LAND USE DECISIONS

BY

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CONTENTS

INTRODUCTION

What do I plant?
How much do I plant?
How do I plant it?

These are the basic questions of land use decisions. When development planners and workers talk about changing agriculture or bringing about agricultural development, the focus is changing one or another of the above three parts of a farmer's land use decision. Either we want to introduce a new crop, expand the acreage of a certain crop, or change the way in which the crop is planted.

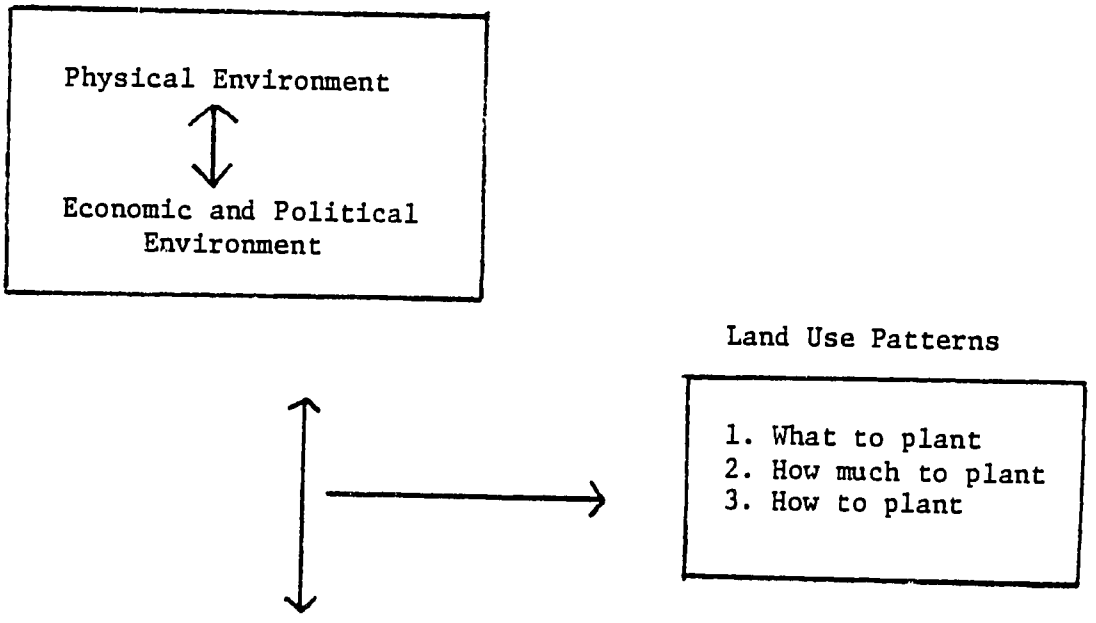
To bring about change, we need first to know what the current results of these decisions are, and then how the decisions are made. That is, we need to have a description of current land uses and we need to know what determines those decisions. This review of the literature of land use decision making will address both those needs. Anthropologists and other social scientists have described land uses over many parts of the world and have identified a series of important determinants of land use patterns. This paper focuses on peasant land use and the words "peasant" and "farmer" are used inter-changeably. Research on land use in the developed countries and in tribal societies is not covered.

In any attempt to say what causes a certain land use pattern, the only accurate answer is "everything". All possible, imaginable factors play a role in affecting the decision making process. Though everything can be important, there are nevertheless some factors which will almost always be important in a given situation and these are the determinants of land use which are dealt with below. It must be recognized that there are many interconnections between these factors: soil fertility, for instance, is itself a product of the natural environmental conditions, the history of population and land use in that area, and the market for fertilizers. However, for the sake of clarity, the determinants of land use are discussed one at a time below, followed by a discussion of the decision making process in general.

To organize this presentation of the decision making process, Diagram One illustrates the major inputs into the three land use questions listed above. First, the physical environment provides certain limitations on crop choice, agricultural practices such as crop timing, and the value of a diverse crop mix or monocrop cultivation. The natural environment interacts with the social environment (Sahlins 1964) to structure the crop options available in the area. Political

DIAGRAM 1 THE DECISION MAKING PROCESS

I. What are the land use options?



II. What are the Household Needs and Resources?

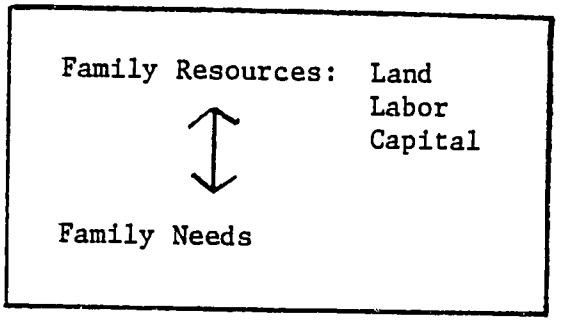


Diagram adapted from Dutia (1957) and Navarro (1977)

factors such as colonization programs, land registration, or warfare, and economic policies such as credit programs price supports, or marketing facilities all contribute to defining what is possible in a given area.

These possibilities are then weighed by each household or family unit. Each family has a series of needs to be met through agriculture and also a group of resources with which to meet them. Household labor, land, and capital are invested in the final agricultural decisions. The variation in household resources within a peasant community is shown by many authors to be an important variable in land use. At each stage in this process, the farmer's perceptions, intelligence, and past history are also a factor. These latter issues are taken up separately below, in Section III, which deals with the more general works on the decision making process.

I. WHAT ARE THE LAND USE OPTIONS?

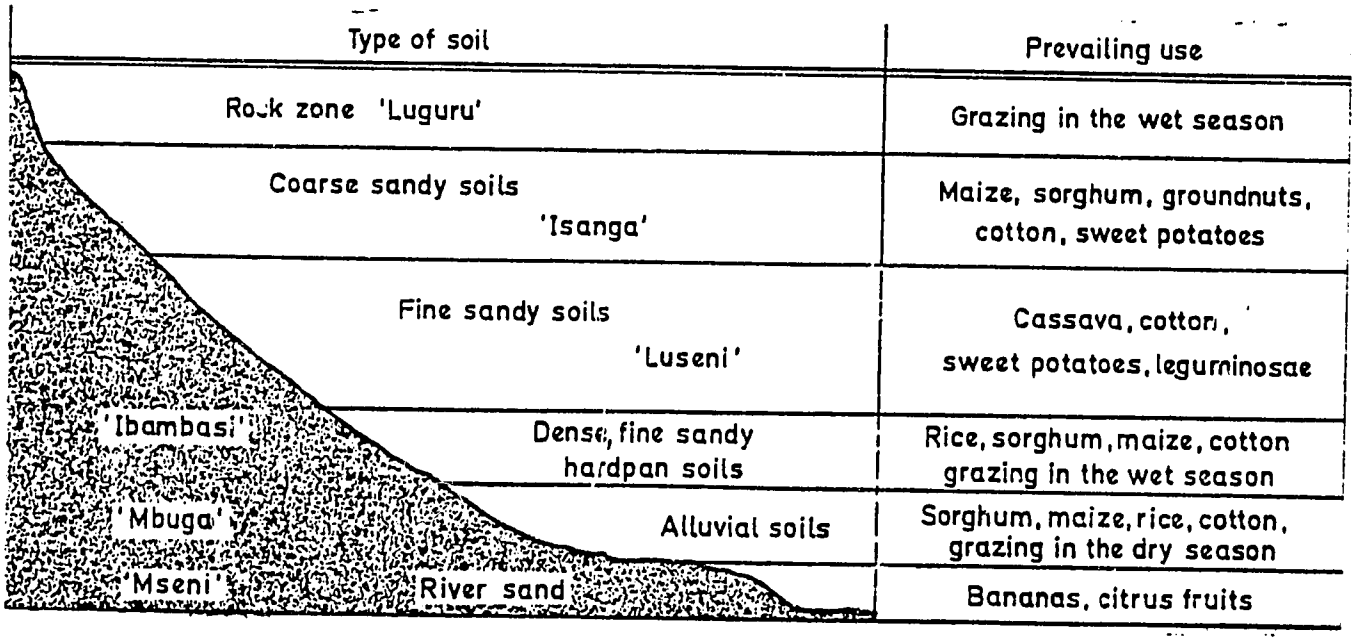
A. Effects of the physical environment

Most studies indicate that environmental factors play a crucial role in determining what land uses are possible and profitable. Wolf (1956:185) cites the ecological factors of altitude, rainfall, temperature, incidence of wind and incline as important in land use decisions in Puerto Rico. Norman (1974:3) adds evapotranspiration rate and soil type to this list. Netting (1968), Edwards (1961) and Johnson (1971a) also discuss these environmental factors, while Beals adds irrigation facilities and potential for wells as important for South India (Beals 1974:83). Farmers know these environmental differences and take them into account in their land use choices.

> Usually people will be able to tell which type of crop will be able to thrive in a particular spot by the type of plant or grass cover presently grown there or by the color and feel of the soil. (Wolf 1956:185)

Von Rotenhan (1968) provides a detailed discussion of the environmental effects on crop choice for one region of Tanzania. See Diagram Two. Some crops like sorghum span a number of soil types, while bananas, for instance, are limited to more favorable environments.

Diagram 2. Soil Types and Land Use in Catena, Tanzania



From Ruthenberg (1968:58) Small holder Farming and Smallholder Development in Tanzania. Reproduced by permission of publisher.

Greenwood (1976) shows that soil type is very important for Basque farmers in Spain also. In the coastal area he studied, farms specialize either in cattle and dairy production or in truck farming, depending on whether the farm has poorer clay soils or the better sandy soils. Greenwood found that 86% of the farms in the community studied conform to the "correct" land use based on soil types (1976:205). The remaining 14% represent cases where agriculture is possible, but the household chooses the less labor-intensive cattle production. The reasons for this farm choice were scarcity of family labor, holding political office (and attendant lack of time), and the availability to the family of jobs in the nearby city. For all three reasons, family labor scarcity changed the land use away from the kind of farm enterprise possible from the soil type.

Altitude is another important determinant of land use, as discussed for highland Peru:

> For example, almidon, the most important variety of maize, requires a nine month growing season in the upper savannah ...but only six months in the lower savannah.... At these altitudes, only such crops as wheat, habas, barley, potatoes, olluku, oca, and naswa can be grown in most years with natural rainfall alone. Other crops require the use of irrigation to extend the growing season.
>
> (Mitchell 1977:47)

Adejuwon studied the intensity of cocoa production in Western Nigeria and found climate to be more important than soil type in predicting the intensity of cocoa farming. Young cocoa trees require regular rainfall to survive, and he found that that factor limited the extension of cocoa production into new areas more than the soil quality (Adejuwon 1962:26). Adejuwon found, however, that once established, the cocoa trees' productivity did not seem to be affected by rainfall. The environmental influence, then, seemed primarily to affect the establishment of the plantation, and thus Adejuwon was able to account for the spread of cocoa into some areas and not in others.

Another important aspect of the environment is the incidence of insects and diseases. Messenger describes the role of the eelworm on Inis Beag, an Irish island (1969). Potato production is attacked by the eelworm after one year and fields are therefore fallowed for four years after the first harvest in order to control the pest. When the eelworm first appeared in the 1920's, it caused considerable land shortage, and the community had to "make more fields" through the creation of soil from seaweed and compost (1969:32).

Rubin (1973) argues that agricultrual patterns in the U.S. South were influenced by the incidence of cattle ticks and poor native grasses which made cattle production and mixed farming there less profitable than in the North. The resulting dependence on staple crop production had important implications for future agricultural development both before and after the Civil War. He indicates that this original environmental difference between the North and the South played an important role in the later development of highly profitable mixed farming in the North and the more vulnerable monocrop structure of the South (Rubin 1973).

The interaction between technology and environmental constraints is demonstrated by Morgan's research on highland Kenya. In areas that Africans had traditionally left uncultivated for a variety of reasons, white settlers were able to develop successful export agriculture through the use of plows, oxen, and wells. In spite of the erratic rainfall, the whites could "set off the profits of a good year against the failure of a harvest in a year of drought, which would force an African cultivator into starvation." (Morgan 1972:215). The availability of capital for such technological investments gave whites an advantage over the Africans who later bought these lands, after 1961. In this case, rainfall was a limiting factor given traditional African agricultural technology, but European farming methods could overcome these limits, given sufficient capital to invest in them. Morgan's discussion, like many of those cited above, shows the dynamic relationship between the physical environment and other factors affecting land use.

