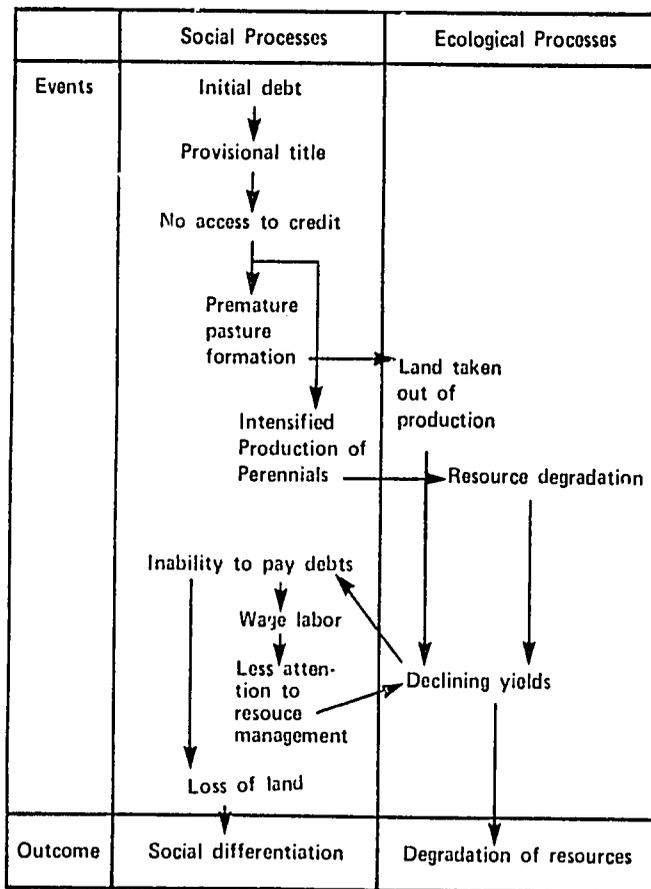


FIGURE 2. SOCIAL AND ECOLOGICAL CYCLES IN ECUADOR

and health center in the 1950s, lack of infrastructure is still a major impediment to economic activity in the region.

The case of coffee production in Tambopata challenges the traditional assumption of development theorists that labor is the most abundant resource for small producers in developing nations (see Kahn 1978, Schultz 1964 for a critique of this notion), and the derived proposition that the opportunity cost of labor for colonists in new and fragile land areas is low (Nelson 1973). This proposition assumes that farmers are able to fully meet their needs with on-farm production, an assumption that no longer characterizes the majority of Latin American small farm producers. Thiesenhausen (1984) notes that semiproletarianization is the most important phenomenon affecting rural Latin American households over the past decade. Deere and Wasserstrom (1980) have argued that small farm resource management cannot be understood without taking into account that 50–75% of small farm income in Latin America is obtained off-farm. Posner and McPherson (1982) and Posner et al. (198?) suggest that the need for alternate employment among members of small farm families reduces the labor available for investment in soil conservation and in productivity-improving technology.

Farmers producing coffee in the Tambopata Valley face a variety of production and marketing constraints, including a lack of access to credit and to inputs such as fertilizers and pesticides, poor transport, insecure titles, and a government-backed monopsony on the purchase of coffee.<sup>4</sup> As a result of these constraints, it has not been possible for a family to obtain a sufficient return from coffee production to meet their

year-round consumption requirements. The vast majority of coffee producers retain highland subsistence plots in order to make ends meet and to provide a measure of security against crop loss, price drops or loss of title. The need to maintain highland production has prevented permanent colonization of the valley, resulting instead in a prolonged pattern of seasonal migration that has lasted three generations (Collins 1984).

Continued participation in both coffee production and highland subsistence agriculture places heavy demands on the labor resources of migrant families. Little or no wage labor is employed and these demands are met primarily by careful scheduling of productive activities, separation of family members into two "work-teams" for part of the year, and reliance on traditional highland mechanisms of labor exchange. Because labor is in short supply, little is available to be expended on the management of fragile valley soils.

Land is brought into production through slashing vegetation in June or July and burning it when it is dry—in August or September. Previously propagated, unimproved seedlings are set out in January or February and replanted about three meters apart in March. The coffee plot is weeded heavily in September and again in November or January. Weeding is performed more intensively than is advisable from the point of view of soil conservation, but this is felt necessary in order to get by with one or two weedings per year, thus minimizing labor inputs during the highland growing season.

