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LANDUSE IN HUMID TROPICAL HILLSIDES MIGRANT FARMERS IN THE ATLANTIC LITTORAL AREA OF NORTHERN HONDURAS

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August, 1994

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INTRODUCTION

Deforestation in Central America is continuing - particularly in the poorest countries of the region, Guatemala, Honduras and Nicaragua (Kaimowitz, 1994) Since the mid-60s, the amount of forest cover has been reduced from 60% to one-third (Utting 1991 1) and in the seventies alone, 15% of the region's forests disappeared (Leonard, 1987 119) The continuance of this process - albeit it at a reduced rate over the past decade as the amount of unprotected forest in some countries has all but vanished (Kaimowitz, 1994) - is cause for considerable concern Unless measures are taken, the well-known image provided by Haiti, a country which has been stripped of its forest cover, will soon apply to the other empoverished countries of the region, indeed El Salvador with less than 12% of its territory remaining in forest - most of it severely degraded (Utting, 1990 1), is close to approaching this level

This study will look at the process of migration, deforestation and land use in an area of Honduras currently undergoing the all-too-familiar scenario of forest-to-pasture conversion While it is impossible to generalize from a study in one area to the region as a whole, there are undoubtedly important similarities between processes occurring in the watersheds under study and those in other areas, with similar biophysical characteristics, in the region's poorest countries This study is intended to illuminate some of these processes

BACKGROUND

Poverty is the main driving force behind deforestation in Honduras, although the the search for valuable hard woods, generally starts the deforestation-ball rolling More generally, however poor farmers and landless peasants seeking an existence away from the marginal conditions of their origin communities, are pulled towards the forests in the hope of staking out their own property and achieving an improvement in their families' standard of living Unfortunately, living standards are generally very low in the forest zones and the effect on the environment is almost always negative Unable to shake off their former poverty, the migrants may find themselves forced to sell the land which they have improved , hence, the ranchers' keen interest in the migrants' activities because they provide them with a ready source of grazing land And so goes the now familiar story of forest-to-pasture conversion in Central America

Honduras is one of the poorest countries of the region with one of the highest birth rates For 1993, the population was estimated to be 5 2 million, up from less than 3 million in 1974, representing a 3 65% annual increase (SECPLAN, 1989 40)[1] While

[1]According to the Plan de Accion Amiental (1993), SECPLAN has revised the outcome of the 1988 census and now puts the population increase at only 2 8% between 1974-88 Other calculations (Walker et al 1992) derived from the 1988 census in conjunction with statistics from the Banco Central de Honduras (1991) and Hernandez

birth rates have declined in the urban areas in recent years, in the countryside the fertility rate is still around 7 children per woman (SEDA, 1993 14) Migration into the forests is overwhelmingly a response to rural poverty and reflects the lack of alternative opportunities available to these rural families And in Honduras approximately 60% of the population is rural (SECPLAN, 1989 42)

Poverty in the countryside derives in large part from inequality in access to land, combined with inappropriate land use The vast majority of the land in Honduras (approximately 80% [SECPLAN, 1989 135]) is designated as being appropriate for forestry use only This is land that is generally too steep for farming (75% of the land has a slope of greater than 30% [SEDA, 1993 44]) with poor soils Only 25%, or 2 8 million hectares is classified as agricultural land Nevertheless, almost 4 million hectares are actually farmed This difference of 1 2 million hectares, almost 30% of the total is largely made up by the appropriation of steep hillsides, classified as having a forestry, rather than a farming vocation (SEDA, 1993 45) Inappropriate usage of land is associated with the fact that 90% of the land designated as agricultural is in the hands of 10% of the producers, hence, 90% of farmers must share what is left, or, as is increasingly the case, use non-agricultural land (SECPLAN, 1989 140) Moreover, cattle raising accounts for an estimated 80% (3 2 million has) of all lands being farmed (SECPLAN, 1989 114) - and given the unequal nature of agricultural land distribution, undoubtedly takes in a good portion of that designated as arable as well In other words, faced with this situation thousands of poor rural families have little option but to migrate to hillside areas which are not well suited to agriculture

While rural-urban migration accounts for the lion's share of internal migration evident in the high rate of growth of the urban population - 5% growth compared with 2 8% for the rural population between 1974-1988 (SECPLAN, 1989 40) - nevertheless it is rural-rural migration that accounts for the tremendous increase in communities which has occurred Between 1961 and 1988, 1426 new villages (**aldeas**) with more than 100 inhabitants were created as well as 15,268 new of hamlets (**caserios**) with less than 100 inhabitants (SECPLAN, 1989 41) These new settlements include land reform communities which were developed mainly in frontier lands in the north and eastern parts of the country, and spontaneous settlements formed by migrants in forests and other uninhabitated zones

DEFORESTATION AND LAND USE IN THE LITTORAL ATLANTIC OF HONDURAS

The literature on deforestation in Central America generally has the peasant farmer cast in the role of a perpetual nomad Landless farmers are held to descend on the forest, cultivate an area for two or three years by means of slash and burn

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Cruz (1992) project that population will decline in the 1988-2000 period, leading to a 2 75% yearly rate of increase, nevertheless, in this study the figure for the 1974-88 period remains unchanged at 3 65% annually (Walker et al, 1992 11)

agriculture, and, once the soil is exhausted, sell it to a rancher for pasture land (See for example Parsons 1976, Leonard, 1987, PDBL, 1990) This is usually referred to as migratory agriculture Our study which was carried out in two partially forested upland catchment areas in Atlantida, in the River Cuero and River Santiago watersheds in the northern coastal region of Honduras, shows this is not always the case It remains to be seen if this is more widespread Hillside farmers in these two watersheds in fact practice a form of rotation agriculture, cultivating an area for one cycle only before leaving the land to return to fallow for an average of three years depending on the crop to be planted and the season And more recently, farmers have begun using improved fallowing, employing green manure, which reduces the fallow period to one year between plantings and raises yields considerably In this way, farmers have remained rather stable on their lots, and in some of the oldest known cases in the watersheds, up to three generations of farmers have farmed the land This suggests perhaps that soil quality is higher in this case than generally found in areas of tropical forest

Nevertheless, cattle production is spreading into the watersheds under study and the forest frontier is constantly under pressure Thus on the surface, farmer activities in the two watersheds would seem to duplicate what has been observed elswhere However, the reasons are different and, as a consequence, the solutions required, also different Farmers in the watersheds sell their land to cattle ranchers quite simply because they are very poor and ranchers have the wherewithall to buy the better (flatter) land, which carries a higher price, for cattle pasture This is not synonymous with the fact that the land is necessarily exhausted, indeed since the flatter land is generally better quality land, it is likely to be much less eroded than the steeper hillsides However, the people farming the land are extremely poor, there is no denying this Thus any short-term crisis, such as a crop loss resulting from the uncertainties of farming in the tropics, or an illness associated with the high incidence of morbidity in the area, tends to prompt a land sale as a way of satisfying the need for quick cash Farmers displaced from their land in this way, will likely try to deforest higher up in the watershed However, by far the greatest amount of deforestation has been generated, and is still being generated, by the arrival of new migrants, and the very large numbers of children coming from earlier settler families who cannot be accommodated on the single family plot

Seen in this way, slowing deforestation and the spread of cattle ranching will not be solved by finding a solution to migratory agriculture rooting the producer in his lot is not the fundamental problem at least not in the short term Increasing farmer income through higher value crops and higher yields, as well as improving health services can help to reduce the risk of short term crises and provide a cushion against losses and this will in turn help to slow land sales to cattle producers Agricultural intensification will also help to absorb the increase in the number of individuals expected to live from the plot as family size grows However, the attempt to increase productivity and/or the agricultural value of production must be combined with a policy

to reduce migration into the area through socio-economic improvements in origin communities, and through the development of alternative outlets for migrants in industry At the same time, family planning services must be made available to drastically reduce the rate of population growth It is simply not possible to talk about sustainable land use when the average number of births per women reaching the end of their child-bearing years is 9 9, as it is in the study region Finally these measures need to be combined with policing of the forest zones in conjunction with a program of sustainable forestry management so that local communities may reap benefits from forest resources

Destruction caused by deforestation is of course not restricted to the locale where trees are actually being removed Downstream watershed populations are severely threatened and inconvenienced by upsteam agricultural activities Severe flooding in October 1993 in the Atlantic littoral area of Honduras caused by torrential rains in combination with inappropriate landuse in the hillsides killed several hundred people and caused hundreds of thousands of dollars-worth of damage to down-stream property And water shortages during the dry season are another problem which is becoming increasingly evident as landuses change Thus on broader socio-economic and environmental grounds, independent of the need to improve the welfare of hillside farmers themselves, there is good reason to intervene to improve hillside land management