One last example shows how the natural environment can limit the adoption of agricultural innovations. Chawdhari, Chowdhury, and Sharma (1965) discuss the major constraints on the adoption of a number of recommended agricultural practices in India. Suitable land is shown to be important for many of them. Farmers who do not use fertilizer indicate that its high cost is important, but that in many cases, their land is not suitable for fertilizer use: it is submerged during key parts of the year, or has inadequate irrigation, or the fertilizer types available are not appropriate for their soils. Some farmers also resisted including a legume in their crop rotations because their land was waterlogged at that season, or they suffered from lack of rain, or the existing legume varieties were not adapted to their ecological conditions. This study shows that ecological factors can often provide the first line of resistance to agricultural change, and are the boundaries within which agricultural decisions must be made.

Do farmers perceive their environments correctly? The study of a peoples' own categories and analyses of their environment has been attempted by a few ethnoscientists, but little of this research deals with peasant land use. Johnson's work on Brazilian farmers is an important exception (1971a). These sharecroppers categorized the lands they worked as either hot or cold and either strong or weak. Hot lands were relatively drier than the moist cold lands, while the "strength" of the land referred to its capacity to give a high crop (Johnson 1971a:57). Johnson explored the extent to which these "native categories" corresponded to planting patterns and found that farmers did, in fact, choose which crops to plant in each field on the basis of those crops' needs for fertile soil and moisture content.

I. WHAT ARE THE LAND USE OPTIONS?

B. Effects of the economic and political environment

The human environment is also crucial to decisions on land use. Many studies of peasant land use indicate the importance of transportation facilities (Cancian 1972: Haswell 1973; Ortiz 1973; Barlett 1975), marketing mechanisms (Forman and Riegelhaupt 1970; Ortiz 1973; Norman 1974; Halperin and Dow 1977), price structures (Dutia 1957; Baum 1968, Norman 1971, 1974; Cancian 1972; Barlett 1977) and other governmental policies. Most of these factors have long been recognized as influencing the outcome of any economic decision, but researchers have only rarely spelled out the direct effects on land use. Therefore, the discussion below is limited to pointing out a few of the less obvious ways in which land use decisions are affected by the economic and political environment.

The price structure for both cash and subsistence crops directly affects land use for most peasants. Clayton discusses the price responsiveness of farmers in Malaya from 1929-1933 (1968:245). In spite of governmental programs and pressures to increase rice production, peasants saw the returns per acre of rubber as much higher, even in bad years. Therefore, they continued their rubber cultivation and used their profits to buy the family's rice.

The market availability of rice, however, is a crucial part of the Malayan situation just discussed, and Ortiz shows that for highland Indians in Colombia the option to choose a more remunerative cash crop over subsistence crops is not possible. The Paez Indian reservation does not have access to a steady market supply of foodcrops. Indians are aware of the profitability of coffee production, but are constrained by the need to assure adequate food first (Ortiz 1973).

Clayton notes this same situation for Tanzania, where if farmers want to assure adequate corn production for subsistence, they must plant a relatively high acreage of corn and weed it well. Such a land use decision means they must plant their cotton late, which significantly lowers its productivity. However, since they have no good supply of food in the market, and since cotton values are relatively low, they are rational to invest their land and labor in corn first (Clayton 1968:247). Thus, local and regional market conditions interact with prices to influence farmer decisions (see also Tax 1953:129).

Cotton production in Western Tanzania is itself the result of the political environment. McHenry discusses the effects of governmental compulsion on cotton production (McHenry 1973). In this case, the choice to grow cotton is not freely made by farmers, but is required by law. Farmers' attitudes toward their required cotton plots seem to focus on its low profitability and high labor input. This Tanzanian case points out the importance of many governmental policies such as taxation, alienation of land by colonizers, or warfare, which profoundly affect land use decisions. Haswell notes that if political instability threatens the security of land tenure, land prices will remain low and improvements in land will be uneconomic (Haswell 1973:39). Land security is clearly important in enabling farmers to take advantage of some crop options (Hill 1970).

Marketing structures are another aspect of the political and economic environment which affects land use. Forman and Riegelhaupt (1970) discuss the recent history of marketing in Northeast Brazil and show the interrelationships of transportation, marketing structure, and land use. As transportation facilities improved and middlemen became more capitalized, the atomistic peasant market declined in importance and has been taken over by more powerful warehouses which effectively control wholesale and retail pricing of commodities. This "rationalization" of the marketing process exerts pressure on small farms because wholesalers prefer to buy in bulk. Especially when prices drop, large commercial farms which can undertake capital investments of scale are more competitive, and small farmers are squeezed out. The authors note that much of the agrarian tension in the Brazilian Northeast is due to this transition and indicate that the transformation of agricultural production methods would not have been possible without roads, markets, and storage facilities (Forman and Riegelhaupt 1970:210).

National history can clarify many puzzling aspects of land use changes. Wolf (1956) shows how the increase and subsequent decrease in Puerto Rican coffee production must be seen in the context of the island's transition from a Spanish military post to an agricultural dependency and then to a part of the U.S. economy. Early in Puerto Rico's history, coffee was seen as an expensive investment for peasant farmers, risky (because of hurricanes) and not as useful for rotation with foodcrops as other crop options. With the consolidation of peasant farms into larger estates, outside capital was invested and coffee became an important land use. The decline of coffee is also explained by forces outside the local community, and especially by Puerto Rico's relations with dominant nations (Wolf 1956:263).

Barlett (1977) combines an analysis of local-level decision making with national and regional trends. Current prices for cattle in Costa Rica have made pasture a profitable crop option for large landowners, though the return per land unit is too low for small farmers. Governmental credit policies which favor loans for cattle, together with the expansion of newly imported fodder grasses, has encouraged a dramatic increase in pasture lands thoughout Costa Rica. Parsons (1976) discusses the massive deforestation which has resulted from these same forces in other Central American countries and in Panama as well. Widespread soil erosion and destruction of watersheds concerns many of the governments of these countries, but Barlett shows the short-term profitability of cattle production for the individual farmer outweighs these more long-term considerations when land use decisions are made (Barlett 1977:300).

As Central American cattle production shows, human populations act on the environment as well as the other way around. Some land use choices restructure the environment that permits them in a way that is less advantageous for the population. An example of this process is sisal production in Northeast Brazil, where lowered prices had serious consequences for family nutrition. (Gross and Underwood 1971). Other economic and political policies are adaptive in increasing the productivity of the ecosystem in a way that benefits many if not all the inhabitants. Irrigation facilities are a prime example (see Mitchell 1977:49).

In summary, the environment in which farmers live, both the natural and human environment, has important consequences for land use decisions. Sometimes the environment limits choices, other times requires them, and often merely pushes one option into a more favorable position over another. Given the range of options open, the farmer must then choose.

POLICY RELEVANT QUESTIONS

1. How are current land uses limited or encouraged by the natural environment?

   How do they, in turn, affect the local and national ecosystem?

2. How do marketing structures, prices, and transportation facilities influence the possible crop options?

   How do they affect which farmers have those options?

3. How are current land use patterns a product of recent national and regional history?

4. Which national or international economic forces are currently having a major impact on the peasant community? With what results for land use?

II. WHAT ARE THE HOUSEHOLD NEEDS AND RESOURCES?

A. Land

Peasant societies may be organized into independent households, or into haciendas, or manors(Halperin and Dow 1977), but for our purposes of understanding land use decisions, we will assume the peasant household is the most important unit of production and consumption and the unit within which agricultural decisions are made (Polanyi 1957; Wharton 1971). Each family or household looks at its needs for food, clothing, cash, etc. and balances them against the resources at its disposal (Tax 1953). Families without land will have to use their labor power or capital resources; families with adequate land but few members will have to hire workers or exchange labor with other households. In understanding the impact of each family's resources and needs on its land uses, we will focus on the variability in those resources among different houses in the community, both in quantity (such as the amount of land and labor available) and in quality (such as the location of the land or the age of family members).

Access to land for agricultural people is one of the most important determinants of land use (since, indeed, it is necessary first to have some land to use!). The importance of land availability and the conditions under which it is available has sometimes been underestimated by development programs, and as the following authors attest, can have a profound impact on how land is used.

Access to land limits or permits certain crop options. A landless farmer who must negotiate each year to rent a different plot of land cannot plant anything but annual crops. Often, such a situation will exclude the family from cash crops which require time to mature, such as coffee, bananas, sisal, cocoa, and other tree crops. Crops which require improvements to the land such as ridging, draining, or extensive manuring, will be undesirable to a family in this situation because they will not be around to reap the later benefits of their work.

Even in situations where agreements between landlords and tenants will protect the investment of the tenant, the way in which the crops are grown can be affected. Edwards (1961:176) cites the case of an older man in Jamaica who sharecrops a given piece of land in bananas, giving half the harvest to the owner. Edwards noted that the man worked the land less intensively than is usual for bananas grown on one's own land, and reported that the tenant

did so consciously "because I do not get the full benefit" (of his labor). The tenant invested considerably less labor than usual, until his marginal costs were closer to his half share of the marginal product of his labor (Edwards 1961:176).

Ownership of land and the traditional rules of tenancy can have a profound impact on the productivity of the land and the care with which it is cultivated. A thorough discussion of just such a case comes from a community near Manila in the Philippines. Takahashi (1970) discusses the low adoption rate of agricultural improvements in this area, in spite of the favorable environment for irrigated rice. Production is much lower than the land's potential, and the farmers seem to have little interest in improving yields. In probing into the reasons for such a situation, Takahashi found that of 25 landowners in the village, only three actually farm the land themselves. The rest of the landholders are involved in commercial or other enterprises, and their land is worked by tenant farmers. Most of these tenants, however, are badly in debt to their landlords, and even before the harvest is in, they may owe all of it and more to the landlord. The Philippine law that at least 15% of the harvest must belong to the tenant is a "dead letter in reality." (Takahashi 1970:131).

The customary rules surrounding tenancy help to explain a number of seemingly non-economic patterns in this Philippine case. The author found that a considerable number of tenants will hire other wage laborers to work on their fields, while they themselves work on others' fields. There is a cultural expectation that no one will do all the agricultural work on his or her rented land. The key to this practice is that landlords must pay half of the wages of anyone hired by a tenant. And secondly, the landowner (and creditor) cannot touch the wage income of his or her tenants for loan repayment. Therefore, a tenant who is badly in debt to the landlord may hire himself out to a neighbor, in order to obtain some cash income. To do his own agricultural work, on his own rented plot, the same tenant will spend half of what he has earned to pay some other worker, the balance paid for by his landlord. The half pay that he keeps is not subject to confiscation by his creditor. "In this village, hired labor plays a leading role in farm production, not merely a role supplementary to family labor. Thus, we can say the logic of family farms is no longer valid in this region" (Takahashi 1970:142).

Many of the improvements for rice cultivation in this area are expensive and, for the poor tenants, are out of reach. Efforts to improve rice production will, however, benefit primarily the landlord, and tenants are therefore reluctant to invest considerable effort or care in another's fields (following the same calculation of marginal returns to labor pointed out by Edwards above). On the other hand, the landlords are deriving their primary income from sources outside agriculture and do not want to invest in improved irrigation facilities or other innovations because they believe their money can be better used elsewhere. Given the lack of incentive for their workers, they are undoubtedly right.

Even when farmers own their land, the location of the plot can make a big difference in land use decisions (Mitchell 1977). Edwards (1961:114) indicates that tomato production requires close attention to the plants, and therefore Jamaican farmers will grow tomatoes only when they have plots near their houses. Many peasant communities have patterns of land inheritance in which each family owns scattered plots in various locations. These plots are often used for different crops both to take advantage of different micro-environments and also to spread risk (Beardsley, Hall, and Ward 1959:124-6: Yang 1945). Both these authors also note that scattered plots have the additional advantage that the tax collector may miss a field.

The chance to buy irrigated land in the next village was a boon to Dalena farmers in South India, but Epstein found that though sugarcane was a much more remunerative crop for that land, two thirds of such farmers grew only paddy rice and the remaining one third grew cane and paddy on these distant plots (Epstein 1962). The requirements of cane cultivation show the rationale for these crop choices. Cane production needs constant irrigation and hence constant supervision to be sure irrigation water is not blocked or stolen. Local farmers walk their fields at night, and some may even sleep by them. Living farther away, Dalena households were at a disadvantage in protecting their water supply and also in defending themselves in any water disputes (1962:217). Epstein also discusses the high labor and capital inputs required to grow sugarcane and both the small scale of paddy and its familiarity; all these factors contributed to the greater acreage in paddy, for the absentee Dalena farmers.