Approximately three to four years after planting, the coffee trees produce their first cherries and they are usually in full production by the fifth year. Migrants report that by 10–15 years, yields have begun to decline markedly, and that after 20 years or so the plots must be abandoned. No fertilizers are used, nor are any significant efforts made to check soil loss by erosion. Despite the fact that land is not freely available and that new plots can only be opened in the lower part of the valley—a two to three day walk beyond the reach of the road—practices that could potentially extend the productive life of the trees are not implemented.

The median size of landholdings in the region is approximately two hectares. The smallest plots consist of less than a single hectare and the largest may reach 10–20 (Instituto Nacional de Planificación 1980). Yields average 600 kg/ha, though new trees at the peak of production may produce up to 900 kg/ha and may drop to 300 kg/ha or less by 20 years (Painter 1984, 1986). Based on 1980 coffee prices, a producer could expect net revenues of about \$385 per 600 kg of coffee (Painter 1984). This income, with few exceptions, goes toward the consumption requirements of the migrant's family or is reinvested in subsistence production in the highlands.

Despite the degree of slope on which production is occurring in the valley, the potential for effective sustained-yield management exists (Painter 1983). Coffee production in many parts of El Salvador and the Dominican Republic is sustained on lands equally precipitous. Permanent residence in the valley would permit intercropping and reduce heavy weeding, thus promoting the maintenance of soil cover, while current seasonal exploitation emphasizes heavy weeding. Introduction of crops such as plantains would improve the Arabica coffee by providing shade and would further reduce erosion. The farmers who grow coffee in the valley carefully manage their soil resources in the highlands, maintaining terraces and drainage systems, rotating and interplanting crops

and using animal manure according to well-defined indigenous agricultural premises. The existence of archaeological remains of terraces in the Tambopata drainage system suggest that prehispanic civilizations applied many of the same principles to valley lands (Isbell 1968), and Peruvian agronomists and social scientists are currently involved in a number of projects to reconstruct such traditional land use practices.<sup>5</sup> Introduction of more intensive practices is not possible as long as producers face heavy alternative demands on their labor, however. This in turn is unlikely to change until coffee production, or cropping systems that incorporate coffee production, become capable of producing income sufficient to make it possible for families to reside permanently in the valley (see Figure 3).<sup>6</sup>

The failure to effectively manage fragile land resources due to alternative demands placed on labor is not unique to the Tambopata Valley. Participation in off-farm labor was listed as a factor in colonist loss of land by Hiraoka and Yamamoto. In any environment where off-farm employment is combined with mixed cropping systems and small-scale animal husbandry, excessive demands on labor may result. The impact of reduced investments in resource management will be felt in any context over time, but is likely to be more rapid and severe on tropical soils and steep lands where colonists do not have long experience in production.

The search for off-farm employment is directly related to the insufficiency of income that can be generated from the producers' holdings, a situation that may be the result of unfavorable price structures and commercialization systems as well as of the small or declining size of landholdings. Seasonal or temporary wage labor is also a frequent response to declining yields. As with the cycles of indebtedness, such a response sets up a positive feedback cycle with yields declining further due to reduced labor inputs. This link between lack of resources and poor management has been identified as a major cause of hill land destruction by Posner and McPherson (1982:347):

Farmers who are less poor have less need to "mine" their farm land by emphasizing present consumption over future consumption. Second, being less poor, farmers will also have more resources, including labour time, to adopt soil conservation practices and invest in productivity-improving technology . . . .

The initial poverty of small producers in settlement areas is an impediment to sound resource management, and government policies exacerbate this problem when they constrain small-scale accumulation and reinvestment by extracting surplus, or allowing it to be channelled to market intermediaries, and by reinforcing the differential access of large and small producers to credit and inputs. The semiproletarianization that increasingly affects small producers in Latin America challenges their ability to use traditional strategies for the management of land and water resources (many of which require inter-familial cooperation). The demands that this process places on labor also reduce the time that producers have available to experiment with and adopt new practices.