RECOMMENDATIONS

The Atlantic littoral of Northern Honduras represents one of the remaining areas of broadleaf forest in the region A large bilateral project between Honduras and Canada aimed at improving community forests has been operating in 10 'integrated management areas' (AMIs) for the past six years and while its future is uncertain at the time of writing, it is widely expected to continue for a second phase, albeit in a different form with more local institutional involvement than at present This will likely include organizations such as FHIA, CURLA, local NGOs and municipalities CIAT s involvement in research in the area will help to strengthen the next phase of the project

The joint Canadian/Honduran project, Proyecto de Desarrollo de Bosque Latifoliado (PDBL), has focused on improving community forestry and more recently, agroforestry In the latter regard, it has concentrated on the development of a germplasm bank for tree species, which is the source of materials used in the extension effort in the communities The proportion of project time devoted to agriculture has been limited and has involved no agricultural research Nevertheless, nearly all farmers in the project area produce for their own subsistence needs mainly maize and beans, and most produce these grains for sale in the marketplace as well In fact grains production is the area least affected by the bilateral project and most widely practised farming activity It should be noted that the majority of farmers migrating into the region are from the Western departments of Honduras, principally Ocotepeque, Lempira, Copan

and Santa Barbara This is an area dominated by the Maya tradition of maize and beans production Migrants are unlikely to abandon several thousand-year old cultural practices notwithstanding the new environment in the foreseeable future dT reason for limited project action in the area of grains is that the land in the study area is mostly too steeply-sloped to be considered suitable for annual crops (i e it is largely above 30% slope) Thus, the Canadian-Honduran forestry project has tried to convert farmers to agroforestry in the expectation that over time this will lower the incidence of annual cropping While it is still too early to predict outcomes, farmers inside the project continue to be heavily involved in the production of basic grains, both for domestic consumption and for sale, and according to information collected regarding future plans, are likely to continue to derive their livelihood from grains production for many years to come Thus it is recommended that landuse improvements begin with innovations in annual cropping (especially in maize and beans) This recommendation is similar to that made by Glasson in her study in the Cangrejal watershed for the PDBL (PDBL, 1990) Poor farmers will not abandon the production of subsistence crops in favour of higher value tree crops, which involve cash transactions in an uncertain market place, because of the risks to survival that the latter strategy necessarily implies Thus, despite the difficulties of making annual cropping sustainable on steep hillsides, research has to be focused on trying to attain improvements in this area as a transitionary step towards a more desirable long-term agroforestry program It is believed that only by lowering the level of risk in annual cropping will farmers be prepared to reduce the area sown in these crops and invest labour and land in agroforestry systems - if these can be shown to provide for longterm household security [2]

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[2]This may pose something of an dilemma for an international agricultural centre such as CIAT whose goal is that of sustainable agriculture since achieving sustainability with basic grains under these conditions may not be entirely feasible However, if basic grains improvement is seen as a transitional phase towards agroforestry, rather than a stand-alone goal, it should be acceptable CIAT is not promoting basic grains on forestry lands, it is simply accepting the fact that thousands of poor farmers are producing grains under these conditions and trying to do something to improve productivity Ignoring the problem will not make it disappear The situation and the debate that it raises is not dissimilar to that which surrounds providing clean needles to drug users or putting condoms in high schools to prevent the spread of AIDS The latter does not seek to condone teenage sex nor the former, drug abuse, but rather both recognize the realities of the world at the present time and seek to prevent the spread of a mortal disease Working with grain producers on hillsides designated for forestry use is not to condone this landuse but to seek a means to diversify in the direction of agroforestry Nevertheless it is recognized that such a project is bound to be controversial

Our study indicates that some of the worst environmental effects caused by basic grains production almost undoubtedly come from the cultivation of beans Maize is somewhat less problematic because it is widely integrated into a green manuring system using velvet bean (Mucuna deeringianum) during the principal production cycle This occurs when rainfall is at its lightest and therefore soil loss is minimized Beans by contrast are produced primarily at the onset of the rainy season and are not cultivated in concert with any system of groundcover during this cycle Indeed farmers routinely burn all vegetation prior to planting Moreover because producing beans in regions of high heat and humidity tends to provoke disease, especially Web Blight (Thanatephorus cucumeris), farmers seek to plant beans on the steepest slopes and at the highest points to maximize insolation and rapid rainwater run-off and thereby to minimize humidity Burning is also believed to the lower humidity associated with rotting plant matter Needless to say, soil and nutrient loss associated with beans cultivation is extremely heavy It is hard to visualize a sustainable system for beans production under these conditions Farmers will almost certainly reject live barriers because they go against the logic of encouraging rapid rainwater run-off

At the present time Zamorano, CURLA and the Secretaria de Recursos Naturales, with support from local CIAT staff, are involved in testing new varieties for tolerance to high heat and resistence to Web Blight in the experimental station at CURLA Farmer teams involved in participatory research have been organized by CIAT and they are also actively involved in the search for better-adapted bean germplasm currently using materials supplied by Zamorano through its RELAF (Red de Ensayos de Linea Avanzados de Frijol) project It is hoped that varieties more tolerant of heat will allow producers to cultivate more widely in the drier season, as they now do with maize, which would thereby reduce the importance of the rainy season cycle During the drier season, beans are frequently produced under mulch (the 'tapado' system) to conserve soil moisture and, therefore, erosion effects are minimized However, at present, low yields associated with poor tolerance to heat, tends to reduce production of beans at this time of the year

The maize and beans harvest in April/May is important because it is one of the only geographical areas in the country where these crops are available at this time of the year An improvement in bean cultivation in the zone therefore has the potential to boost national production while virtually guaranteeing the producer a good price for his product The importance of the maize/Mucuna system to the area is precisely that it has been able to boost production of maize at a time of high national prices generated by scarcities in the marketplace We need to find a comparable system to improve beans production during this same season of the year

If annual cropping/mulching systems are to be improved, however, this must be done in concert with trees Land slides in the areas where Mucuna is planted are widespread and farmers recognize the seriousness of the problem Gliricia sepium is widely used as live fencing in the area and, because it is deep- rooting, could be

adopted to maintain soil on the slopes Other species might also be employed Research could be directed at combining trees with annual cropping/mulching systems Finally, CIAT would need to work closely with other institutions in the following areas

PDBL and CATIE in the areas of agroforestry, FHIA is working with PDBL in certain areas of agroforestry - eg cacao and the incorporation of high value tree and other crops (viz black pepper, laurel)

Secretaria de Recursos Naturales, Zamorano and CURLA in the area of germplasm improvement, particularly beans

Secretaria de Recursos Naturales concerning the establishment of a collection of multipurpose legumes

CIMMYT and researchers from U S universities working in the area of Mucuna and other green manure systems

SITE SELECTION

CIAT's decision to locate research in the Atlantic littoral hillsides of Honduras was the outcome of a meeting in August 1992 of the Central American Hillsides Consortium comprising CIAT, CATIE, IICA and CIMMYT The rationale for including this area in the research resides in the serious problem presented by forest to pasture conversion in Central America and the human migration stream from western areas to lower-lying eastern areas of the region which is a central component of the landuse conversion process It was planned to have research focussed both in areas of expulsion and attraction in order to grasp, and to try to arrest, this destructive dynamic which is integral to understanding the problem of Central American rural development and conservation at the present time (Leonard, 1987, Nations, 1992, Parsons, 1976, Utting, 1991) The Atlantic littoral hillsides represent an area of attraction which is currently undergoing active deforestation

Institutional presence at the study sites was also deemed an essential criterion in the site selection process In the case of the Atlantic littoral hillsides, the presence of the COHDEFOR/CIDA bilateral project was considered a positive factor in the provision of project support The Proyecto de Desarrollo de Bosque Latifoliado, as this bilateral project is called, is distributed in 10 AMIs, or integrated management areas along the length of the Atlantic littoral hillsides and has personnel resident in each area Since the project is primarily concerned with forestry management and, more recently, agroforestry management, a space for collaboratory agricultural, as well as agroforestry, research was clearly provided One of the sites selected, Rio Cuero, is an AMI, the other, Rio Santiago, is not, although the Santiaguito Woodcutter's Cooperative which is a chapter of the larger Atlantic littoral woodcutters' cooperative COATLAHL provides some local organization The community, however, receives no agricultural support

Another criterion used by CIAT in the selection of sites was that a range of rainfall zones be included In this case, the Atlantic littoral hillsides with average rainfall between 2,000-3,300 mm per year represents a heavy rainfall regime