Access to land was found in Paso, Costa Rica to be the major determinant of land use decisions, both of what to plant as well as how much (Barlett 1975, 1978). In this community, all households derived their major income from agriculture, and the amount of land available to the household determined which of the four crop options available to the community could be chosen. Barlett divides the community into five groups on the basis of land available to the household: small, medium, and large landholders, landless households, and "heirs" (those landless households who will someday inherit land). Landless households must arrange to rent land each year and have no security of land tenure. Heirs have more security in some cases, and, as can be seen in the table below, can choose to plant a permanent crop such as coffee (usually in a small plot around the house), since there is a good chance they will continue to have rights to that land.

Table 1. Land Use in Paso, Costa Rica
(average number of manzanas*per household)

	N	Traditional Corn & Beans	Tobacco Corn & Beans	Coffee	Pasture
Landless	13	.8	.3	--	--
Heirs	8	1.8	.4	.3	--
Small	26	.6	.4	.7	.4
Medium	17	1.1	1.5	1.9	8.3
Large	8	2.0	.5**	2.0	58.4
	72				

* one manzana equals .69 hectare or 1.7 acre.
**this represents only one household of the eight.

Table 1 shows that all households plant subsistence corn and beans in the traditional manner, which uses modified slash and burn methods. The majority of households in Paso also plant tobacco, which is rotated with corn and beans, though the averages in Table 1 do not reveal the groups of Pasanos who do not grow tobacco. Both of these land uses involve only annual crops. Coffee and pasture are more permanent land uses, and of the landless farmers, only heirs plant a small amount of coffee. Neither heirs nor the other landless households use their land for pasture (its return per manzana is too low). For both coffee and pasture, the more land the household owns, the greater the amount planted to these land uses. There is an increase in the amount of tobacco produced also, from landless households up to medium-sized landholders. Tobacco production is very labor intensive and, as discussed in the previous section, large landholders can more profitably put their lands into pasture. Tobacco production therefore increases with the amount of land owned, up to the eight large landholders.

Access to land was found to be more important in predicting the amounts of land planted to the various crop options in Paso than household size or years of marriage. These factors have been found to be important by other researchers (See Section IIB: Chayanov 1966; Ortiz 1967; Chibnik 1974), but the Costa Rican data show that land is a more important determinant for that decision making environment (Barlett 1978).

Table 2. Land Use in Paso by Various Factors (contingency coefficients)

	Household Size	Years of Marriage	Land Owned
Traditional Corn and Beans	.24	.28	.43***
Tobacco, Corn and Beans	.40***	.25	.33*
Coffee	.25	.30	.67***
Pasture	.30	.44***	.61***

* significant at the .10 level
** significant at the .05 level
*** significant at the .01 level

The contingency coefficients in Table 2 show the amount of land owned to be closely related to the amount of land planted for the three crop options (traditional corn and beans; tobacco, corn and beans; and coffee). Access to land is less strongly correlated with tobacco production, but as noted above, tobacco is not planted by most large landowners. As this table shows, land uses are quite predictable, based on the amount of land available to the family. Every household plants corn and beans for subsistence, while many plant tobacco for cash in addition. If there is sufficient land after these crops are assured, land is put into coffee, and then into pasture. Large landholders, however, do not dedicate themselves solely to cattle production, though they could, but rather continue to plant subsistence grains and coffee, to diversify their agricultural enterprise and to raise their productivity for the over-all farm. For a more detailed discussion of each of these agricultural decisions, see Barlett 1977 and 1978.

Boserup and the Relationship of Population to Land

Boserup's analysis of agricultural change (1965) represents a major reorientation in understanding peasant land use. Noting the changes over time of agricultural methods in many parts of the world, she proposes a sequence of agricultural intensification that moves from long fallow systems (in which forests are allowed to completely regenerate before being cut again) through short fallow systems, to annual cropping and finally multicropping. This agricultural sequence has been validated in archeological sites as well as by fieldworkers in many disciplines (see, for instance, Spooner 1972). Boserup sees population pressure as the causal mechanism which pushes farmers to use their land more frequently and their labor more intensively (Halpern 1958; Carneiro 1961; Geertz 1963; Baum 1968; Netting 1968; Harner 1970; Haswell 1973; Knight 1974).

As the fallow cycles are shortened, farmers begin to contend with grass invaders of their fields. Simple weeding techniques are no longer effective against grasses, and, together with the need to increase soil fertility, one solution is plowing. Only when fallow cycles are greatly shortened and soil fertility has significantly declined will farmers be forced to manure, compost, or use crop rotations (see Netting(1968) for a detailed study of such soil conservation methods in intensive hoe farming in Nigeria).

These measures to maintain soil fertility are not seen as "progress" by the farmer with sufficient land to rotate with fallow, since that form of maintaining soil fertility is obviously less work. The less intensive agricultural methods have been found to yield much more highly than was previously thought: yields from swidden fields

can be used only a year or two whereas the lower yields of plow agriculture are usually found associated with stable annual cultivation.

Farmers who find that population pressure forces them to use their fields each year also find their labor is less well rewarded. Their resistance to intensification is called the "law of least effort", and much of the "laziness" of tribal agriculturalists can be seen as a rational attempt to get the highest possible returns to their labor. Many "modernization" schemes advocated by agricultural development workers involve the addition of labor, and it is important in understanding peasant response to such proposals to check the returns to this additional labor. Often the returns are not as high as for traditional activities. If the family's needs are already met, farmers will be likely to resist the suggested scheme.

Boserup's findings are essential to understanding land use in many peasant communities today. Basehart (1973) shows that the intensity of farming in one area of Tanzania is affected by population density (see also Gleave & White 1969). Hanks shows that rice cultivation in Thailand is often supplemented with other resources as long as population density is low. Less labor is invested in rice with "more dependence on hunting, fishing, and collecting" (Hanks 1972:64). When land becomes more scarce, "there is no alternative to dependence on rice" (Netting 1974:39).

Ruthenberg's research in Tanzania traces the transition of subsistence crops from high quality grains such as millet and maize to low quality but higher yielding starch crops (cassava and sweet potatoes) (Ruthenberg 1968:334). Farmers in this situation opt to increase returns in calories per land unit but they accept decreasing returns per hour of work and lower nutritional standards. Grazing land for cattle is also cut back as population expands. Cattle are replaced by goats and sheep and eventually animals are grazed only on fallow fields instead of on their own pastures (Ruthenberg 1968:334-5). Ruthenberg cites various ways in which these agriculturalists resist new technology and new agricultural methods. When investigated, these innovations often represent declining returns to labor, and farmers are rational to resist adoption until forced by the pressures of population.

Boserup's perspectives have been refined by a number of authors, of which two can be indicated here. Rubin's (1973) discussion of agricultural change in the U.S. South has already been mentioned, and his analysis of China and Russia also indicate that climate is a limiting factor and must be added to the determinant of the people/land ratio in understanding agricultural history.

Smith (1975) uses Boserup's theory of population density and the intensity of agricultural production together with Von Thunen's theory that intensity varies according to the distance from the market center. Her Guatemalan study shows that agricultural production patterns depend on an interaction between the distance of the community from the central market area, the distance to the nearest smaller market town, and its population density. Boserup and Von Thunen are seen to complement each other, since population is usually densest around market towns and markets are usually located in the densest areas.

Boserup's theory shows that when populations are less dense, farmers will make decisions based on the returns to labor. Only when pressure on the land reaches a certain point are returns to each land unit the prime criterion of land use decisions. Given that in most peasant communities, different households have access to different amounts of land, this "tip point" of scarcity of land or labor may come at different times for different decision makers. Let us turn now to consider the family's labor resources, and the choices in investing them.

II. WHAT ARE THE HOUSEHOLD NEEDS AND RESOURCES?

B. Labor

Labor resources are crucial for the farmers' production decisions. While labor can be purchased in many peasant areas, and must be purchased in some (see Epstein below), the household members usually form the bulk of the labor force for the peasant farm. Labor scarcity or abundance can make important differences in land use decisions. On the other side, the same household labor force represents consumer demand as well; the number of mouths to feed will also constrain farmers' decisions.

Obviously, if each household has so little land at its disposal that it can use only a fraction of the days of labor available, then labor scarcity has no meaning. Such a situation is probably more common in the Third World than the reverse, and with increasing world populations, it is likely to become ever more common. In areas where land is abundant, however, labor resources may be a limiting factor.

Norman (1971) finds that labor scarcity is an important limiting factor in Nigerian agriculture. For farmers there, labor scarcity can be overcome with an abundance of capital, to pay workers, but most households cannot count on more than their own labor resources (Norman 1971:35). Labor is not scarce all year around, though. Norman notes that the heavy weeding period of June and July is the bottleneck which limits the amount of land planted. The family's labor resources at the weeding period were found to be more important in determing the amount of land planted per household than either the amount of land available or the labor needs for harvesting(Norman 1976:5).

Clayton discusses a similar situation among Tanzanian corn farmers. Agriculturalists clear their fields and plant them, in successive plots, thereby staggering peak labor times and climatic risk. At some point, however, the farmer must decide whether to go on planting new fields or to weed the corn sown earlier. This early weeding will raise productivity per field, but farmers know that planting an additional field will produce more corn than would be gained by the weeding. To the chagrin of agricultural extension workers, farmers usually continue planting new fields and accept lower returns per field (Clayton 1968:246). In this case, with abundant land, they are maximizing the returns to their labor.

In another case that involves two crops, Clayton shows that overlapping labor needs requires a decision to be made by the farmer. Corn needs to be weeded at the same time coffee bushes need to be pruned. Since the increase in value of the coffee harvest, if properly pruned, is greater than the increase in corn harvest, if properly weeded, again the corn weeding suffers (Clayton 1968:247). A casual observer might assume that farmers in this case were "lazy" or unwise in their decision not to weed their corn, but a careful analysis of return to scarce labor reveals the basis of the labor investment decision (see also Haswell 1973:64).

Baum confirms this conclusion for another area of Tanzania where the government has subsidized and encouraged sugarcane production. Cost benefit figures show that the returns per hour of work in sugarcane are lower than for the traditional subsistence crops (mainly rice and corn) (Baum 1968:47). Farmer resistance to the cane program can be better understood in this light.

A number of other authors indicate the impact of labor scarcity, especially during seasonal peak demands (Schultz 1964; Nash 1965; Baum 1968; Haswell 1973; Mwamufiya and Fitch n.d.). Greenwood's analysis of a Basque community was discussed earlier, and labor shortage was noted as constraining some farms from the optimum land use based on soil type. The intensive vegetable farming in that area requires high investments of labor--up to 18 hours a day in July and August! Successful vegetable farming requires not only time invested in production and preparing for market, but also a high labor cost in selling the produce in town as well (Greenwood 1976:155). De Young notes that in Thailand farmers recognize that transplanted rice is of better quality than broadcast rice and gives much higher productivity per acre. It requires considerably more work, too, and farmers in the area studied do not have access to extra labor. Since households must be self-sufficient, broadcast rice is more common (DeYoung 1966:85).

Land use decisions can be constrained by the way labor is organized as well as by its scarcity, as shown by an Indian example. The Indian caste system traditionally provided economic security to all households linked together in fixed hereditary exchanges (Epstein 1962). These hereditary relations can also limit responses to new land uses. For Wangala village, in South India, Epstein discusses the Japanese method of rice production which was claimed to increase production four-fold. No farmers adopted it, however. Traditionally, Wagala farmers' rice is planted by a team of 10-12 women called a gumpu. The gumpu is paid a fixed wage for this work, and the wage is then divided among its members.

Part of the Japanese method requires more careful transplanting of rice seedlings into the irrigated field. Since this extra work requires more time and more care from the gumpu, but does not affect their pay, they were unwilling to do it. All the benefit from the higher production would accrue to the landowner and not to the workers. Demand for gumpu teams is high at peak planting times, and Epstein notes that if a farmer tried to exert pressure on the gumpu, he might not be able to get one at all until the optimum planting time was past (Epstein 1962:64). In this case, the traditional organization of the labor force directly affected the farmers' land use decisions, and they did not attempt the Japanese method. It should also be noted that India has had a lower population density than Japan until relatively recent history (Moore 1966). The adoption of these more labor intensive methods, more suited to a very dense population, can be expected to take some time, as the population adjusts to the new land/labor ratio and its productivity demands.

Chayanov -- Household Needs versus Labor Resources

Chayanov's pathbreaking work on peasant economy sees the intensity of labor as a balance between the mouths to feed and the number and age of workers in the family (Chayanov 1966, original 1925). In this sense, he provides a useful link between the labor resources of the family and its consumption needs, the dual issue which is the topic of this section.