### Conclusions

Recent years have seen an increasing interest on the part of development agencies in the promotion of viable small

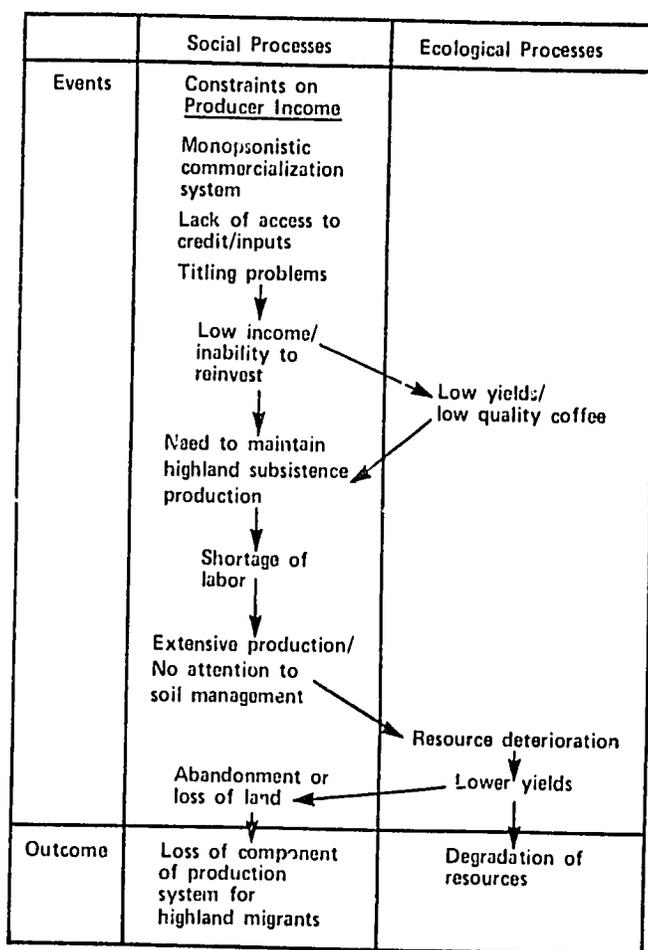


FIGURE 3. SOCIAL AND ECOLOGICAL CYCLES IN PERU

farm sectors in developing nations. Governments throughout Latin America have promoted or permitted the colonization of new and easily degradable land areas by small producers. Yet as small farmers fail in these areas, losing their lands to larger interests or abandoning them in the face of declining yields, important questions are raised about the viability of small farm colonization of tropical lands.

Case studies of colonization areas reveal a consistency in the dynamics of such failure. It is tied to the kinds of constraints and incentives faced by small farmers—structural factors such as credit, titling, and commercialization networks that work against sustained-yield production systems. Small-scale accumulation for reinvestment is hindered by the inavailability of credit and technical inputs for such systems, or by marketing networks unfavorable to producers. Where they exist, credit policies discourage experimentation by focusing on crops such as rice in the Brazilian Amazon, and difficulties in obtaining title discourage investments. Further, once larger, more capital-intensive enterprises such as ranching enter a region, the most lucrative of mixed cropping systems find themselves at a relative disadvantage in terms of access to resources (Bunker 1981).

Faced with these constraints and incentives, producers are forced to orient production toward short-term gain. Whether farmers shift toward monocropping in order to benefit from credit and technical assistance available for certain crops, intensify production to repay credit obligations or expenses associated with claiming land, or fail to use appropriate man-

agement practices because insufficient revenues force them to work off-farm, the impacts are similar. Shortened fallows and monocropping on the one hand, or failure to use appropriate technologies and practices on the other, lead to soil erosion and deterioration, declining yields, increased economic pressures and almost inevitably, loss of land. Those who escape this cycle do so, not because they are necessarily better managers or make more appropriate choices, but primarily because they find ways to move into cattle ranching, marketing, or service activities. They must, in other words, "get big . . . or get out" (Hecht 1981:82).

Development programs that seek to promote a viable small farm sector in colonization zones of the humid tropics must seek to alter the incentives provided to small producers and the constraints placed on small-scale accumulation and reinvestment in such enterprises. They must recognize that labor is not unlimited and that its opportunity cost may not be low. Research is required that will provide an improved understanding of the ways in which credit, titling and factor and commodity markets affect the behavior of small producers in a variety of settings. Such insights can then be incorporated into models of the social and environmental cycles that characterize colonization of tropical lands and into policies designed to promote sustainable production, in keeping with environmental realities and the overall goals of agrarian policy.