Nevertheless, rainfall is distributed in a bimodal pattern with a fairly distinctive dry season between February and May which generally accords with the range of precipitation regimes set by CIAT for inclusion in its definition of well-watered hillsides (Carter, 1991)

CIAT also included moderately acid soils amongst its criteria for site selection While the Atlantic littoral is assumed to have low pH soils (see PDBL, 1991 11), samples taken in the two watersheds of the study area are generally not very acid The lowest value pH obtained in a plot worked (with fallowing) for 40 years, was 5 2, the highest value, 7 3, was found on a plot which had been used for 14 years and recently planted with Mucuna cover crop The large amounts of calcium contained in the organic matter are believed to provide the explanation for the much lower than expected acidity Nevertheless, long term use would clearly lower organic matter content and hence, the pH of the soils

Finally, relatively easy accessibility was another criterion for selection The reality of frontier zones is that they are not generally easily accessible Nevertheless, sites within an hour's drive from La Ceiba with access routes were chosen In the case of the Rio Cuero site, the 8 km-road to the first community El Recreo, is generally accessible year-round - although the torrential Fall rains may wash out parts from time to time The municipality is also in the process of extending this road to the community of San Marcos, another 6kms into the watershed Despite the difficulties involved in constructing this road, which may prove insuperable, the possibility of road access has helped fuel in-migration The community of Santiago Arriba in the Rio Santiago watershed is accessible year-round, lying as it does a few kilometers from the main La Ceiba-San Pedro Sula highway, at an elevation of less than 100 masl The Rio Cuero and Santiago watersheds lie adjacent to one another within the buffer zone of Pico Bonito National Park Despite their close proximity, however, they represent two different dynamics Rio Cuero is currently undergoing heavy inmigration and deforestation By contrast, Rio Santiago, which is much more easily accessible, has virtually closed itself off from in-migration by actively preventing incursions by migrants into the communal forest However, the cooperative has not managed to prevent deforestation by cattle owners who have bought up privately-owned, as opposed to community-controlled, lands in order to sow pasture In Rio Cuero, the conversion to cattle pasture is occurring more rapidly as ranchers have broader access to already cleared land because of the much larger migrant population which is resident there The different nature of the deforestation dynamic in the two cases was regarded as a positive factor in site selection since it allowed for a better understanding of the forest to pasture conversion process

DESCRIPTION OF THE STUDY SITES

The Rio Cuero and Rio Santiago watersheds are situated at the western flank of Honduras' largest national park, Pico Bonito The park covers an area of 107 300 hectares, of which 53% falls within a demarcated buffer zone region (Rodriguez

1992 31) Economic activities in the two watersheds are conducted mainly within the park's buffer zone Recent changes to park legislation, however, have also allowed for logging inside that part of the nuclear zone which borders on the upper reaches of the Cuero watershed Activities within the buffer zone are meant to conform to certain land use guidelines, the reality, however, is that they do not and there are no controls in place to enforce specific patterns of land usage Thus slash and burn agriculture and cattle ranching all take place within the park's buffer zone which, in the area of the Cuero watershed, is slowly advancing closer and closer towards the park's nuclear zone and the virgin tropical forests contained within this area

In the lowest reaches of the watersheds, forest may be found as far down as 100 masl, rising up to 1,600 masl in the case of Rio Cuero (PDBL, 1993) This area encompasses Humid Tropical Forest (0-200 metres), Very Humid Subtropical Forest (200-800 metres) and Very Humid Sub-Tropical Low Montane Forest (800-1800 metres) (Rodriguez, 1992) In reality the lower forest areas as well as large sections of the medium altitude forests in the watershed areas have been destroyed through cutting and burning for agricultural usage Nevertheless as mentioned, in the Santiago watershed there is still forest cover on large sections of hillside to the east of the river which is situated within close proximity of the community

According to a study carried out by the PDBL in the Rio Cuero watershed, slope is distributed in the following manner

Range of Slopes	Area (Has)	%
0 - 10%	382	2
10 - 30%	2164	13
30 - 50%	4232	26
50 - 75%	4733	30
75 -100%	2678	17
> 100%	1886	12
	16,975	100%

(PDBL, 1993 3)

Information on slope distribution is not available for Rio Santiago However, in both watersheds the pattern of landuse is the same The communities occupy land close to the rivers The land nearby, covering slopes around 0-30%, are increasingly dedicated to pasture Agriculture, mostly for the production of maize and beans but also some rice as well as cacao, is situated on more steeply sloped lands which sometimes reach the 100% mark As can be seen from the chart above, in the case of Rio Cuero only 15% of the land is below 30% slope and, therefore, is considered to have an agricultural land use capacity However the PDBL study considers that on slopes between 30-50% which cover 26% of the watershed area, agriculture with conservation practices is permisable, (where the soil is sufficiently deep - 60-100 cms), or agroforestry The latter may also be practised on slopes of up to 75% where deeper soil conditions permit

this (PDBL, Mapa de Capacidad de Uso, Rio Cuero) In other words, agricultural and agroforestry activities may be practised over a wide area of the watershed according to the PDBL study

THE STUDY COMMUNITIES

The main communities in the hillside areas of Rio Cuero are El Recreo, Santa Fe and San Marcos As mentioned, to reach El Recreo it is necessary to take the mountain road for 8 kms from the lowland town of La Masica which lies on the main La Ceiba-San Pedro Sula highway, around 50 kms west of La Ceiba, Santa Fe and San Marcos lie above El Recreo in the watershed, the former is on the eastern side of the river and is less accessible because of problems in crossing the river at certain times of the year San Marcos refers to both a community as well as a collection of hamlets which have formed around the tributaries of the Cuero river San Marquitos, Quebrada Galana, Quebrada Zacatalosa, Quebrada El Pital and Quebrada El Cacao Some of the hamlets, however, such as El Oestino, El Manchon, El Higuerito and Betania are far enough away to be considered villages in their own right These last three are many hours walk from the road and were not included in this study A map of the area showing the communities is given on the following page

The three main communities in the Rio Cuero uplands each have primary schools, offering grades 1-6, with two to three teachers in each However, poor teaching conditions, the isolation, and low pay, tend to make the teachers' attendence at the schools less than full-time Since Mondays and Fridays are usually used for travel to and from the locations, the scholastic week is generally only three or four days at best Finding replacements for teachers has also proven to be a slow business and El Recreo has just received a second teacher after three years of having only one to attend 100 students spread across six grades, this led to a forced reduction in enrollments Santa Fe was the first community in Rio Cuero with a school, this began more than 30 years ago and received students from the three communities However, some informants in San Marcos studied in the past through radio and learned to read and write in this way In Santiago, however, the school was not built until the 70s by CARE and all the older members of the original settler families in the watershed are illiterate It presently has approximately 50 students in the school with one teacher in attendence to cover all six grades

MAP OF STUDY AREA IN THE ATLANTIC LITTORAL OF HONDURAS

Settlement patterns in the two watersheds are affected both by the desire to be close to services most importantly schools, and access to the outside for the sale and purchase of goods and medical services This has produced a nucleated pattern of residence with some of the earliest migrant families often inhabiting the village centre and newer arrivals living further afield However, as migration has increased in the Rio Cuero watershed, new arrivals and the offspring of earlier settler families are going further and further into the upper watershed in the hope of gaining access to their own piece of land Some of the older migrants who have come over the mountains from Yoro also inhabit these distant hamlets Other families continue to live within one of the three main communities because of the desire to be close to schools but own land in the upper watershed and commute back and forth between the two locations Thus it is not possible to describe the communities according to residence period in the watershed Santiago Arriba, the only community in the upper Santiago watershed does have a much older settled population which has largely emerged from two original settler-families who arrived in the thirties and forties Most families in Santiago live close to one another on lots that are community-owned

Land in both watersheds is generally held in usufruct only, it is not legally titled land In some cases, those who have cleared the land have purchased a private document which names them as the usufruct holder, this document is commonly used for the purpose of buying and selling properties although property boundaries are generally not acurately defined having never been surveyed Other individuals will sell their land without ever having had a private document made up and in this case it is simply a face to face transaction between the two parties involved In the case of Santiago the lack of legal land titling has led to the loss of land of at least one of the original settler families to a large cattle owner