Chayanov argues that the peasant family economy cannot be analyzed with the same tools used to understand the capitalist firm. The major difference lies in the area of labor: farmers do not calculate their own labor on the family farm in terms of wages. Hence, some agricultural activities do not repay the family at a rate competitive with outside wages; peasant farmers can support a marginal return to labor that approaches zero. Chayanov saw the needs and resources of the family as indivisible--if the family needs one more potato, more labor will be invested to produce it, even if the labor cost is very high. Farm decisions are made on the basis of the family's consumption needs, and family resources are invested until those needs are met. This importance of the household's consumption needs in decision making is reinforced by other authors as well (Boserup 1965; Friedrich 1968; Hanks 1972; Haswell 1973).

Chayanov developed the concept of the labor-consumer balance to explain the variation of intensity of labor over the life-time of the family. As a couple has more children, and as these children grow older, the number of mouths to feed increases steadily until these children leave home to establish their own families. The number of workers available to feed those consumers grows more slowly, however. Especially while there are

very small children whose contribution to the farm work is low, the level of self-exploitation of the farmer and his wife is high, as they seek to satisfy the family's needs (Chayanov 1966:6). In Table 3, the increasing number of children, and their delayed contribution as workers is illustrated. The column on the far right gives the ratio of workers to consumers, and shows that the level of self-exploitation of the parents will be highest in the fourteenth year of this hypothetical family.

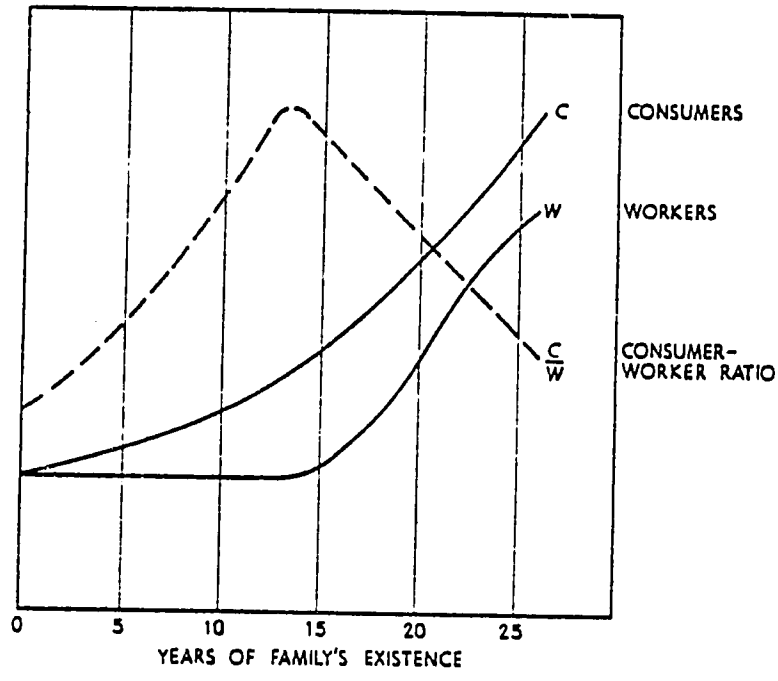
Chayanov says that families weigh the drudgery of the extra labor required to meet the family's needs against those needs, until an equilibruim point is reached, in which the extra produce gained by additional work is equal in value to the drudgery required to produce it. This equilibrium changes over the life of the family: Diagram 3 illustrates the dynamics of the consumer-worker ratio expressed in Table 3.

Table 3. Chayanov's Consumer - Worker Ratio

Years of Family's Existence	*Married Couple*	*Children*									*Total in Family*		*Consumers ÷ Workers*
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*Consumers*	*Workers*	
1 ...	1.8	—	—	—	—	—	—	—	—	—	1.8	1.8	1.00
2 ...	1.8	0.1	—	—	—	—	—	—	—	—	1.9	1.8	1.06
3 ...	1.8	0.3	—	—	—	—	—	—	—	—	2.1	1.8	1.17
4 ...	1.8	0.3	—	—	—	—	—	—	—	—	2.1	1.8	1.17
5 ...	1.8	0.3	0.1	—	—	—	—	—	—	—	2.2	1.8	1.22
6 ...	1.8	0.3	0.3	—	—	—	—	—	—	—	2.4	1.8	1.33
7 ...	1.8	0.3	0.3	—	—	—	—	—	—	—	2.4	1.8	1.33
8 ...	1.8	0.3	0.3	0.1	—	—	—	—	—	—	2.5	1.8	1.39
9 ...	1.8	0.5	0.3	0.3	—	—	—	—	—	—	2.9	1.8	1.61
10 ...	1.8	0.5	0.3	0.3	—	—	—	—	—	—	2.9	1.8	1.61
11 ...	1.8	0.5	0.3	0.3	0.1	—	—	—	—	—	3.0	1.8	1.66
12 ...	1.8	0.5	0.5	0.3	0.3	—	—	—	—	—	3.4	1.8	1.88
13 ...	1.8	0.5	0.5	0.3	0.3	—	—	—	—	—	3.4	1.8	1.88
14 ...	1.8	0.5	0.5	0.3	0.3	0.1	—	—	—	—	3.5	1.8	1.94
15 ...	1.8	0.7	0.5	0.5	0.3	0.3	—	—	—	—	4.1	2.5	1.64
16 ...	1.8	0.7	0.5	0.5	0.3	0.3	—	—	—	—	4.1	2.5	1.64
17 ...	1.8	0.7	0.5	0.5	0.3	0.3	0.1	—	—	—	4.2	2.5	1.68
18 ...	1.8	0.7	0.7	0.5	0.5	0.3	0.3	—	—	—	4.8	3.2	1.50
19 ...	1.8	0.7	0.7	0.5	0.5	0.3	0.3	—	—	—	4.8	3.2	1.50
20 ...	1.8	0.9	0.7	0.5	0.5	0.3	0.3	0.1	—	—	5.1	3.4	1.50
21 ...	1.8	0.9	0.7	0.7	0.5	0.5	0.3	0.3	—	—	5.7	4.1	1.39
22 ...	1.8	0.9	0.7	0.7	0.5	0.5	0.3	0.3	—	—	5.7	4.1	1.39
23 ...	1.8	0.9	0.9	0.7	0.5	0.5	0.3	0.3	0.1	—	6.0	4.3	1.39
24 ...	1.8	0.9	0.9	0.7	0.7	0.5	0.5	0.3	0.3	—	6.6	5.0	1.32
25 ...	1.8	0.9	0.9	0.7	0.7	0.5	0.5	0.3	0.3	—	6.6	5.0	1.32
26 ...	1.8	0.9	0.9	0.9	0.7	0.5	0.5	0.3	0.3	0.1	6.9	5.2	1.32

From Chayanov (1966:58) The Theory of Peasant Economy. Reproduced by permission of publisher.

Diagram 3. The Consumer - Worker Balance



From Chayanov (1966:59). The Theory of Peasant Economy. Reproduced by permission of publisher.

With this labor-consumer balance, Chayanov seeks to explain variations in the intensity of labor investment among farmers in otherwise similar situations. This variation in labor investment can be seen in many situations to be an important difference in land use among households. Sahlins (1971), Dutia (1957), and Tax (1953) indicate that the size of the family is an important predictor of this labor intensity in certain situations. Beals notes that some agricultural options are chosen precisely because they employ surplus family labor (Beals 1974:125). In such a situation, returns to the extra labor invested may not be high but it can be assumed that other employment opportunities are scarce, or perhaps less remunerative, for those family members.

In Jamaica, Edwards' study concludes that there is "little scope for increasing...family labor in farming" (Edwards 1961:165). Brush concurs that in highland Peru, a loss of labor from the area would result in a decline in production (Brush 1977). Edwards sees the family labor resources in the Jamaican community he studied as almost completely utilized: more than half the population of the community works over 8 hours a day, 300+ days per year. This level of labor use is undoubtedly higher than in other areas where fewer days of work are necessary to provide an adequate standard of living. Boserup suggests that a larger investment of labor will be necessary when land is scarce and high yields must be produced on small plots. The national political and economic climate may also maintain prices, wages, or land tenure so as to require larger amounts of work than under other conditions. What the people in any one place consider

"an adequate standard of living" varies as much as the amount of labor they are willing to invest in production. Both Boserup (1965) and Wilkinson (1973) suggest that over the evolution of human cultures, there has been a tendency for both the standard of living and the human labor needed to produce it to rise. Wilkinson also outlines some of the social and human costs of the higher material standard of living (Wilkinson 1973).

The cycle of family size may affect access to land as well as land utilization and family labor resources. Family size usually ebbs and grows in a cycle, depending on the cultural rules of inheritance and post-marital residence. A household which consists of only a newly married couple will expand for a period with the birth of children, and later will contract as the children reach adulthood, marry and leave home. In many peasant areas, extended families keep all the children (or all the sons) at home, whether married or single, and in these cultures the household labor force will continue to grow steadily until the household splits, often at the death of the grandparents. If the parents must give their children their portion of the family's land when the children marry, then farms will decline in size as the children mature. This pattern results in both smaller farms and incomes for older people as Friedrich (1968:205) discusses for Tanzania. In other areas, land inheritances are not divided until the death of both parents, but children who marry still leave home to set up their own households (Barlett 1975). In such a situation, the number of workers on the farm will decline while the farm size remains intact.

Edwards notes that for Jamaica, this latter pattern means that farmers inherit their parents' land in their middle years, when he feels they are less able to develop it effectively than if they had inherited it earlier (Edwards 1961:156). A typical family cycle in this case begins with a man's marriage in his early 30's, after living at home to accumulate sufficient cash until then. Marriage is usually accompanied by some small land purchases, building a home, and the subsequent birth of children. By the time a man usually inherits land from his parents, his family is large enough to present constraints on his agricultural activities as he tries to feed them all adequately. His wife is also unable to help with the development of the family farm because her home and childcare duties are heaviest at this point. We can assume that some kinds of agricultural innovations would be very attractive to a man or a woman at this point in the life cycle, but the constraints of family obligations would cause resistance to others.

Ortiz presents another example of the importance of farm and family cycles in understanding land use decisions. Paez Indians in Colombia receive all their inheritance at marriage, and their major land use decision is how much of that land to put into coffee (Ortiz 1967:214). The Paez farmer must balance a number of factors in making this decision: the labor he needs to establish his coffee plantation, the labor needed to maintain and harvest it, the cash and food needed to pay workers, the demands on his time from exchanges with other farmers who need workers, and his own subsistence needs. The amount and quality of land he has received, together with his capital and labor resources, determines the proportion of land he will allocate to coffee and the proportion that will remain for foodcrops.

> "...Decision making in coffee agriculture... (is) a conscious act which takes place once, or at most twice, in the lifetime of a farmer." (Ortiz 1967:215)

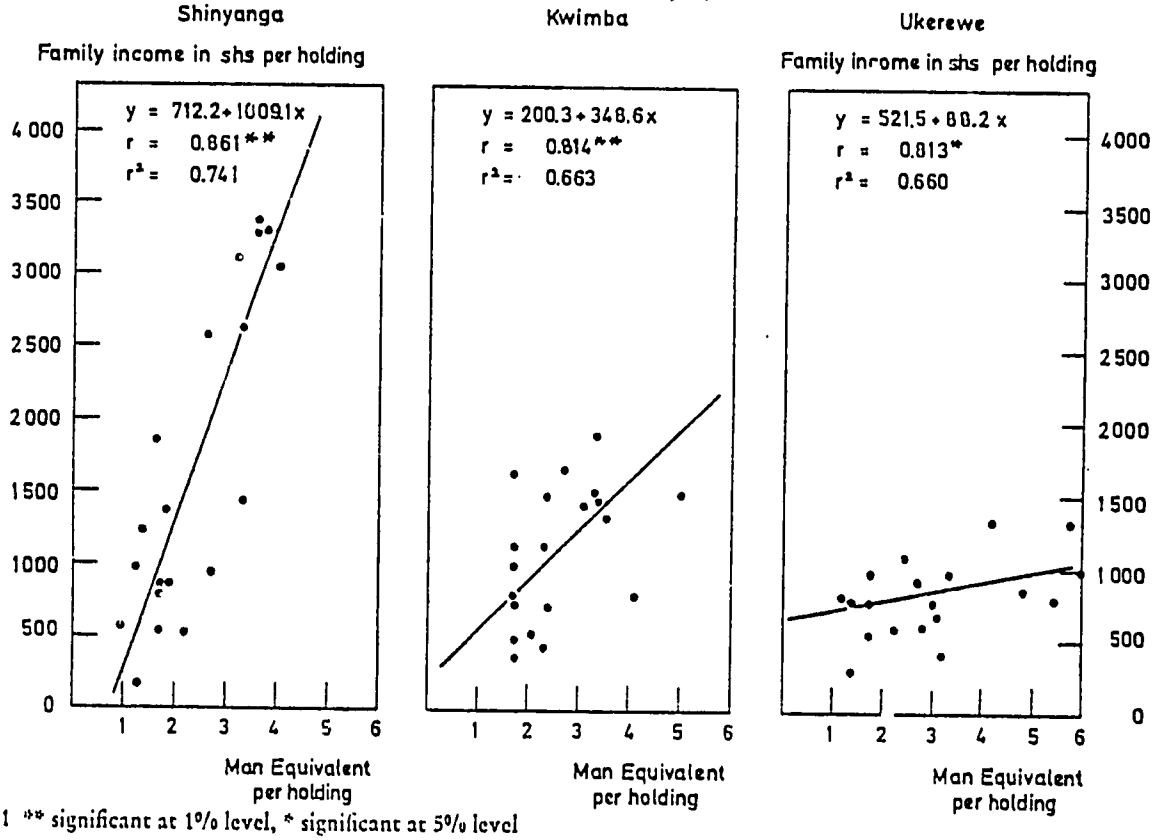
The impact of the life cycle on agricultural decisions in this area is therefore crucial, and "there are optimum times for expansion of certain enterprises, according to social and economic factors" (Ortiz 1967:224). A governmental program which seeks to expand coffee plantings may find that a positive response from a small fraction of the villagers may be in fact 100% of all possible adopters of the proposed changes, given this decision making pattern.