It has been argued that in some contexts national and international development policies have created impediments to accumulation by small producers, perpetuating labor-intensive simple commodity production (Bartra 1975; Kahn 1978; Collins 1984; Painter 1984). Colonization zones are one context where such a strategy presents advantages to dominant classes since new lands can be opened by the intensive labor of peasants and then turned over to larger economic interests (Foweraker 1981; Katzman 1976; Charles Wood 1983; Schmink 1982). In some instances the latter process has become institutionalized, as in the case of *troca pela forma*—the exchange agreement whereby a peasant family possesses land while hand-clearing and converting it to pasture for the rancher-owner in Brazil (Charles Wood 1983). Where smallholder production is used as a lever for subsequent or simultaneous development of large farm enterprises, the failure of the small farm model as a viable option is predetermined. Questions about land use and ecology are tied to these kinds of policies and practices and the larger political economic context, and cannot be answered without reference to the differential interests of groups vying for land or without consideration of who benefits and who suffers as a result of the changes that occur.

Recognition of the links between structural incentives to produce for short-term gain, deterioration of resources, and loss of land by smallholders challenges the simple answers frequently provided to the question of how new tropical lands can best be brought into production. Assertions that these lands are simply unsuitable for agriculture, or that they require the superior management skills and capital resources of larger enterprises, are no longer tenable. Where a political commitment exists to support small farm production, and where available knowledge is relied upon to create incentives for sustainable resource management, small farm colonization should be able to succeed. Such a commitment, however,

often comes at the expense of short-term economic benefits accruing to politically powerful interests. Perhaps for these reasons Latin America has not yet provided examples of such a strategy.

#### NOTES

<sup>1</sup> An initial version of this paper was presented at a Land Tenure/ Common Theme Workshop sponsored by the Agency for International Development and the University of Wisconsin Land Tenure Center, and was distributed as a working paper by the Institute for Development Anthropology (IDA). The author thanks IDA for providing support for workshop attendance through their Cooperative Agreement on Settlement and Resource Systems Analysis.

<sup>2</sup> See, for example, the works of Buol et al. (1975), Cochran and Sanchez (1982), Hecht (1982), Nicholaides et al. (1982), Posner et al. (1982), Qureshi et al. (1980), Sanchez et al. (1982), and H. A. Wood (1972).

<sup>3</sup> Research was conducted in the highland province of Huancane and the lowland province of Sauidia, department of Puno, Peru during 1980. Funding was provided by an Inter-American Foundation Doctoral Fellowship.

<sup>4</sup> See Collins (1984) for a discussion of the history and impact of this commercialization system.

<sup>5</sup> See, for example, Dourojeanni and Molina (1983) and CONCYTEC (1983).

<sup>6</sup> The benefits to dominant economic interests of maintaining coffee production as a seasonal activity and of constraining capital accumulation in the valley are beyond the scope of this paper and are described elsewhere (Collins 1984).

#### REFERENCES CITED

- Barlett, Peggy  
1976 Labor Efficiency and the Mechanism of Agricultural Evolution. *Journal of Anthropological Research* 32(2):124-140.  
1980 Adaptive Strategies in Peasant Agricultural Production. *Annual Review of Anthropology* 9:545-573.
- Bartra, Roger  
1975 Peasants and Political Power in Mexico: A Theoretical Model. *Latin American Perspectives* 2:125-145.
- Bennett, John  
1969 Northern Plainsmen: Adaptive Strategies and Agrarian Life. Chicago: Aldine.
- Boserup, Esther  
1965 The Conditions of Agricultural Growth. Chicago: Aldine.
- Brush, Stephen  
1977 Mountain, Field and Family: The Economy and Human Ecology of an Andean Valley. Philadelphia: University of Pennsylvania Press.
- Bunker, Stephen  
1981 The Impact of Deforestation on Peasant Communities in the Medio Amazonas of Brazil. *Studies in Third World Societies* 13:45-60.
- Buol, S. W., P. A. Sanchez, R. B. Cate, and M. A. Granger  
1975 Soil Fertility Capability Classification. *In Soil Management in Tropical America*. E. Bornemisza and A. Alvarado, eds. Pp. 126-141. Raleigh: North Carolina State University.
- Cochrane, T. T., and Pedro A. Sanchez  
1982 Land Resource, Soil Properties and Their Management in the Amazon Region: A State of Knowledge Report. *In Amazonia: Agriculture and Land Use Research*. S. B. Hecht, ed. Pp. 137-210. Cali: Centro Internacional de Agricultura Tropical (CIAT).