The lack of legal definition governing land holdings in the watersheds and the prohibition against deforestation at the present time, which is certainly not being well observed in the Rio Cuero watershed, makes the issue of land tenure a delicate one Some families were reluctant to discuss how much land they hold and how they had acquired it, this was particularly true in the case of the newest arrivals who had either deforested illegally or were awaiting an appropriate moment to do so In Santiago Arriba, illegal deforestation of community forestland is not apparent even though a sizeable number of people in the community are landless This is because the woodcutters cooperative has been very active in deterring would-be deforesters Their determination to prevent this was revealed in a recent incident which involved two members of the woodcutters cooperative and a campesino family with a small herd of cows and terminated in the death of the cattle owner after he was caught felling trees in an area of community forest There is a good deal of tension between those who make their livelihoods in the forest from the extraction of wood and those who would prefer to cut down and burn the forest in order to clear agricultural land for themselves If the woodcutters view the forest as a valuable resource they are likely to defend it faithfully However, as I shall discuss later on, problems in the organization of

woodcutters and government regulation of forest management, weakens the resolve to defend the region's forests

METHODOLOGY

The methodology used for gathering information for this study was through semi-structured interviews This involves the interviewer having in mind a determined number of items he/she wishes to cover in the interview but allowing the respondent to initiate discussion at any time around those areas that most interest him/her In a well-run interview, the interviewer evokes discussion around the desired areas of interest but in such a way that the required information flows freely without the respondent feeling that he/she is being subjected to a rigid set of questions The ease with which the conversation flows, allows for constant interjection of the respondent's ideas and goals The disadvantage with the approach is that it demands a lot more of the interviewer than the simple administration of a questionnaire and if not performed well can result in the collection of uneven information sets

The decision to use this approach, as opposed to a questionnaire format, was primarily based on the desire to obtain a strong sense of what the farmers themselves are concerned with and how they view opportunities for change since the study was intended as the basis for the development of a project of participatory research Had research funding for the participatory research already been in place, it would have been appropriate to do a community diagnosis of research problems However, since we had no long term funding at the time we felt that it would have raised community expectations unduly to have conducted such a diagnosis Hence the decision to chat more informally to individuals in their homes for the purpose of gathering information whilst explaining in each case that we hoped to use the information to prepare a report in order to obtain money for a future participatory research project

During the course of the interviewing, which lasted from August 1993 to March 1994 we did form two farmer experiment teams (CIALs) in Santiago Arriba and El Recreo, notwithstanding the lack of long-term funding The reason for the change of strategy was that the Department of Agronomy of the Escuela Agricola Panamericana at El Zamorano offered us bean germplasm for testing Bean production, we quickly learnt from discussions with farmers, was one of the key problem areas for local producers All the farmers mentioned the severe problem of hielo with respect to cultivating beans And, as researchers, it was easy to see that beans had to be the cause of a good deal of erosion since farmers always chose the highest and steepest slopes on which to grow their beans in an effort to minimize disease Thus with community approval and community selection of farmer teams, we began a limited form of participatory research in October 1993

The other reason for selecting a semi-structured interview approach was to try to make information collection as unobtrusive as possible so that people who might be engaged in illegal deforestation activities would be less threatened by our arrival and more willing to discuss a variety of issues with us While the approach did not

succeed in eliciting information from all heads of households visited, it was only a very small number of individuals who refused to talk to us

The information that we had gathered in the course of interviewing in the first two communities, which was more exploratory in nature than anything else, was then organized into a more comprehensive set of interview topics to be covered in the communities of Santa Fe and San Marcos higher up in the watershed These interviews which totalled N128, are much more complete than the first set and have been largely used in the analysis given below However, where solid data exists from the first two communities, for example with regard to migration and landholdings, this has been employed to produce a larger data set (N186)

It was not possible to know exactly how many people reside in the upper part of the watersheds The best source of demographic information for these communities is probably the 1993 agricultural census but, at the time of writing, this has not been published and an attempt to obtain information from the municipalities was unsuccessful Given this situation, we selected informants according to geographical location Specifically we tried to cover as wide a geographical range of households as possible in the survey and therefore to include households from all the different community neighbourhoods and hamlets This was particularly important in the case of San Marcos where the population is spread amongst a number of hamlets higher up in the watershed Such an approach made it more likely that both newer and older migrants would be included since, as mentioned, often the older migrants were located closer to the community centres than the newer arrivals Nevertheless, since a list of the families in each community is not available there is no way of checking how large a percentage of the total population was finally interviewed, we believe, however, that we included close to half the households from the communities in our sample Finally, while we attempted to interview household heads, we did not restrict this to male heads Nevertheless males were on average better informants about landuse than women since they are more intimately involved in land use activities in the region Women are more likely to be involved in small livestock production than they are in cropping and land clearing This has been found to be consistent in studies in other parts of Central America (Kairemans, Radulovich, Lok, 1993) Hence our preference was to talk to male household heads but in their absence, we also talked with women, and other adults in the household

INTERNAL MIGRATION AND DEFORESTATION IN THE ATLANTIC LITTORAL OF HONDURAS

Human settlement throughout Central America has traditionally been concentrated in the highland areas located in the western portion of the region The lower-lying hillsides on the eastern flank of the central cordillera, and the flatter plains that link the highlands with the Atlantic coast, have been sparsely populated owing to the high incidence of disease generated by the humid conditions of the area With the increase in population density in recent decades, combined with inappropriate land

usage and the lack of outlets for urban employment, the rural population of the region has been forced to move into areas hitherto deemed undesirable for human habitation It is this human exodus that has imperiled the region's tropical forests which, until the sixties, covered most of the eastern section of the isthmus

The Atlantic littoral region of northern Honduras represents one of the remaining zones of tropical or broadleaf forest in Central America The tropical forest area is located on the steep, ocean-facing slopes of the mountain chain, the Cordillera Nombre de Dios, which runs parallel to the Atlantic coast This chain is interrupted by numerous water courses which carry the runoff from the heavy rains down towards to the ocean, producing a series of steeply-sloped watersheds, running south to north, along the coast The coastal plain itself is now largely deforested accept in a few protected areas close to the coast

Migration into the Atlantic littoral area was previously motivated by the possibility of securing employment in the banana plantations situated on the coastal plain In 1899 the first concessions of land were ceded to several transnational companies, most importantly, the United and Standard Fruit Companies, in exchange for the construction of a railway line along the coast These companies expanded along the coast creating a high demand for labour, particularly in the decade of the twenties when the industry reached its apogee With the coming of the Depression and the collapse of the international market, however, employment dropped precipitously Notwithstanding the subsequent resumption in trade, the industry was plagued with higher costs associated with banana disease, as it was with labour problems which eventually resulted in a widescale strike in 1954 By 1957, the Tela Rail Road Company, United's subsidiary in Honduras, was only employing half the number of people that it had 4 years earlier

The problems affecting the banana industry led to the adoption of a new strategy on the part of the banana companies In the 60s the transnationals began to contract local producers to cultivate bananas in order to lower the level of corporate risk while they themselves diversified into new areas of production such as citrus and pineapples (Herrera, 1989 in Lopez de Mazier, 1991 8) After 1962, with the passage of the first Agrarian Reform Law promoting colonization and the recuperation of illegally held lands (Ruben and Funez, 1993 13), these national producers were increasingly farmer groups organized into cooperatives for the production of export crops This process of land transference from the transnationals to the cooperatives received a fillip in the 70s with the introduction of new agrarian legislation and was further aided by the devastation to the coastal plains by Hurricane Fifi in 1974 leading to increased land sales Forty per cent of the lands redistributed through the agrarian reform program were transferred between 1973-1977 and the greatest concentration of these holdings were located in the north of the country (Ruben & Funez, 1993 16)

By the early 1990s, this tendency towards indirect control on the part of the transnationals had reversed itself and the banana companies were once again seeking

direct control over the production process This tendency received its strongest support in 1992 with the passing of the Agricultural Modernization Law which among other things, sought to title thousands of properties hitherto held in usufruct only and to thereby provide greater security to owners and investors of capital Under the law, national or ejidal land occupied between 1965 and 1989 was eligible for privatization (Ruben and Funez, 1993 88) In other words, the companies could now buy legal titles from cooperativists who were willing to sell up And this possibility was increasingly available as co-op members became disillusioned with the collectives over the decade of the eighties

The foreign banana companies were not the only interests involved in the purchase of the cooperatives in the coastal area According to the study by Ruben and Funez national companies and individuals, particularly, cattle ranchers peasant leaders and high-ranking military officials have all been involved in the purchase of the coastal lands (1993 71-74) In the case of land sales to the transnationals as well as national companies, the cooperativists often sell up on the promise of future employment in the export sector, this condition, however, is often not met in practice Others have been forced to sell on the basis of threats (Ruben and Funez 46 73, CIAT study fieldnotes) Those forced to leave the area after the sale often migrate to the mountainous zones of the Department of Atlantida (Ruben & Funez, 1993 55)