Chayanov linked the cycle of family size to the amount of land planted by each household (Chayanov 1966; see also Halpern 1958; Friedrich 1968). As the Russian peasant family grows in numbers of mouths to feed, the household will expand the amount of land planted, either buying or renting additional land. When children marry and receive their portion of the farm as inheritance, the process reverses itself, until the old couple find themselves again on a small plot of land. Chayanov stressed that the difference between large landowners and small landowners is primarily a demographic difference, related to this cycle of farm size. While differences in land resources between families are usually more fixed than Chayanov suggests, the lifetime of the family may play an important role in the size of the farm and the agricultural decisions on it. Clearly, such a cycle such as Chayanov outlines is only possible in "thinly populated countries" and where land can be freely bought and sold to accomodate to the fluctuations in household consumption needs.

Family needs can also determine what to plant. Netting tells of one Nigerian farmer who planted a largish field in eleusine. This crop choice was explained: " 'He has many small children.' Eleusine is used to make a thick nourishing gruel (waar) which is valued as a food for infants and youngsters." (Netting 1968:80).

Von Rotenhan's research in Sukumaland in Southern Tanzania ties together many of the factors discussed so far: population density, labor intensity, and agricultural productivity. In areas where land is abundant and population density low, Von Rotenhan found that family income varies directly with the labor resources of the family. See Diagram 4. When population density rises, however, and land scarcity begins to limit the productivity of labor, the relationship between family incomes and family size declines in importance (Von Rotenhan 1968:78). The three areas shown in Diagram 4, from left to right, represent increasing population density, and the declining returns to labor investment are dramatically illustrated. This research combines, then, the theories of Boserup and Chayanov and demonstrates the interaction of the factors discussed above in parts A and B of this section.

Diagram 4. Relationship between Family Income, Availability of Labor, and Availability of Land in Three Areas of Sukumaland, Tanzania.



1 ** significant at 1% level, * significant at 5% level

From Ruthenberg (1968:78) Smallholder Farming and Smallholder Development in Tanzania. Reproduced by permission of publisher.

II. What are the household needs and resources?

C. Capital

Capital is the third factor of production recognized by economists as important in agricultural decisions. (Technology as a factor of production in peasant communities will usually be imbedded either in capital or labor resources. Entrepreneurship will be discussed in section III.) For traditional peasant economies, capital availability is usually linked to access to land or to labor, as noted in several cases above. Briefly, then, we can discuss two examples of the family's capital resources and their effect on land use.

Nair provides an example of decision making on the part of a large landholder in India (1961:43). The owner of a vast estate, this landlord rents almost all his land to Harijans (Untouchables). Nair reports that he is opposed to land reform which would distribute his estate among his workers because he feels the over-all productivity would decline. Is his productivity presently high, she asks? No; the 80 paras of paddy per acre he averages is a poor yield for the region. The large landholder says that he knows he is not using sufficient fertilizer "in the scientific manner. But, 'if I do that then the margin of profit will decrease.' ". The landowner also rejects the Japanese method of rice production because he reports that his friends have tried it and found the rewards are not commensurate with the investment and effort expended (Nair 1961:44). In this case, the return per unit of capital is the most important criterion of land use decisions.

In Mexico, DeWalt studied the adoption rate of new fodder crops and found that only the wealthiest farmers were able to try them. Dividing the community into quartiles based on wealth, he found the adoption rates of new forage crops to be: 0%, 15%, 13%, and 45% respectively (DeWalt 1975:156). To try this new land use option, farmers must have significant amounts of cash on hand, and there are no credit facilities available. This high capital investment plus the relatively high risk involved discourages all but the wealthiest farmers, even though profits average one third more than other crop options. DeWalt stresses that these factors of risk and scarce capital determine the low community adoption rate of fodder crops, not peasant traditionalism or conservatism (DeWalt 1975:164).

II. WHAT ARE THE HOUSEHOLD NEEDS AND RESOURCES?

D. Risk

Households vary in their resources and needs and also in their ability to withstand risk. Land use choices, throughout the world, are carefully weighed for the likelihood of disaster or good harvest. There are a number of theories of decision making which take account of risk, and there are many case studies which illustrate decisions concerning risk as well, but few of these works focus directly on land use. Since concern with risk has been well recognized in recent years, this section will be brief, with a longer discussion of Cancian's work on risk at the end.

Wharton stresses the importance of risk for the subsistence farmer and uses it to explain some resistance to technological change. Wharton says the whole farm is the decision making unit, not the single crop, and risk and returns must therefore be seen within that larger context (Wharton 1971:169); DeWalt 1975; Chawdhari, Chowdhury, and Sharma 1965). Such an approach may seem to disagree with a number of the analyses reported above, which do see peasants acting on one crop at a time, but Wharton is undoubtedly right that these individual crop decisions come together in the over-all assessment of use of resources of the whole family farm.

Wharton stresses the range of outputs from any crop option--the harvest will always vary, though some crops fluctuate more than others (also Ortiz 1967:193). He argues that a household knows its subsistence minimum and weighs the likelihood of falling below that minimum when making agricultural decisions. Wharton also notes that many proposed innovations have a wider variability than do traditional agricultural patterns and therefore are riskier. If that risk threatens to cut into the family's subsistence minimum, resistance to the innovation can be expected. Wharton's analysis of the role of risk shows that households will vary in their assessment of the risks and benefits of an innovation--just as households vary in their consumption needs and resources with which to meet those needs. The subsistence minimum will be very close to the average harvest for some families and far below it for others. These differences in ability to withstand risk are crucial in understanding farmers' decisions.

Schluter and Mount show that risk can explain otherwise surprising agricultural patterns in one Indian District (Schluter and Mount 1976). In that region, groundnuts are more profitable

than cotton and are more labor intensive. The authors expected, therefore, for goundnuts to be attractive to families with a high worker/land ratio . Results of their research showed the worker/land ratio of groundnut growers to be actually lower than that for cotton growers. Risk is the key. Groundnuts are riskier and households with either large families or small land areas prefer cotton with its lower risk. In this case, families with either fewer resources or greater needs cannot afford the risk of the more productive but more variable groundnuts (Schluter and Mount 1976:253).

Schluter and Mount were able to quantify the importance of risk and link it to the resources of the household--in this case, whether land is irrigated or not. See Table 4. The authors conclude that risk may clearly be a limiting factor on unirrigated land, while increased capital requirements may constrain the farmer on irrigated land (Schluter and Mount 1976:254).

Table 4. Risk and Capital Requirements of Irrigated and Unirrigated Fields

	Rupees 100 increase in income results in :	
	increased deviation in yield (risk)	increased capital requirements
Irrigated	Rs. 25	Rs. 50
Unirrigated	Rs. 100	Rs. 20

(adapted from Schluter and Mount 1976:254)

Ortiz has studied the actual decision making process for a sample of Paez Indian farmers and finds that there is "a considerable difference in the range of incomes expected by each farmer" (Ortiz 1976:15). Further, poorer farmers were found willing to accept much lower gains than Ortiz had predicted. This acceptance is explainable partly by recent past experience with low coffee prices, but more importantly by the flexibility of the family farm. When yields or prices are extremely low, the farmer can reallocate the factors of production to other parts of the farm enterprise. In this way, the peasant farm is more adaptable to fluctuating market conditions than is a larger commerical plantation (Ortiz 1976:16).

In the case of panela (brown sugar) production, Ortiz notes that farmers will accept very low return (and high risk) because

the activity is valued as a complement to other economic activities. "...Cane can be planted, harvested, and processed when farmers are not involved in their coffee plantations. Furthermore, as a complimentary cash activity, it is more profitable than wage labor." (Ortiz 1976:16-17). Clearly, in this case, Wharton is right that decisions on risk are made with the whole household's resources and needs taken into account.

Many traditional agricultural practices and social arrangements can be seen as reducing risk. Johnson discusses patron-client relations as a means used by Brazilian sharecroppers to reduce the uncertainties of their economic situations (Johnson 1971a; 1971b). Labor sharing arrangements may provide a cushion against disaster, as well as a source of workers beyond the resources of the family alone (Johnson 1971b). By planting a variety of different crops, many farmers spread environmental risk (Tax 1953:131; Gould 1963; Johnson 1971b:145; Ortiz 1976:16; Abalu 1976) and intercropping within the same field has the same advantage (Norman 1971; 1974). In these ways, farmers' decisions may not always be focused on the highest possible return to labor, capital, or land, but may instead be adaptive in reducing risk.

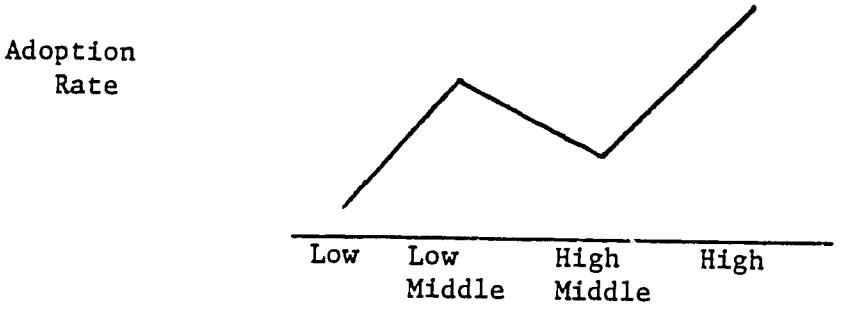
Cancian's study of corn farmers in Zinacantan, Mexico, links the importance of risk (or uncertainty) to the different land and labor resources of households in the community (Cancian 1972). In this case, the main land use decision is <u>where</u> to rent land. The Zinacantecos live in the highlands of Chiapas, and roughly a quarter of the community produces corn (and other crops) in their own lands there, 90% rent lands in the nearby lowlands for corn production. Cancian focuses on the decision of how far down into the lowlands the farmers are willing to go, and divides the area into 9 zones. Since most farmers must hire help to work these lowland plots, and must pay transportation costs of these workers, the greater the distance from Zinacantan, the greater the cost in both transportation and labor. Yields are also higher, however, at the lower altitutudes, so that the farmer must trade off gains and losses when deciding where to rent land (Cancian 1972:72).

Two important changes on the level of the regional economic environment - transportation and marketing - played an important role in the sharp rise in lowland rentals by Zinacantecos in the last 10 years (Cancian 1972:76-95). First, roads have been built and improved, allowing easier transportation of workers to the

lowlands and also of the harvest back home. Secondly, the Mexican government has established corn marketing centers which provide facilities for the Indians to market their corn directly in the lowlands, rather than transporting it back to their highland market town. These marketing centers have also added stability to corn prices, which has aided farmers to try the more distant (and more productive) lands. Cancian notes that dealing with the marketing centers does require the Indians to be bilingual. Less sophisticated farmers may be reluctant to entangle themselves in the complications of dealing with the centers. Many farmers, however, choose to work with a more experienced neighbor or friend, who will handle these marketing arrangements for them (Cancian 1972:86).

Cancian's analysis focuses on which farmers began to farm the distant zones first and which were more resistant to the risks involved. His results show that stratification in the community is an important predictor of who will innovate first. He divides the community into four groups, based on economic status--low, low middle, high middle, and high, and presents alternative hypotheses to test the reasons for the relatively high or low innovativeness of the 4 ranks.