- Collins, Jane  
1984 The Maintenance of Peasant Coffee Production in a Peruvian Valley. *American Ethnologist* 11(3):413-438.
- CONCYTEC  
1983 *Ciencia, tecnología y desarrollo del medio rural*. Lima: Consejo Nacional de Ciencia y Tecnología.
- Deere, Carmen Diana, and Robert Wasserstrom  
1980 Household Income and Off-Farm Employment Among Smallholders in Latin America and the Caribbean. Paper presented at the Seminario Internacional sobre la Producción Agropecuaria y Forestal en Zonas de Ladera in América Latina, 1-5 December, Turrialba, Costa Rica.
- Dourojeanni, A., and M. Molina  
1983 The Andean Peasant, Water, and the Role of the State. *CEPAL Review* 19:145-166.
- Derham, William  
1979 *Scarcity and Survival in Central America: The Ecological Origins of the Soccer War*. Stanford, CA: Stanford University Press.
- Foweraker, Joe  
1981 *The Struggle for Land: A Political Economy of Pioneer Frontier in Brazil from 1930 to the Present*. New York: Cambridge University Press.
- Goodland, Robert  
1980 Environmental Ranking of Amazonian Development Projects in Brazil. *Environmental Conservation* 7(1):9-26.
- Guppy, Nicholas  
1984 Tropical Deforestation: A Global View. *Foreign Affairs* 62(4):928-965.
- Hecht, Susan  
1981 Deforestation in the Amazon Basin: Magnitude, Dynamics and Soil Resource Effects. *Studies in Third World Societies* 13: 61-100.  
1982 Cattle Ranching in the Eastern Amazon: Environmental and Social Implications. In *The Dilemma of Amazonian Development*. E. Moran, ed. Pp. 155-138. Boulder, CO: Westview.
- Hiraoka, M., and S. Yamamoto  
1980 Agricultural Development in the Upper Amazon of Ecuador. *Geographic Review* 70:423-445.
- Instituto Nacional de Planificación (INP)  
1980 *Migraciones y colonización en Puno*. Puno, Peru (mimeo).
- Isbell, William  
1968 New Discoveries in the Montaña of the Peruvian Andes. *Archaeology* 21:108-114.
- Johnson, Allan  
1971 *Sharecroppers of the Sertao*. Stanford, CA: Stanford University Press.
- Kahr, Joel  
1978 Marxist Anthropology and Peasant Economics: A Study of the Social Structure of Underdevelopment. In *The New Economic Anthropology*. J. Clammer, ed. Pp. 110-137. New York: St. Martin's Press.
- Katzman, M. T.  
1976 Paradoxes of Amazonian Development in a Resource Starved World. *Journal of Developing Areas* 10(4):445-460.
- Martínez, Hector  
1973 El saqueo y la destrucción de los ecosistemas selváticos. *América Indígena* 38:125-150.
- Moran, Emilio  
1974 The Adaptive System of the Amazonian Caboclo. In *Man in the Amazon*. C. Wagley, ed. Pp. 136-159. Gainesville: University of Florida Press.  
1981 *Developing the Amazon*. Bloomington: University of Indiana Press.
- National Research Council, Committee on Selected Biological Problems in the Humid Tropics  
1982 *Ecological Aspects of Development in the Humid Tropics*. Washington, DC: National Academy Press.
- Nelson, Michael  
1973 *The Development of Tropical Lands: Policy Issues in Latin America*. Baltimore, MD: Johns Hopkins University Press.
- Netting, Robert McC.  
1968 *Hill Farmers of Nigeria: Cultural Ecology of the Kofyar of Jos Plateau*. Seattle: University of Washington Press.
- Nicholaides III, J. J., P. A. Sanchez, D. E. Bandy, J. H. Villachica, A. J. Coutu, and C. S. Valverde  
1982 Crop Production Systems in the Amazon Basin. In *The Dilemma of Amazonian Development*. E. Moran, ed. Pp. 101-154. Boulder, CO: Westview.
- Painter, Michael  
1983 Resource Use in the Tambopata Valley, Peru. In *Natural Resource Management Workshop: Collected Papers*. Eileen Berry and Barbara Thomas, eds. Pp. 131-147. Worcester, MA: Clark University and the Institute for Development Anthropology.
- 1984 Changing Relations of Production and Rural Underdevelopment. *Journal of Anthropological Research* 40:271-292.  
1986 The Value of Peasant Labor Power in a Prolonged Transition to Capitalism. *Journal of Peasant Studies* (forthcoming).
- Posner, Joshua, and M. McPherson  
1982 Agriculture on the Steep Slopes of Tropical America. *World Development* 10:341-353.
- Posner, Joshua, G. Antonini, G. Montanez, R. Cecil, and M. Grigsby  
1982 A Classification of the Steeplands in the Northern Andes. *Mountain Research and Development* 2:273-280.
- Qureshi, A. H., L. S. Hamilton, D. Mueller Dombois, W. R. H. Perra, and R. A. Carpenter  
1980 Assessing Tropical Forest Lands: Their Suitability for Sustainable Uses. Honolulu: East-West Center.
- Rivière d'Arc, Helene  
1980 Public and Private Policies in Santa Cruz, Bolivia. In *Land, People and Planning in Contemporary Amazonia*. F. Barbira-Scazzocchio, ed. Pp. 154-161. Cambridge, England: Center for Latin American Studies Occasional Publication No. 3.
- Sanchez, P. A., D. E. Bandy, J. H. Villachica, and J. J. Nicholaides III  
1982 Soils of the Amazon Basin and their Management for Continuous Crop Production. *Science* 216:821-827.
- Schmink, Marianne  
1982 Land Conflicts in Amazonia. *American Ethnologist* 9(2): 341-357.
- Schultz, Theodore  
1964 *Transforming Traditional Agriculture*. New Haven: Yale.
- Smith, Nigel  
1982 *Rainforest Corridor*. Berkeley: University of California Press.
- Souza Martins, José de  
1980 Fighting for Land: Indians and *Posseiros* in Legal Amazonia. In *Land, People and Planning in Contemporary Amazonia*. F. Barbira-Scazzocchio, ed. Pp. 95-105. Cambridge, England: Center for Latin American Studies Occasional Publication No. 3.
- Stouffer, John  
1984 Cattle, Coffee, Cocoa and Development in the Amazon. Unpublished manuscript, Department of Anthropology, State University of New York at Binghamton.
- Tendler, Judith  
1980 Shifting Agriculture, Land Grabbing and Peasant Organization on Brazilian Northeastern Frontier. Unpublished manuscript, Department of Agricultural Economics, University of California at Berkeley.
- Thiesenhausen, William  
1984 The Illusory Goal of Equity in Latin American Agrarian Reforms. Paper presented to Land Tenure/Common Themes