SETTLEMENT IN THE ATLANTIC HILLSIDES

The effect of the presence of the transnational companies in the Atlantic littoral, and more recently the cooperatives, has been to concentrate the population on the coastal plain Until the seventies the forested hillsides behind the coastal plains were only very sparsely populated Information collected from elderly informants in the study area of Rio Cuero, which flanks part of the coastal lands previously belonging to Standard Fruit, helps convey how life in the forest was occasionally interrupted by events occurring on the coast earlier in the century Our eldest informant a 93-year old man whose family migrated into the area in 1910 from Yoro, on the other side of the mountains, remembered how the watershed provided a route for merchants to transport their wares from the interior of the country and other parts of Central America, to those employed by the transnationals Rio Cuero was also where the telegraph wires traversed the mountains, linking Yoro to the coast, and attendants were frequently in evidence checking the lines The same route was used by the transnationals to transport money to the coast, via mule trains accompanied with armed military protection and overnight hostels were constructed to accommodate this diverse range of travellers

The earlier settlers in the forests were generally people from Yoro who drifted over the top of the mountains in search of land However even though they were not lured by the banana companies like the majority entering the department of Atlantida at that time they nevertheless sometimes became marginally linked to capitalist activity beyond the forest The banana companies contracted local people to cut posts

in the forest to support the banana trees while foreigners, searching for valuable hardwoods, principally mahogany, would advance cash to the forest dwellers in exchange for the delivery of wood Nevertheless, until the early seventies, informants living besideside the Cuero river could easily name the families throughout the watershed, the situation in neighbouring Santiago watershed was the same

The small number of inhabitants within the watershed prior to 1970, who were mostly from adjacent areas, contrasts with the situation after that, especially in the late eighties and early nineties, when migrants began arriving from the western departments of the country This in-migration into the forests must be viewed in conjunction with the decline in employment opportunities within the banana industry and its replacement by other activities, less labour-intensive in nature, particularly cattle raising Moreover, while Hurricane Fifi opened up certain opportunities in the lowlands for the cooperatives on lands formerly owned by the transnationals, it also forced many migrants who were already living there to seek safer havens up in the hillsides Thus the wave of migrants into the forests in the seventies and thereafter were mostly individuals from other departments who first settled on the coastal plains before moving up into the hills This pattern of step-migration, via the coast, has continued upto the present

Another event of significance to understanding migration during the seventies, was the conflict with El Salvador in 1969 This conflict displaced large numbers of people living in border communities in the western departments, who frequently migrated in step-fashion through Santa Barbara before moving to the Atlantic littoral in the eighties and early nineties

CHART I

In-migration into the Cuero and Santiago Watersheds
(Communities El Recreo, Santa Fe, San Marcos, Santiago Arriba)

Birth Place	%	#
West (Intibuca, Ocotepeque, Copan, Lempira, Santa Barbara)	45 7%	(85)
East (Yoro, Olancho)	16 6%	(31)
Coast (Cortes, Atlantida, Colon)	16 1%	(30)
Centre/South (Comayagua, Choluteca, F Morazan)	3 2%	(6)
R Cuero Santiago	14 5%	(27)
D/K	3 8%	(7)
	100%	(N=186)

CHART II
Step Migration Process

From birthplace via	%
West (Santa Barbara Copan)	31 37%
Coast (Atlantida, Cortes Colon)	55 88%
East (Yoro)	12 74%
	100 0% (N=102)

The information collected on migration within the two watersheds, shown above, concurs with patterns evident in the national statistics According to the 1974 and 1988 national censuses, Ocotepeque, Lempira Intibuca and Copan are subject to heavy outmigration and in each case Atlantida has been amongst the receiving departments Census information on Santa Barbara shows this to be a department which acts as a conduit to channel population from the above-mentioned western departments towards the coast (Rodriguez de Simons, 1991 26) Likewise, Yoro is both a receptor and expeller of population receiving migrants from Lempira and Copan, amongst others, whilst expelling population towards the coastal departments (Rodriguez de Simons 1991 21) This process is clearly reflected in the step-migration pattern evident in the study statistics shown above which involves 54 8% (N102) of the sample (N186) however, by removing those either born in the community or those originating from the coast, 79% arrived by step-migration from elsewhere in the country

Information collected from the study sample by origin and the number of years in the community provides further information on the nature of the migration process As can be seen in Chart III below, the heavy migration from the western departments is a recent phenomenon, having occurred largely in the last 12 years and particularly within the last four years At the other extreme is the 14 5% born within the community who have more than 20+ years there in this case however, this is simply a reflection of the average age of household heads in the sample, since years in the community amongst this category corresponds to actual age

CHART III

Origin by Number of Years in River Santiago and Cuero Communities

Years	West	East	Coast	Cen/So	Native	%
1-4	24 7%	3 8%	3 8%	1 6%	0	33 9%
5-12	15 0%	2 7%	2 1%	0	0	19 8%
13-19	1 6%	2 7%	3 8%	0 5%	0	8 1%
20+	4 3%	7 5%	6 5%	1 7%	14 5%	33 8%

D/K 3 8% (7) N=186

The process of settlement in the receiving communities is characterized by concentrations of groups from the same sending communities and areas This is partially because migration is overwhelmingly of families rather than individuals, some of them quite extensive, and because of communication by word of mouth to the sending area which tends to produce a new wave of migrants Thus, as is evident in the information below, Santa Fe and El Recreo are largely comprised of individuals from the western departments, in the case of Santa Fe, the vast majority of these individuals have passed, in step-migration form, through the area known as Tres Cerros (or Tras Cerros as it is sometimes called), in Macuelizo, a region in northern Santa Barbara close to the Guatemalan, border before coming onto Santa Fe In the case of San Marcos, the bulk of the population originates either in the west or from Yoro/Olancho to the immediate south-east, in the latter case, it is the ease of entry which has determined location since residents have simply come in over the back of the mountains Santiago, as can be seen, has a larger percentage of its residents born inside the community than the others

CHART IV

Percentage of Migrants by Origin in Each of the Study Communities

Community	West #	West %	East #	East %	Native #	Native %	Coast #	Coast %	Ce/So #	Ce/So %	D/K #	D/K %
El Recreo	20	71 4	2	7 1	1	3 5	5	17 8	0		0	
Santiago	7	24 1	6	20 6	9	31 0	7	24 1	0		0	
Santa Fe	35	62 5	2	3 5	6	10 7	8	14 2	4	7 1	1	1 7
San Marcos	24	33 3	22	30 5	11	15 2	11	15 2	2	2 7	2	2 7

West Copan Intibuca, Lempira Ocotepeque Santa Barbara
East Yoro Olancho
Native Born in community
Coast Atlantida Colon Cortes
Ce/So Choluteca, Comayagua, F Morazan

The much older nature of migration in Santiago, compared to the other three communities is described in the chart below, where it can be seen that 48% has more than 20 years in the community compared to only 3 4% with less than five years By contrast, in the other three communities between 37 5% to 46 4% of the total population sampled has arrived within the last 5-year period

CHART V

Number of Years of Residence in Each of the Study Communities

Community	20 yrs +		13-19 yrs		5-12 yrs		< 5 yrs		D/K	
	#	%	#	%	#	%	#	%	#	%
El Recreo	11	39 2	0	0	3	10 7	13	46 4	1	3 5
Santiago	14	48 2	5	17 2	7	24 1	1	3 4	2	6 8
Santa Fe	14	24 5	2	3 5	18	31 5	22	38 5	1	1 7
San Marcos	25	34 7	9	12 5	10	13 8	27	37 5	1	1 3

Needless to say, the heavy inmigration in recent years has triggered heavy deforestation in the region of River Cuero In Santiago, however, the strong woodcutters cooperative has served to prevent migrants from intervening in the community forest and therefore, has served as a disincentive to settlement in the community, hence the particular settlement profile there

The data on inmigration, however, does not help explain the amount of degradation associated with cattle production Most of the large cattle owners are not recent migrants and they do not live in the communities but rather contract migrants to take care of their livestock on their behalf The destructiveness of cattle production is particularly notable in Santiago, notwithstanding the low level of inmigration, and also around Santa Fe and Recreo, the communities closest to the highway Residents living in the communities who do own cattle tend for the most part to be small farmers with small herds or one or two animals Cattle owners, particularly the large ones, are more likely to buy land which has already been deforested than to go out and deforest virgin territory, hence, in the case of Santiago, the woodcutter's co-op has not been successful in preventing the spread of cattle since the land used was not part of the community forest when it was purchased I shall return to the issue of cattle production in the section of Land Use below