Diagram 5. Economic Rank and Risk-Taking



Adapted from Cancian 1972

Testing the hypotheses on data of farmers' choice of lowland location and choice of marketing facilities, Cancian found that low ranking farmers tended to innovate less, conforming to the perspective that either poorer households cannot afford to risk (supporting Wharton above) or that they "refuse to compete in the economic sphere because past failures have made it seem an inefficient way to seek rewards" (Cancian 1972:142). Low middle ranking farmers innovate more than high middle farmers because they have less to lose and are more anxious to improve their economic status. In comparison to them, high middle ranks will risk less, because they feel "it is more likely a random change will be downward rather than upward" (Cancian 1972:137). The highest ranking people innovate most of all, having more resources to invest and being better able to recover should the decision be a disaster. Wealthier farmers may also have access to better information and therefore actually be taking less of a risk than poorer and less-well-informed farmers (Cancian 1972:139).

POLICY RELEVANT QUESTIONS

1. What effects does access to land have on land use choices in the area of interest?

   Are the farmers in question landowners, renters, or sharecroppers?

   Are landless farmers constrained from important crop options?

2. How are land uses affected by population density? Have some "improvements" to farming been rejected by farmers because they represent lower returns to labor than traditional activities?

3. How does labor or capital scarcity play a role in land use decisions?

   Does the cycle of family size have an effect?

4. How do traditional agricultural practices provide safeguards against risk?

   Will proposed changes affect these safeguards? Which kinds of farmers will experience more or less risk?

5. Will proposed changes increase or decrease variation among farmers in wealth, land, labor, and capital?

III. THE DECISION MAKING PROCESS

A. Efficiency and Responsiveness to Change

Are the decisions made by peasant farmers tradition-bound or open to innovation? Are allocations of resources efficient? How much difference do personality and individual idiosyncracies make? Do peasant farmers see themselves as entrepreneurs? What is the role of women in household decisions? These questions represent some of the issues in regard to land use decisions which have been raised and debated many times. Compared to the previous sections this part is more of an overview of the decision process. Having discussed the natural and human environment which structures crop options and the household needs and resources which lead to decisions on those crop options, we can now look at the decision process from a distance and see some of its characteristics.

Schultz was one of the first economists to assert that traditional farming is "poor but efficient" (Schultz 1964). Wolgin (1975:622) lists a number of other researchers who have tested this assertation and who agree. Lipton notes that the margin between the econometrician's maximum efficiency and the traditional agricultural allocation of resources may be an adaptation to risk (Lipton 1968). Schluter and Mount agree, noting that even with sophisticated calculations, farm incomes in India would increase by 5-10% or less with a different allocation of productive factors (Schluter and Mount 1976:253). Norman found the same results for Nigeria, concluding that an agricultural development policy to increase farm incomes through a better use of production factors is unlikely to succeed. Reallocation of household resources will yield only limited gains (Norman 1971:47).

Dillon and Heady provide a nice complement to the above research on Third World farmers. They tested seven major decision theories on the actual farm decisions of a group of U.S. farmers (Dillon and Heady 1960), projecting first what the optimal use of resources should be and then comparing that to what farmers actually did. The choices made were found to be definitely sub-optimal. Profits could have been increased by "at least 21%" if farmers had followed other resource allocations (Dillon and Heady 1960:927). The report suggests several possible reasons why farmers did not choose more optimal land uses, but the authors did not ask the farmers, and so cannot say, really, why the decisions were made as they were.

This U.S. study suggests that the levels of "inefficiency" are quite relative, and the real causes for them are often unclear. At present, we are better off assuming that farmers are rational

decision makers (see Cancian 1972) and their decisions are responses to their own needs and the environment in which they operate. Johnson (1971a) summarizes the findings of many different research perspectives when he notes that though agricultural decisions are complex, farmers are not tradition bound and are adapting to the actual conditions around them. Development programs will have to change their economic circumstances in order to change their agricultural decisions.

Question: How willing are farmers to innovate?

Answer: In general, very.

Netting notes that Nigerian farmers are quick to adopt new crop strains (Netting 1968:84). Johnson cites examples of Brazilian sharecroppers trying new crops, new strains, and new agricultural techniques (1971b:146; see also Tax 1953:129-130). The economic viability of the innovation is the most important determinant of its adoption, holds Wharton (1971) and Haswell (1973), while Danda and Danda (1972) stress that the innovation must also be compatible with other cultural practices. Usually, however, cultural resistances can be seen as adaptive in various economic ways as well: traditional labor relations guard the availability of workers, ties to patrons assure credit in emergencies, labor invested in "newfangled" projects gives lower returns, etc.

Though farmers in one area of Mexico are considered to be "very conservative" by the agricultural development personnel there, DeWalt found that 84 out of a sample of 87 farms there had tried fertilizer at some point. Over 66% of the sample used fertilizer in two of the three recent years studied (DeWalt 1975:155). The poorest quartile of households was found to have the highest rate of fertilizer adoption (78%) which shows that simple predictions about innovation adoption are not possible. In this Mexican case, De Walt found that the poorer families used fertilizer readily because their fields were not producing enough to assure subsistence. The wealthier farmers also adopted fertilizer readily (70%) in order to maximize their profits, though their subsistence needs were already adequately met. The two middle quartiles were less likely to use fertilizer (56% and 64%) and DeWalt notes that they already produced enough corn for their own needs. Many of these families had other economic pursuits as well, where their returns on capital and labor were presumably higher.

Fertilizer recommendations are not always optimal from the farmers' point of view. Winkelman reports on fertilizer adoption as part of CIMMYT's Plan Puebla recommendations in Mexico (Winkelman 1976). He found in one area that if farmers used 75% of the recommended level of fertilizer, their profits dropped by only 2%. If they used 50% of the recommended fertilizer application, their profits declined by 6% (Winkelman 1976:5). Resistance to Plan Puebla recommendations can be seen as quite rational in this case.

Resistance to innovations is described by many authors, and the reasons for it are diverse. Thai farmers described by Hanks have not found tractors to be as attractive as one might expect, given that the environment is favorable to tractor use. True, says Hanks, tractors do give speed to a farmer, but "speed is not necessarily useful" (Hanks 1972:54). If time permits plowing to be done leisurely over several days, the way planting usually is, then the tractor has no advantage over the traditional plow. Furthermore, it may be hard to get fuel or a mechanic to repair it. The farmers also worry that driving a tractor will spoil a worker for other tasks, making the person "too proud to help with transplanting" (Hanks 1972:54). The advantages of the tractor are therefore less than the disadvantages according to these farmers.

Lutfiyya sums up the Jordanian peasant's "show me" attitude:

> The general state of poverty among the villages causes them to adopt a conservative attitude toward experimentation in agriculture. Most farmers are unwilling to invest either their time or money in any experiment unless it has been tried in the village and has produced good results. (Lutfiyya 1966:109)

Mead adds:

> ...Most of the farmers of the world are not motivated by abstract ends or speculative results.... For them, "seeing is believing...." (Mead 1953:198)

Thus, the evidence is strong that Third World farmers are efficient in their agricultural decisions and are open to innovations. Variations in wealth and resources can make farmers more or less able to risk on new ideas, but generally resistance to innovations can be seen as stemming from clearcut and sound decision making criteria.

III. THE DECISION MAKING PROCESS

B. Individual Differences in Decision Making

> Yet, in Niiike (Japan), as elsewhere, individuals vary in their reactions to innovation. At one extreme, there is the relatively well-educated young farmer who is willing to experiment with fruit-growing and dairying in preference to raising the customary crops of rice and dry grains. At the other extreme, there is the traditionalist, not necessarily less educated, who will reason: "I can't afford to gamble on new fangled farming--even if I liked the idea, which I don't." The bulk of farmers come between these extremes. (Beardsley, Hall and Ward 168:69)

> Farming techniques, costs, and yields differ greatly between holdings, according to the efficiency of the particular farmer, his financial resources, the size and fragmentation of his holdings, and the quality of his land. (Epstein 1962:41-42)

Beals recognizes that there will be individual variations in efficiency of farmers, but "blunders...tend to be of marginal significance" (Beals 1974:128). Such individual differences are noted by other researchers as well (Johnson 1971a; Hanks 1972; Barlett 1975)but they conclude that these variations do not affect the community's over-all agricultural strategies. Shapiro found that farmers who excel in the traditional farming methods would be most likely to try new agricultural innovations (Shapiro 1975). This past success also correlates with youth, literacy, and years of education, but none of these factors is clearly causal in predicting different responses to new opportunities.

Moerman states "Often, differences in household composition and personality so merge that it is impossible to say which is paramount" (Moerman 1968:147). Personality differences not only reflect household composition but past history, family resources, and many other factors whose impact on decision making can be measured more directly. Though the variety among farmers in intelligence and agricultural skills is recognized, it is no greater than for any other group--urban, suburban, industrial, agricultural--and therefore the other sources of variability (land, labor, etc.) among farmers have been found to be more important in understanding land use decisions.

Berry investigated the early cocoa entrepreneurs in Western Nigeria to see if 1) personal backgrounds and experiences led some farmers to try this new crop or 2) if local circumstances provided greater incentives to try cocoa production (Berry 1975). Through interviews with the descendants of the earliest cocoa producers and general historical research into the area, she found that both merchants and missionaries were advocates of cocoa. Merchants and traders established their own farms and "served as an important source for the dissemination of knowledge about cocoa farming to the rest of Western Nigeria" (Berry 1975:41).

Many Christians were also "enthusiastic advocates of agricultural innovations," preaching "the gospel of 'coffee, cocoa, cotton, and work.' " (Berry 1975:41-42). Berry notes that many of the early cocoa farmers were in fact Christians, but there was no evidence that they were marginal in their communities."...Individuals' accounts of their own (or their forebearers') conversions do not support such an interpretation. At most, they suggest that conversion to Christianity, like the decision to try a new crop, often represented a willingness to experiment with new methods of solving practical problems." (Berry 1975:48). Thus, concludes Berry, cocoa innovators cannot be identified by their religious preference nor in their personal characteristics.

Berry then looked at the availability and attractiveness of alternative economic opportunities and the incentives to try new income sources. She found no evidence that cocoa was more profitable in one area or another, nor did the availability of a good railroad seem to make any difference — cocoa developed also in the isolated areas.

Several important national-level changes did correspond with the early cocoa experiments, however. First, there was a sharp decline in the world prices for palm products. A number of African merchants in Lagos had depended on these products, and suddenly found themselves facing a critical business slump. They turned to farming and experimented with new crops including cocoa. Thus, the impetus to the new cash crop was the decline in the old one.

At the same time, Berry notes the end of the Yoruba Wars and the demobilization of warriors, both slave and free (Berry 1975:51). Some communities had been made up almost entirely of full-time warriors and peace brought both new opportunities to travel safely as well as "a large group of unoccuppied

people seeking new means of earning income"(Berry 1975:53). Other villages had participated in the wars on a more part-time basis, and these men were more easily reabsorbed into their agricultural pursuits when peace came. Berry notes, "thus... cocoa farming was apparently adopted most readily in Ibadan and Ilesha — the two principal belligerents in the Sixteen Years War" (Berry 1975:53). With this detailed study, Berry shows that entrepreneurship is not so much a personality variable between one person and another but reflects different opportunities and incentives that may affect separate individuals or whole communities.

One of the most important contributions the anthropologist can make to understanding the decision making process is to clarify the goals of the farmers' decisions:what do farmers want? Obviously, no economic actor maximizes profit exclusively, nor does the most conservative agriculturalist seek only to reduce risk. Though we know the goals of a decision may lie somewhere in between, we may not know much more than that. Dutia argues that farmers are always both subsistence and cash oriented (Dutia 1957:215) and Chayanov among many others cited above would agree. Nash (1965) argues that for the Burmese villages he studied, there were clear differences in decisions made by farmers oriented toward self-sufficiency and those oriented toward entrepreneurship. But when he specifies the catalysts to transforming the "get along farmer" to the "get going" farmer, they look very familiar: access to over 25 acres of land, good market facilities, and access to capital via moneylending and commodity speculation (Nash 1965:26). The life cycle of the farm or the age of the farmer may also be an important factor in explaining why some households seek only the bare minimum while others invest in risky ventures to maximize gain.

"The peasant is what he is not because of his attitudes, but because of forces beyond his control", concludes Ashcraft (1973:19) when describing economic development in Belize. The Bolivian revolution and subsequent land reform brought about some important changes in farmers' decisions and household goals there, too. Simmons (1974) began his research assuming farmers' fatalistic attitudes were a hindrance to an improvement in their standard of living. His book concludes that attitudes are not a significant factor, however, but rather, severe isolation and economic deprivation lead to fatalism and passivity.