- Workshop, USAID/University of Wisconsin Land Tenure Center, April 23-26, Annapolis, Maryland.
- Vickers, William T.  
 1982 Development and Amazonian Indians: The Aguarico Case and Some General Principles. *In* *The Dilemma of Amazonian Development*. E. Moran, ed. Pp. 25-50. Boulder, CO: Westview.
- Wharton, Clifton R.  
 1971 Risk, Uncertainty, and the Subsistence Farmer: Technological Innovation and Resistance to Change in the Context of Survival. *In* *Studies in Economic Anthropology*. George Dalton, ed. Pp. 152-179. Washington, DC: American Anthropological Association Studies No. 7.
- Whitten, Norman  
 1978 Amazonian Ecuador: An Ethnic Interface in Ecological, Social and Ideological Perspectives. Copenhagen: International Work Group for Indigenous Affairs Document No. 34.
- Wood, Charles  
 1983 Peasant and Capitalist Production in the Brazilian Amazon: A Conceptual Framework for the Study of Frontier Expansion. *In* *The Dilemma of Amazonian Development*. E. Moran, ed. Pp. 259-278. Boulder, CO: Westview.
- Wood, Charles, and Marianne Schmink  
 1979 Blaming the Victim: Small Farmer Production in the Amazon Colonization Project. *Studies in Third World Societies* 7: 77-93.
- Wood, H. A.  
 1972 A Classification of Tropical Agricultural Land Use for Development Planning. *Canadian Geographer* 16:249-255.