PUSH AND PULL FACTORS AFFECTING MIGRATION

The reasons cited for in-migration into the River Cuero watershed are varied but most importantly migrants have come in search of land -- for them and for their children They received word from earlier migrants that the Cuero watershed has good land for farming and that it is just a question of deforesting an area in order to claim a right to property The fact that most have family members already living in the watershed makes the settling-in period a good deal easier since families simply double-up until they have built their own houses out of local materials However the recent prohibition on deforestation, and the intermittant military presence to enforce this, has served to brake the pace of deforestation although it has certainly not stopped it and most landless families are simply awaiting an appropriate moment before heading into the forest bent on carving out their own plot of land While the search for land is the overriding pull factor propelling migrants in the direction of the Atlantida hillsides, push factors which have driven migrants from either their birth places or from the way-stations visited en route, are more varied It should be pointed out that all migrants are from rural areas and it is landlessness that is cited as the primary cause of outmigration, however, in reality it is land use which has made life intolerable for most migrants In the past, poor rural households could provide for their families by renting land for milpa production which they combined with wage labour on larger properties The expansion of cattle production has done away with both wage labour and access to land Families who originally left the western border departments in the late sixties and early seventies, either because of war or landlessness, to go to Santa Barbara where there was still frontier land available, by the late eighties were once again landless as cattle expansion continued unabated Moreover the steep slopes in Santa Barbara combined with the reduced area available for farming has provoked serious land degradation resulting in very poor yields Once again, however, this must be viewed in conjunction with cattle ranching since, typically, poor farmers end up on the steeper slopes while ranching occupies the flatter lands Migrants frequently cited degradation as a reason for leaving their former homes Over a thirty-year period of residence in the Macuelizo area in northern Santa Barbara, yields were reported to have declined from around 25 cargas/mz to 6 cargas/mz The few migrants who owned small parcels of coffee land in Santa Barbara cited the desire to have access to crop land to produce food for their families, in combination with the higher costs in coffee production associated with the onset of coffee rust in the area Migrants coming directly from the more westerly departments also mentioned the aridity ('es demasiado arido') of the zone as a reason for leaving In this case soil degradation and deforestation have almost undoubtedly heightened the effects of the dry season as the capacity of the soil to retain moisture

has been reduced This is leading to a process of 'desertification'[3] in the semi-arid departments of the country

Another reason cited by migrants who arrived in step-migration fashion via the coastal plains or Yoro was the failure of land reform cooperatives and/or land reform ajudications to provide a permanent location for them While many were never direct members of the co-ops, they had access to co-op land via a family member who was directly affiliated As discussed above, sales of cooperative lands became common in the eighties and early nineties once the realities of the collectives became apparent to the members Many had debts were mismanaged, poorly organized, and all lacked the degree of support necessary to truly allow them to function effectively (Ruben and Funez, 1993 91-104) According to information from the Institute of Agrarian Reform (INA), there were 462 cooperatives operating in the country in 1985 involving nearly 14,000 members, while some 35 450 individuals were organized into land reform groups or micro-companies (SECPLAN, 1989 116) Nearly 46% of the groups of land reform beneficiaries are located in Yoro, Santa Barbara and the coastal departments (SECPLAN, 1989 117) -- which are those departments commonly cited in the step-migration process (see Chart II) Migrants cited dissatisfaction with the cooperatives as a reason for leaving them or irregularities in securing legal title to the reform lands Very often these titles were bought out from under the cooperatives by individuals with influence And in cases where resistence was offered, the use of physical threats were applied Ex-members of the Sombra Verde Co-operative in Esparta who arrived in El Recreo in the early nineties, all told of the pressure on them to sell up And the massacre of co-operativists who refused to leave another location in the River Lean area after it was purchased by a high-ranking military figure stuck out in everyone's mind as a reminder of what might have happened had they refused the purchase offer The significance of land titling is not simply limited to the land reform community In Honduras approximately 80% of the land is held in usufruct (dominio util) without legal title (SEDA, 1993 79) Small farmers who know little about land titling, may suddenly find that the land they had long believed was theirs by right of use, is taken from them because someone else buys the title (dominio pleno) without their knowledge or because they lack the financial resources to do this themselves Titled land is most commonly the flatter land and the buyers are usually those with good connections Migrants cited having lost common land (ejido) occupied by them for years to cattle ranchers in this way At the outset the new purchasers were content to have the former owners make their milpas on the land in exchange for the sowing of pasture after the

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[3]According to Bilsborrow and Geores (1992) desertification, is derived from the correct and broader term **dessication** (Falkenmark et al 1990) This more accurately parallels the migrants use of the word arid to describe what is increasingly occurring in the older degraded environments

harvest, however, after a number of years, once all the land was under pasture, the former owners were excluded from access or were simply allowed onto low-yielding poor quality land, which needed to be resown with pasture Either way, small farmers were effectively pushed off the land

DEMOGRAPHIC CHARACTERISTICS OF MIGRANTS EDUCATION

Educational levels in the rural areas of Honduras are extremely low According to the 1988 census, the literacy rate in the countryside was around 58%, up from 49% a decade earlier (Cano 1990, 11) This compares to a literacy rate of 83% in the urban areas However in reality the level of literacy in the rural context is open to discussion since conditions in the rural schools are generally very poor, often with only one teacher to cover six grades Not surprisingly those who manage to reach grade six are not functioning at a generally acceptable grade 6 level However 75% of registerred students in rural schools are to be found in the first three grades, most never reach grade 6 (SECPLAN, 1989 54)

The situation in respect to education in the western departments, where nearly 48% of the sample originates, is even worse than in the rest of the rural areas According to the 1974 census, when out-migration towards the receiving area began illiteracy was as high as 60% in some of these departments by 1988 it had dropped by about 10%, but nevertheless remained behind the country in general (Cano, 1990 14) Further evidence of the poor educational attainments of the population in the western departments may be deduced from the fact that less than 30% of the population between 5 and 29 actually attends any educational institution (Cano, 1990 17)

The low educational level of the rural population in the western departments relative to the rest of the country, is almost certainly a factor serving to stimulate rural-rural migration since in the urban setting, low literacy levels are more likely to have an adverse effect on employment prospects than in rural areas Unfortunately, census information is only enlightening in so far as inter-departmental movements are concerned, it does not provide information on rural versus urban occupations of migrants

Amongst the 116 male and female heads of households for which information about literacy was obtained in the study, 55% were illiterate [4] However, amongst the 45% who claimed to be able to read and write literacy is generally very minimal and it is likely that there is a percentage in the group who have only numerical literacy In other words, this is not likely to be a very reliable indicator of functional literacy More detailed information regarding schooling however was gathered on the children of

[4] The figure of 55% illiteracy is slightly under that of 62% found by Buckles et al , (1992 25) in their study which was carried out amongst migrants in different watersheds in the same area

the household heads This showed the following

CHART VI

Educational Levels amongst the Children of River Cuero Migrants

Grade 6+	1 5% (6)
Grade 6	28 6% (113)
Grade 5	4 8% (19)
Grade 4	7 9% (31)
Grade 3	16 5% (65)
Grade 2	10 7% (42)
Grade 1	10 7% (42)
No schooling	19 3% (76)
	100 0 (N=394)

In other words, 43% of the sample had above grade 3-level education and 30% had grade 6 or above This is considerably better than the statistical average for the rural areas, mentioned above which shows that 75% of rural students do not go beyond grade 3 (SECPLAN, 1989 54) However our information does not allow us to know whether the students actually completed each grade National figures show that 30 1% of students initiated 6th grade and 29 1% completed it, the former clearly parallels the study results (Cano, 1990 25) Nevertheless, earlier caviats regarding educational quality in the rural areas must be borne in mind when comparing figures to national educational averages

Despite the apparently higher than average level of education amongst migrant offspring relative to rural averages, our data does not allow us to establish any causal relationship between education and migration Migrants may have some educational ambitions for their children, however, schooling was almost never cited as a factor in the decision to move, while complaints about the local education available in the watershed were widespread Moreover, the data does not clearly establish where the education was acquired in each case Because of the step-migration process many migrant children were educated at a number of different locations, including the receiving area

Finally, as already discussed, the educational facilities available to students in all four of the study areas are extremely poor Teachers generally put in at most four days per week and frequently attend to several, if not all six, grades text books are not available classroom facilities are hot and crowded, and students regularly miss classes in order to help their parents in agriculture