We cannot expect the peasant farmer to always be able to specify and verbalize the criteria of decisions made, any more

than we ourselves, might be able to explicate our family budgets and their allocations (Ortiz 1967). Nevertheless, careful research on the decision making process in any one locale can be expected to clarify what farmers' land use decisions are, how they make them, and why. Such an understanding should take into account the general pattern in the community or in the area, but must also be aware of the significant differences between households in terms of their resources and needs, differences which will create variability in land use decisions.

Another important issue in understanding decision making is to correctly identify the decision maker(s). Western researchers operating from the male-bias of our own culture, may tend to ignore the important contributions of women into the decision making process. Many readers may forget that "the farmer" described above can also be a woman. While women's roles in agriculture are often inadvertently reduced by development programs (Boserup 1970; Tinker 1974; Wellesley Editorial Committee 1977; Boulding 1977), women continue to have important inputs into the decision making process, and sometimes are the major decision makers. Knight notes the agricultural spheres dominated by Tanzanian women, but admits he could not talk with them about their decisions (Knight 1974:129). Ruthenberg's research in Tanzania briefly mentions women's responses to innovation, but the decision maker is always referred to as "he" (Ruthenberg 1968). Women play important agricultural roles in many Southeast Asian countries and in the Andes of South America as well. Though women may sometimes run agricultural enterprises entirely on their own, there is no research on agricultural decision making that focuses on women.

IV. PRIORITIES FOR FURTHER RESEARCH

There is much left to be done in researching land use decisions. There are three aspects at which further research needs to be aimed: the topic of the research, the focus of the research, and the methodology.

Topics. We need much more detailed information on land use decision making for all areas of the world. Several regions, however, are severely under-represented: South America, especially areas of major Indian population density in the Andes and areas of more recent colonization in the Southern Cone, the Near East, and North Africa, for which there are virtually no detailed peasant land use studies in English. Though there are several good studies done in India, and Southeast Asia, the tremendous diversity of that area makes further research a necessity. There are a number of good African studies, but they are limited primarily to several English-speaking countries, and more work needs to be done in other African countries.

In areas that have been studied before, topics have sometimes been left out. The role of women was discussed briefly above as a crippling deficiency in the analysis of certain groups. Remedial research to fill this gap is crucial. We need more studies that focus on each of the topics taken up in this review:

ecological determinants
infrastructural effects (markets, prices, transportation, etc.)
land tenure and access to land
labor resources and the effect of employment alternatives family size, etc.
capital availability
risk and its effect on different sub-groups.

Each of the policy relevant questions above outlines a topic of research that may be important before an agricultural project is designed and implemented. This information is obtainable and in order to modify land uses in the Third World, agricultural development professionals will need to know the decision making structure and environment. These topics, then, should form the priorities of agricultural decision making research.

The focus of the research should be to determine the incentives and constraints on farmers, to understand their decision process, and to explore what factors seem to have priority, especially as limits to change. This last point is perhaps the challenge of the next decade of development research. The data cited here reveal a welter of limiting factors, of important influences. Which come first? How can a change agent know whether capital scarcity or labor scarcity will be more important? Whether the poorest farmers will adopt fertilizer readily or resist it stubbornly? These are not impossible questions, and already there are a number of approaches toward this kind of prediction. But we need more and better research with this focus.

Thirdly, research methodology must combine many levels of inquiry. There is no substitute for asking the farmers directly. Nor for an in-depth period of research in the peasant community. Many studies cited here have found interesting correlations between x and y but have no way of determining which causes which. As the longer-term studies show, often the statistical indications on the surface obscure some complex things going on underneath. Micro analysis, done carefully and over a period of time, will provide some of the accuracy missing from current studies.

Future research must combine a number of levels of inquiry. Farmers' discussions about what they see themselves as doing, and why, are essential. Gladwin and Ortiz are examples of researchers who have done this well. This insiders' view of the decision making process must then be linked with an outsiders view: careful measurements of what farmers do do, which farmers, and when (Johnson and Barlett). Generalizations about the over-all community patterns of land use must be clarified (as does Epstein and Hanks) and then broken down into the important groups in the community, if there are differences among households in land use decisions (see Cancian). These community-level understandings must then be linked to regional, national and international forces and changes (Cancian, Berry) in order to provide the context for the micro-level decisions being analyzed. At each stage, researchers must be concerned to measure their findings carefully, and then match their views as outsiders to the farmers' own views of the same issues.

Finally, when agricultural development projects are planned, administrators need more than a pilot feasibility study. Research can be useful not only to guide project development but also to aid projects in process and then to evaluate projects when completed.

Even the biggest disaster of a project is of value if good follow-up research indicates what went wrong, so others will not blunder down the same path.

While there is a wealth of research available, the answers to the questions: what do I plant?

how much do I plant?

how do I plant it?

remain unanswered for many peasant farmers in many parts of the world. As the pressure of growing populations focuses our attention ever more closely on food, the environment, and energy resources, these questions demand increasingly to be answered, and answered with care, sophistication, and commitment.

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General review of social structural factors. Economics considered primary. demonstrating that peasants are rational.

Freidrich, Karl-Heinz
1968 Coffee-Banana Holdings at Bukoba: the Reasons for Stagnation at a Higher Level. In Smallholder Farming and Smallholder Development in Tanzania. Hans Ruthenberg, ed. p. 175-212. Munchen: Weltforum Verlag.

Ecological description of stable banana and coffee agriculture with data presented on returns to land, time and allocations of same. The stability of the new cash cropping regime is seen as "stagnation."

Geetz, Clifford
1963 Agricultural Involution. Berkeley and Los Angeles: University of California Press.

Classic work on Javanese agriculture, contrasting the intensive irrigation rice production with the extensive swidden agriculture. Historical and economic perspectives linked with Rostow's theory of stages of growth.

Gladwin, Christina H.
1976 A View of the Plan Puebla: An Application of Hierarchical Decision Models. American Journal of Agricultural Economics. Dec:881-887.

Constructs a ladder decision tree for three agricultural recommendations, which can predict over 80% of farmers' behavior. Farmers perceptions of risk, etc., and knowledge of technology and credit are seen as important. but structural determinants of their behavior are not included.

Gleave, M. B. and H. P. White
1969 Population Density and Agricultural Systems in West Africa. In Environment and Land Use in Africa. M. F. Thomas and G. W. Whittington, eds. p. 273-300. London: Methuen.

Uses an evolutionary approach to human/land adaptations, with an approach similar to Boserups which sees population pressure as causal. Land uses which conserve or deplete fertility are contrasted as productivity per land unit becomes more important.

Gould, Peter R.
1963 Man Against His Environment: A Game Theoretic Framework. In Environment and Cultural Behavior. Andrew P. Vayda, p. 234-251. Garden City, New York: Natural History Press.

Shows desirable crop mixes in wet and dry years, demonstrating the possible value of game theory in understanding land use in Ghana.

Greenwood, Davydd
1974 Political Economy and Adaptive Processes: A Framework for the Study of Peasant States. Peasant Studies Newsletter. 3(3):1-10.

Discusses two themes in peasant economics: one de-emphasizes peasant maximization and examines constraints of non-economic factors. The other stresses the ability to maximize within the non-economic constraints. Also deals with the nature of peasantry, seeing the peasant state as an adaptive mechanism.

Greenwood, Davydd J.
1976 Unrewarding Wealth: the Commercialization and Collapse of Agriculture in a Spanish Basque Town. Cambridge University Press.

Economic anthropological theories are synthesized in an approach which combines macro-level community and regional influences on Basque agriculture with measurements of production and marketing on the family level. Explores the variety of responses to the new economic opportunities and illustrates the power of governmental and economic forces in changing the profitability and desirability of traditional land use options.

Gross, Daniel R. and Barbara A. Underwood
1971 Technological Change and Caloric Costs: Sisal Agriculture in Northeastern Brazil. American Anthropologist. 73:3 June.

The advent of sisal production in Northeast Brazil is shown to have severe effects on the nutritional status of children.

Halperin, Rhoda
1977 Redistribution in Chan Kom: A Case for Mexican Political Economy. In Peasant Livelihood. Rhoda Halperin and James Dow, eds. p. 79-85. New York: St. Martins.

Several important families in Chan Kom serve as redistributive centers, monopolizing certain resources and controlling political compliance of others through allocation of ejido lands and residence rights. Build-up of cattle latifundia at the loss of agricultural smallholdings is traced to the redistributive advantages of three families.

Halperin, Rhoda and James Dow, eds.
1977 Peasant Livelihood: Studies in Economic Anthropology and Cultural Ecology. New York: St. Martin's Press.

Theoretical underpinnings of the substantivist approach in economic anthropology are linked to a series of excellent studies on production and distribution.

Hanks, Lucien M.
1972 Rice and Man. Chicago, Aldine.

Combines the general study of rice culture with the specific case history of one Thai village. Shows that increasing population density leads to increasingly intense use of the land, with declining returns to labor (supports Boserup). Uses an ecological and evolutionary framework but sees Bang Chan's adaptation on a local level linked to national and international forces of change.

Harris, Alfred
1972 Some Aspects of Agriculture in Taita. In Population Growth: Anthropological Limitations. Brian Spooner, ed. p. 180-189. Cambridge, Massachusetts: MIT Press.

Agriculture in this area of Kenya would be called "simple" by Boserup, but involves complex use of different micro-environments, many crop choices and selective breeding of crop species. Agriculture cannot be understood separate from the social context which determines who gets land, how it is transferred, and what crops are grown.

Haswell, Margaret
1973 Tropical Farming Economics. London: Longman.

Looks at the tropical regions of the world and notes the low agricultural productivity and low labor utilization. Discusses the low population density, poor transportation, political instability, the low marginal returns to factors, the pattern of farmer debt to merchants in small towns, disease and poor diet, and the investment of agricultural "surplus" in luxury consumption rather than in an increased agricultural productivity as the causes. No clear solutions. Accepts Boserup and the evolutionary perspective and sees farmers as rational but also assumes increased consumption and productivity are always desirable.

Hill, Polly
1970 Migrant Cocoa Farmers in Southern Ghana. Cambridge University Press.

Economic history of migrant cocoa farmers in Southern Ghana. Two forms of economic organization emerged as landowning units: the "company" system, based on patrilineal ties and evolving into strip farms, and the family land system, based on matrilineal ties and a mosaic cultivation pattern. Individual family units shown to be strongly economic in their agricultural behavior, though linked with these kin groups as they established cocoa plantations and reinvested the proceeds in more land.

Hopper, David W.
1965 Allocation Efficiency in Traditional Indian Agriculture. Journal of Farm Economics. 47:611-624.

Data from 1954. Tested allocation efficiency of land, labor, bullock-time (power) and irrigation water to see if, given the same market conditions, peasants could maximize profit through a different allocation. Found close correspondence of ideal allocation and actual farming practices using a Cobb-Douglas function. "The farmers, on the average, appear to have successfully 'economized' their scarce resources."

Johnson, Allen
1971a Sharecroppers of the Sertao. Stanford University Press.

Sharecroppers in Brazil's northeast categorize lands into types and then plant accordingly. Crop mixes are also strongly affected by attempts to spread risk. Documents considerable variation in land use among households.

Johnson, Allan
1971b Security and Risk-Taking Among Poor Peasants. In Studies in Economic Anthropology. George Dalton, ed. p. 144-151. AAA, Anthropological Studies #7.

Sees agricultural behavior as the result of adaptive strategies for coping with the natural and social environment. Farmers may be acting in the short run in a way which does not maximize income. However, he shows for northeast Brazil that they are maximizing security in the face of risk. Stresses the internal variation within the peasant community.

Keleny, G. P.
1963 Social Organization and land use pattern. Papua and New Guinea Agricultural Journal. 16(1):65-8.

Human society modifies its environment especially with grasslands in the tropics. Terra's studies showed patrilineal people in Indonesia have cattle and matrilineal people have mixed hoe farming (slash and burn agriculture, problems with grass invaders). Hence the social organization acts on the environment and the form of land use is not absolutely determined by the environmental factors.

Knight, C. Gregory
1974 Ecology and Change. New York: Academic Press.

Analysis of Mbosi area of Tanzania and its agricultural history and current ecological adaptations. Supports Boserup, gives production and input figures, and explores causes of agricultural change: demographics, European land alienation, new crops, transportation and communication, government programs, taxation, and migration. Conclusions suggest how to speed agricultural modernization but all within a framework of respect for farmers' resistance and for past adaptations.

Leach, E. R.
1961 Pul Eliya: A Village in Ceylon. London: Cambridge University Press.

Analyzes land rights and inheritance with respect to kinship (patrilineage) systems, criticizing Radcliffe-Brown as putting rules and ideal forms first when ecology and economics are often more important determinants. The paddy fields are resources that must be organized in a certain way to maximize agricultural productivity.