INFANT AND CHILD MORTALITY

The background of poverty of the vast majority of migrants can be gleaned from census data showing mortality rates in the major sending areas Infant mortality is a sensitive indicator of poverty since the very young are the most vulnerable to poor

living conditions The rural areas of the departments of Copan, Lempira and Intibuca in 1974 all had infant mortality rates of above 100 per 1000 live births, Ocotepeque was close behind with a rate of 96 (Rodriguez de Simons, 1990 22) These were amongst the highest infant mortality rates in the country While they have fallen by around 30% in the last decade, they are nevertheless still the highest in Honduras

The figures on child mortality[5] collected by the study team in the two communities Santa Fe and San Marcos, show rates that suggest strong parallels with those in the main sending areas although our information does not allow us to determine with preciseness all the ages and locations at which death occurred in the children For this reason it cannot be compared directly with the regional statistics Nevertheless, given the concentration of westerners in Santa Fe, who have mostly arrived within the past 12 years, especially the past four (see Chart V), we can assume that most of the deaths in this community occurred in the location of the western departments

Based on 57 informants living in the community of Santa Fe who provided informantion, there were 57 deaths to 350 live births reported amongst infants and young children, representing a mortality rate of 162 8 In San Marcos there were 481 live births to 51 deaths reported by 72 informants, this translates into a mortality rate of 106 02 It must be remembered, however, that these rates encompass a period of many years since they are generated by informants as old as 83 and therefore probably take into consideration the years as far back as 1930 The higher rate in Santa Fe would seem to be explainable by the fact that a much higher percentage of the population (62 %) is from these poverty-stricken western departments than is true of San Marcos where origin is more diverse (see Chart V above) It should be mentioned that while childhood deaths are generally concentrated in the under five age category deaths amongst older children and youths from unknown diseases as well as known infectious diseases, such as polio, meningitis, measles, were common as were deaths from accidents such as drowning whilst crossing the river Violence amongst young men,

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[5]The Under Five Mortality Rate is the principal indicator used by UNICEF to measure the well-being of children The Honduran statistics employ infant (0-1 age range) mortality to measure well-being The figures employed in our study focus on the group between 0 and under-5 However in some of the cases, the exact age at which the child's death occurred could not be ascertained Nor was it always clear whether it was really a live birth since informants talked about their dead children even when they had clearly suffered miscarriages too early in their pregnancies for these to be counted amongst the live births We did our best to eliminate such cases but some nevertheless remained unclear For this reason these figures should be treated as indications of child mortality rather than strict statistical measurements of it

leading to death, was another commonly cited cause of mortality in this older category In other words even after passing the age of 5, there is still a strong risk that a child will not reach full-adulthood for one reason or another

Child mortality cannot be divorced from the very high birth rate amongst migrant women Based on 123 cases, there were 831 live births, producing an average of 6 76 births per woman However, if we exclude the younger women and take in only those at the end, or nearing the end of their child-bearing years, namely women over 40 (N=43), there were 9 9 live births per female, indicating the close nature of birth spacing and the difficulty of providing adequate care to the very young It should be noted that women in the sample were not, for the most part, taking any form of birth control and in the few cases where women had been sterilized, this procedure was related to medical problems rather than the attempt to regulate family size Thus there is no indication amongst the migrant group interviewed that family size is in any way declining Lack of information on family planning lack of access to adequate health services, resistence from men and the influence of religion, are the principal reasons for the continuance of the very high fertility rate, along, presumably, with the rather high risk of losing a child to illness or accident as mentioned above The role of fundamentalist protestant sects, in particular in Santa Fe, was responsible for providing resistence to the idea of birth control and for promoting unchallenged male dominance within the household contraception was equated with an invitation to 'loose behaviour' on the part of women, in the mind of the local pastor who was outspoken against it However, women with very large families, as well as younger women wishing to avoid this fate showed considerable interest in the topic during the course of the interviews

Unions, particularly amongst younger couples, are unstable Legal marriage is extremely rare among migrants and relations dissolve easily, leaving the women, in most cases, with the children However, there are few young single female-headed households in the communities since life on the frontier for a single woman with young children is extremely hard and those who find themselves in this situation are probably more likely to go to cities where they can find paid employment than migrate to a rural frontier area Single women with older sons who are capable of carrying out slash and burn agriculture, however are present Fifty percent of the women in the sample had their first child below the age of 20, 17% had their first child at the age of 14 or below after they were stolen away (robada) by their prospective partners, it is hard to know whether such stealth is really forced on women or is akin to elopment Whatever the circumstances of the formation of these unions the children resulting from them when they are of short duration, are commonly taken into the household of the grandmother If these young mothers form another union, as they commonly do, their children may not always accompany them I suspect that this results in underreporting of first births At the same time nearly 14% (N=16) of the women questioned reported their first birth at over 26 years This likely includes those in their second or later unions who fail to report earlier births particularly when the interview is

conducted in the presence of the later spouse In other words, the sample probably underreports the total number of births and overreports the age at which the first birth in fact occurred

Men involved in a second or third unions are quite likely to seek a spouse considerably younger than themselves In 35% (N=36) of the cases, there was an age difference between husbands and wives of 10 or more years in 18% (N=19) of the cases, the age difference was greater than 15 years Since the men were often reluctant to discuss their earlier unions, and how many children they had had in the presence of the current spouse, one was quite often left to deduce that there had been a former relationship based upon the informant's age, versus the age of the spouse and reported children What is important here, however is that notwithstanding the number of children either spouse may bring to the relationship, the man will almost certainly want to have children with the new spouse if this is possible Thus the very instability of relationships probably serves to increase the number of children that a woman will bear during her lifetime, it would certainly act as a disincentive to undergoing sterilization given that a sterilized woman would be considered a less than desirable future partner

Notwithstanding the average large family size, average household size in two of the sampled Cuero watershed communities is only 6 members per household unit (N=127) This is both a reflection of the early age that young people seek independence from their parents' households, as well as the number of young families present in the sample who are just beginning the domestic cycle Since houses are constructed out of locally available materials, it is more a question of labour and access to a plot of land than of saving funds to cover the physical cost of housing materials Nevertheless, while young adult couples may endeavour to have their own houses as soon as possible, they are likely to continue to require access to family land unless they are in a position to carve their own plot out of virgin forest -- something that is becoming increasingly difficult to accomplish In other words, saving enough money to buy land from the low agricultural earnings, or from those acquired from forestry, is difficult to achieve and therefore sons may be dependent on their fathers for their livelihoods for many years

LANDOWNERSHIP

Landownership in the four communities presents similar patterns Whereas the percentage of farms, at the national level, is heavily concentrated at the minifundia level (63 9% of the total consist of less than 5 has) the tendency in the four study communities is for the percentage of farms to be spread more evenly through minifund a to middle-size properties of up to 50 hectares in other words, the degree of concentration present at the national level has yet to occur Nevertheless cattle ranching is increasingly moving into the area to skew the distribution of landholding towards the large owners, who, as mentioned, do not live in the communities for the

most part The group in the top category are cattle producers who generally have several properties which extend from the hillsides to the coastal lowlands Since San Marcos is rather a long way from the coastal road (3-hour walk), these large cattle ranchers have yet to buy lands in the community, once the road through the watershed is completed however this situation will surely change By contrast in the community of Santiago, in the area leading up to El Recreo and between El Recreo and Santa Fe, there are now large areas owned by a handful of ranchers These areas are under permanent pasture and the pressure is on the small farmers, who have flatter land to sell to these ranchers

CHART VII

Landholdings from Communities in the Atlantic Littoral Hillsides (El Recreo, Santa Fe, San Marcos, Santiago)

Size of holdings (hectares)	#	Percentage of the Total
< 5	27	14 36%
5 - 9 9	30	15 95%
10 - 19 9	36	19 15%
20 - 49	26	13 83%
50 - 99	3	1 6%
> 100	5	2 66%
Landless	48	25 53%
DK	13	6 91%
TOTAL	188	100 0%

(The higher number of total cases than those in the larger sample [#186], arises from the inclusion of the properties of 2 large cattle ranchers who lived in the lowlands and were therefore not amongst the migrants)

The size of the landless category is, it can be argued, deceptively large since it includes individuals who have access to family land but who nevertheless claim to be landless In some cases this claim is justified since the relative, and this is sometimes the father, may charge rent for the use of the land or, alternatively, will demand a portion of the harvest in exchange for land -- a practice also used by those who have no relationship to the renter While these individuals who have access to family land should perhaps not be labelled as landless, the fact that they regard themselves as such, means that they fall into the group which is awaiting the opportunity to deforest In other words, from the point of view of deforestation it is all the self-described landless individuals who pose a threat This is a full quarter of the sampled population