McHenry, Dean E. Jr.
1973 "The Utility of Compulsion in the Implementation of Agricultural Policies: A Case Study from Tanzania." Canadian Journal of African Studies. 7(2):305-316.

Explores farmer reactions to the Tanzanian government's compulsory cotton production. Notes the importance of profitability, labor scarcity, and alternative employment opportunities in explaining the variations in the area with respect to cotton production.

Miracle, Marvin P.
1968 Subsistence Agriculture : Analytical Problems and Alternative Concepts. American Journal of Agricultural Economics. 50:292-310.

Shows how "subsistence" farmers are a varied lot and the concept clearly useless. Shows how certain levels of risk, resources, etc., will affect decisions. Proposes a list of seven variables on which to classify small farmers with the goal of seeing which will be more responsive to change and growth.

Mitchell, William P.
1977 Irrigation Farming in the Andes: Evolutionary Inplications. In Peasant Livelihood. Rhoda Halperin and James Dow, eds. p. 36-59. New York: St. Martins.

Discusses the ecological adaptations of high-altitude irrigation and shows how the irrigation system channels scarce water into different areas at different times to maximize overall productivity. Also discusses community differentiation of who gets water and who doesn't, the institutions that control the irrigation system, and their relations to theories of irrigation as causal in the

development of the state. His research suggests that irrigation systems in the Andes are too small and localized to require inter-community organization (contrary to Wittfogel and Steward theories).

Moerman, Michael
1968 Agricultural Change and Peasant Choice in a Thai Village. Berkeley: University of California Press.

Detailed anthropological account of how wet rice is grown and its social implications. Covers different techniques of rice farming in one community, including allocations of land, labor and capital. Analyzes the decisions to plant distant or near fields and to use plow or tractor combining both the farmers' views of these decisions and the "external viewpoint" of costs and returns.

Mwamufiya, Mbuki and James B. Fitch
N.D. Labor Use Patterns for the Production of Maize in Southern Zaire. Mexico City: CIMMYT.

Availability of family labor seem to be an important factor in amount of land planted, and planted to corn, but access to land also seen as possibly a key variable.

Nair, Kusum
1961 Blossoms in the Dust: The Human Factor in Indian Development. London: Gerald Duckworth and Company, Ltd.

Explores the cultural traditions and attitudes in many areas of India, noting customs that seem to work for and against "progress". Often, the behaviors recorded are accurate but the reasons are not adequately pursued.

Netting, Robert McC.
1968 Hill Farmers of Nigeria. Seattle: University of Washington Press.

The Kofyar intensive agricultural practices show land use well adapted to supporting a high population density. Farmers practice ridging, terracing, manuring, composting, crop rotation, and fallowing to maintain stable productivity.

Netting, Robert McC.
1974 Agrarian Ecology. Annual Review of Anthropology. 3:21-56.

Review of anthropological research into agricultural systems -- historial and theoretical trends, relations between ecosystems and social factors, and agricultural intensification. Thorough bibliography.

Norman, David W.
1971 Initiating Change in Traditional Agriculture. Agricultural Economics Bulletin for Africa. 13(June):31-52.

General discussion of agricultural development policy stressing intercropping, risk, scarce resources of labor and capital. Linear programming shows little gain possible from the reallocation of factors or from the adoption of current technological recommendations. Income gains can come from a rise in cash crop prices and from the addition of more labor.

Norman, David W.
1974 Rationalizing Mixed Cropping under Indigenous Conditions: The Example of Northern Nigeria. Journal of Development Studies. 11(1):3-21.

Contributes to the scarce research on mixed cropping by showing that there are valid reasons for farmers' reluctance to change to a sole cropping system. Mixed cropping is found to be more profitable, less risk, and spreads the work load. Reviews of literature on other reasons for mixed cropping.

Ortiz, Sutti
1967 The Structure of Decision Making among Indians of Colombia. In Themes in Economic Anthropology. Raymond Firth, ed. p. 191-228. ASA Monograph #6.

Summarizes the important land and labor constraints on agricultural decisions, showing how the conditions of the Paez Indian reservation in Colombia affect decisions on both subsistence and cash crops.

Ortiz, Sutti R. de
1973 Uncertainties in Peasant Farming: A Colombian Case. New York: Humanities Press.

A complex social environment of uncertainties and constraints is carefully discussed to show the structure of Paez Indian decisions in many aspects of the farm enterprise. Life cycle demands, scarcity of labor and the exchange of foodstuffs limits the farmer's allocations of land in coffee production and limits his marketing options as well.

Ortiz, Sutti
1976 The Effect of Risk Aversion Strategies on Subsistence and Cash Crop Decisions. Conference on Uncertainty and Agricultural Development. Agricultural Development Council. Mexico.

Analyzes additional data from Colombia in relation to Shackle's theories of focus loss and focus gain. Community members vary widely in the decisions acceptable to them and there are important variations by crop as well.

Parsons, James J.
1976 Forest to Pasture: Development or Destruction? Revista de Biologia Tropical. 24(supl. 1):121-138.

The spread of pasture throughout Central America in recent years has had a number of economic and ecological effects and its long-term effects are unknown.

Porter, Phillip W.
1965 Environmental Potentials and Economic Opportunities -- A Background for Cultural Adaptation. American Anthropologists 67:409-420.

Excellent geographical description of Kenya, showing how agricultural and livestock land use varies by altitude, incidence of diseases, and rainfall (using a calculation of risk factors). Indicates the role of population density.

Prothero, R. M.
1972 People and Land in Africa South of the Sahara. New York: Oxford University Press.

Collection of 23 articles, mostly from the early 1960's. Increasing population pressure is shortening fallow periods and upsetting stable swidden systems in many areas of Africa. Population pressure linked to the resistence or adoption of agricultural intensification in a number of the articles.

Rubin, Julius
1973 Notes on the Comparative Study of the Agriculture of World Regions. Peasant Studies Newsletter. II(4):1-4.

Criticizes Boserup's reliance on the people/land ratio as the major determinant of land use and agricultural systems. In a brief discussion of China, the United States and Russia, recent research shows climatic, technological and market factors play an important role in determining if transformation to more intensive and technological agriculture is possible. Suggests theory of agricultural development should be based on climatic-cultural regions.

Ruthenberg, Hans, ed.
1968 Smallholder Farming and Smallholder Development in Tanzania. Munchen: Weltforum Verlag.

Collection of ten case studies from German agricultural economics school. Provides detailed quantitative data on agricultural

practices with varying quality of analysis of causes for those practices. Perspective is developmental with Western agricultural technology and methods seen as "proper" but data fit into several current theories of population pressure, external constraints on agriculture, and peasant decision making. Excellent source book.

Schluter, Michael G. G. and Timothy D. Mount
1976 Some Management Objectives of the Peasant Farmer: An Analysis of Risk Aversion in the Choice of Cropping Pattern, Surat District, India. Journal of Development Studies. 12(3):246-261.

Excellent decision making and land use study which shows how concerns to maximize income and reduce risk will lead to specific crop choices. Limiting factors on agricultural decisions change as the form of agriculture changes (from non-irrigated to irrigated). Policy implications specified.

Schultz, Theodore W.
1964 Transforming Traditional Agriculture. New Haven: Yale University Press.

Challenges traditional economic theory of peasant farming with several in-depth examples and a new approach to developing agriculture. One of the earliest works to propose that peasant farming is "poor but efficient" and that labor productivity is far above zero in developing countries.

Shapiro, Kenneth H.
1975 Measuring Modernization Among Tanzanian Farmers: A New Methodology and an Illustration. In Formal Methods in Economic Anthropology. Stuart Plattner, ed. p. 128-148. American Anthropological Association Special Publication. No. 4.

Using factor analysis Guttman scaling and interview data on a range of knowledge and behavior related to "modernization," Shapiro finds that youthfulness, literacy and education are all strongly correlated with modernization, wealth less clearly related than would be expected, but success in traditional farming is closely related to the adoption of modern traits.

Singh, J. P.
1975 Resource Use, Farm Size, and Returns to Scale in a Backward Agriculture. Indian Journal of Agricultural Economics. 30(2):32-46.

Re-does Hopper, et al, to see if factor allocations are efficient, using data from the 1960's. Clear discussion of Cobb-Douglas production function and results. Finds that Uttar Pradesh's "very backward" farms are efficient and that land is the most

important factor of production (returns to land are mazimized by decision makers). Notes the poor quality of the factors of production and suggests modern inputs and improved technology will increase output. Notes that small farmers use labor more intensively, and that the marginal returns to labor are higher on large farms, but finds no statistically significant differences between large and small farmers.

Smith, Carol A.
1975 Production in Western Guatemala: A test of Von Thunen and Boserup. In Formal Methods in Economic Anthropology. Stuart Plattner, ed. p. 5-37. AAA Special Publication, No. 4.

The intensity of agrarian production in Western Guatemala is not solely a function of population density nor of distance to the market center but rather requires the interaction of the two. Marketing networks access to marketing centers and population density combine to predict whether townships will produce intensively or for subsistence, export labor, or produce simple or specialized crafts. Purchasing power is concentrated in a central area thereby structuring the market options for areas near and distant.

Sofranko, A. J., F. B. Fliegl, and W. R. Pletcher
1976 Agricultural Modernization Strategies among Ghanian Farmers. Journal of Modern African Studies. 14(4):706-712.

Farmers who have planted tobacco under the careful watch of "assistants" from the Ghanian Tobacco Company did carry over their sophistication to their other crops (used fertilizer, insecticide, tractors and the extension service more for cash crops but not for "personal consumption crops.") No change was found, however, in farmers' attitudes toward farming as the result of this contact with the tobacco company.

Takahashi, Akira
1970 Land and Peasants in Central Luzon. Honolulu: East-West Center Press.

Good analysis of Philippine rice cultivation showing the importance of land tenure customs in determining the quality of agricultural production. Both historical and contemporary perspectives in discussing local level effects of national forces on land ownership and control. Good analysis of why peasants do seemingly "irrational" "lazy" things.

Tax, Sol
1953 Penny Capitalism: A Guatemalan Indian Economy. Washington: Smithsonian Institution.

Classic description of an Indian village economy in Guatemala based on careful measurements of production and consumption. Some land use decisions specified. Overall the economy is based on a "strongly developed market which tends to be perfectly competitive."

Von Rotenhan, Dietrich
1968 Cotton Farming in Sukumaland: Cash Cropping and its Implications. In Smallholder Farming and Smallholder Development in Tanzania. Hans Ruthenberg, ed. p. 51-86. Munchen: Weltforum Verlag.

Area of rapid rising cotton production. Useful discussion of land uses and corresponding soil types. Intensified agricultural methods fit high population density. Interesting discussion of family income and labor resources which vary directly until labor becomes scarce. Population pressure pushes cotton land toward foodcrops.

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. p. 152-179. Washington, DC: American Anthropological Association. Anthropological Studies #7.

Adoption of innovations is often resisted because the range of possible outcomes possibly falls below the family's subsistence minimum. New crops or methods are often seen by the farmer to have a wider range of risk than traditional methods. Though farmers are maximizing their income, it is within the context of this risk constraint.

Wiens, Thomas B.
1976 Peasant risk aversion and allocative behavior: a quadratic programming experiment. American Journal of Agricultural Economics. 58(4):629-635.

Uses data from the 1930's in China to show that farmers do indeed avoid risk, but the larger the farm, the closer to the "optimal" crop mix allocation.

Wilkinson, Richard G.
1973 Poverty and Progress: An Ecological Perspective on Economic Development. New York: Praeger.

Synthesizes the latest anthropological data on cultural evolution with the ecological perspective and applies both to the study of economic development. Developmental change is seen as an adaptive response to ecological, technological, and social problems caused by a disequilibrium between human populations and their environments.

Winkelmann, Donald
1976 The Adoption of New Maize Technology in Plan Puebla, Mexico. Mexico City: CIMMYT.

Demonstrates that fertilizer use has spread considerably, though less than half of it through governmental credit programs. Adoption of fertilizer recommendations and plant density recommendations varies by agricultural zone, and the author shows that profits and productivity for each level of recommended technology in each zone can accurately explain the differences in adoption. Risk aversion and the opportunity cost of labor cannot be demonstrated to be important factors.

Wolf, Eric R.
1956 San Jose: Subcultures of a "Traditional" Coffee Municipality. In The People of Puerto Rico. Julian H. Steward, ed. Urbana, Illinois: University of Illinois Press.

Land use related to local environmental variations, local, national and international market forces, and availability of capital and credit. External forces seen as primary in explaining shifts from subsistence crops to coffee and the current decline of coffee.