The nature of landholding in the area, which, as discussed, is less concentrated than the national average, is typical of what would be expected in a frontier zone where, until very recently, individuals were free to go and carve themselves out a piece of the forest as they saw fit However the larger size of holdings in general than those at the national level, is also representative of a strategy by household heads which is aimed at keeping sons on the family property As discussed earlier, migrants often cited the need for land for their children especially their sons as a reason for migration By offering their sons or sons-in-law, access to land, household heads increase the probability that their offspring will stay on to work the land and therefore, will be available to take care of them in old age The fact that individuals continue to seek access to their own land, independent of land available to them via the family, indicates a source of tension within the family grouping

Having access to sufficient land to keep the family intact is a very logical desire given the dynamics of family relationships amongst the very poor once family members are no longer in close proximity Unlike migrants for whom migration results in an increase in earnings which can then be remitted back to the family to help improve living standards in the sending area, permanent rural-rural migration to frontier areas effectively severs economic ties with those left behind in the sending area This is because earnings are too low and and communications too poor in the frontier areas Thus amongst poor households where family members have a generally low education, the prospect of receiving remittances from kin who have migrated to other rural areas is undoubtedly very low, unless they are fortunate enough to obtain a position in commercial agriculture Frontier zones provide the resources to maintain poor families intact and therefore to provide members with continuing support, which is especially important during their later years when they cannot work In this case, control over land acts as an incentive to the maintenance of family loyalty and distribution of lands prior to death appears very infrequently Women sometimes hold land in their own right but this generally involves widows, or, more exceptionally women who have separated from their husbands and have managed to take a share of the family property with them

The role of land in maintaining families as a cooperating unit serves as an incentive towards carving out larger parcels from the forest than is required for subsistence purposes Thus earlier settlers often held large chunks of both forested and deforested land However, family crises, particularly illnesses in conjunction with the low income-earning capacity of the land relative to the high labour investments required to make the land produce, have often forced earlier settler families to sell land to new migrants and cattle ranchers

The preference for extended family landownership and the larger than average size of properties in the area does not square with the concept of migratory agriculture described in much of the literature dealing with deforestation The widely-held view is that migrants descend on an area of forest cut it down in order to farm it for a couple of years, and then sell it to a rancher when it is exhausted (Parsons, 1976,

Leonard, 1987, PDBL 1990[6]) While this may be the predominant practice when the land is of such poor quality that rotation in the foreseeable future is impossible, it is not rational when rotation is an option Instead, pioneer farmers are more apt to obtain access to land that is larger than required and to maintain a good portion of it as fallow, in the form of secondary forest or even in primary forest as a reserve

This produces a system of land rotation, rather than migratory agriculture Later migrants who have bought land, or those who have lost part of their land for one reason or another and may own an insufficient amount to fallow it adequately, may rapidly exhaust soil fertility and be forced to move to the frontier However, this is not the predominant local pattern as those with insufficient land are more apt to rent than to exhaust what little they have, the land rental market in the zone is quite open and supply is relatively plentiful Thus cattle ranchers, for the most part, are not purchasing land which is no longer suitable for crop production, rather, they are purchasing the best land - meaning land most conveniently located in relationship to roads, and land that is flattest This land carries a substantially higher price than land on steep hillsides (generally four times higher) and poor farmers, who put little value on their own labour time may opt in favour of walking an extra two hours each day to a plot at the forest frontier if this means having extra cash in their pockets from the sale of the higher value property And so goes the process of forest to pasture conversion in the area under study

LAND USE

When the Spanish arrived in Honduras in 1503, the Atlantic littoral area was populated by Tolupanes, often referred to as Xicaques Their area of influence extended from the Sula Valley, which bordered on Maya territory to the west, and on the east, extended to the mouth of the River Aguan (Tejeira, 1982 cited in Rivas, 1993 48-49) According to Chapman the Tolupanes were cultivators of root crops but most importantly they were hunter-gatherers (Chapman, 1978, cited in Rivas, 1993 149) who lived from the products of the forest and from the numerous rivers that flowed through their hunting grounds In reality little cultivation was likely required since the river bank areas in the forests of the Atlantic littoral are full of wild tubers and even today many migrants supplement their diet at certain times of the year with the gathering of wild yams (Discorea convoluvacea) and malanga (Xanthosoma violaceum) Nevertheless, cassava was almost undoubtedly cultivated, as it is amongst other tropical forest dwellers, such as the Pech and the Tawahkas, who live to the east of

[6]An interview conducted at the local Agrarian Reform office in La Ceiba elicited a similar response from the representative there regarding local land use, namely, migrants did not remain for more than a couple of years on the land before selling it to a rancher for cattle

the area in question and whose culture is still entirely cassava-based[7] The Tolupanes are today located further south in Yoro and their culture is centred around maize and beans

The humidity of the coastal forest zone combined with the semi-nomadic way of life associated with hunting and gathering, would have made maize and beans -- the main Maya staples -- extremely difficult to produce While the lowland Maya also practised shifting agriculture within tropical forest areas, they were considerably drier than the forests of the Atlantic littoral Cassava by contrast does well in such moist environments, and storage raises no problem since it is capable of being preserved for a year in the ground

The inhabitants of the forests of the Atlantic littoral today, however, are, as discussed above, migrants from many parts of Honduras, but particularly from the western departments, in other words, a very large percentage of the migrants are of Maya extraction These migrants are overwhelmingly cultivators of maize and beans, who tend to hold the traditional staples of the coast, viz plantains and cassava, in rather low regard, their first priority is put beans and tortillas on the table -- notwithstanding the less than optimal conditions for these crops in their new forest surroundings

Older residents of the Atlantic hillsides suggest that inmigration has improved agriculture in the area by opening up the forest and thereby lowering the severity of hielo -- the name given by Honduran farmers to a variety of diseases (See Bentley, 199) which, in this case, are very likely fungii engendered by the high humidity As the forest has been cleared, beginning in earnest in the seventies, so the incidence of hielo has tended to diminish - notwithstanding the undoubted introduction of new diseases which have accompanied the increase in production Nevertheless, the problem of hielo in beans (mainly Web Blight) has only been partially resolved at a rather high cost to the environment -- namely deforestation of eastward-facing mountain tops which receive the early morning sun, thereby helping to lower relative humidity and the incidence of the disease

The following is a description of the predominant land use activities in the area today

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[7]Interviews conducted amongst the Pech in the community of El Carbon in January/February, 1994 clearly revealed that the production of beans in their area is a recent phenomenon Previously they were purchased from ladinos in San Esteban, south-east of Carbon, or exchanged directly for cassava bread, sasal Older residents also remembered hearing from their parents and grandparents that maize was not produced by their ancestors

MAIZE CULTIVATION

Maize cultivation in the Atlantic littoral is carried out during two distinctive cycles the spring or **primavera** cycle and the fall or **postrera** cycle Traditionally the former was the most important (Sain and Matute, 1993 199) but with the advent of Mucuna deeringianum, a perennial legume used as a cover crop, which is now applied extensively in the postrera cycle throughout the area (Buckles et al , 1992), the latter has become the major maize cycle

The Postrera Cycle

Mucuna or fertilizer bean (**frijol de abono**) as local farmers refer to it, refers to a number of species belonging to the family Fabaceae, in Honduras, the species most widely cultivated is *Mucuna deeringianum* (Buckles et al , 1992) According to a recent study by Buckles (1994), Mucuna reached hillside farmers of the Atlantic littoral area of Honduras in the early seventies, having probably been introduced to Central America in the twenties when the banana companies began using it mainly as mule forrage (Buckles, 1994 13) As the process of inmigration to the Atlantic littoral began to speed up in the seventies, with the growth of the cooperatives and later on with the movement of many migrants towards the hillsides, so the diffusion of Mucuna grew rapidly Most farmers have obtained their seed from other farmers in the area (Buckles et al , 1992 24) The CIMMYT study estimates that 83% of the farmers in the Atlantida area studied, or approximately 5,250 farmers, have had direct experience with Mucuna (Buckles et al , 1992 8)

Mucuna is used most extensively in areas with heavy rainfall which is distributed in a bimodal pattern (Buckles, 1994 19) The Atlantic littoral of Honduras as discussed already, receives around 2,000 to 3,300 mm of rainfall per year However, these figures were collected at points on the coastal plain, rainfall readings from the area in question are only now being collected According to farmers in the Rio Cuero and Santiago watersheds, the dry season is more pronounced than the chart would lead one to believe and farmers expect only low amounts of rainfall between February to May

Rainfall in the Atlantic Littoral 1972-1990

(Sain and Matute, 1993 198)

The postrera cycle begins shortly after the heaviest rainfall period in November/December, when the Mucuna plant produces seeds and the vegetative cycle comes to an end At this stage farmers cut down the tangled mass of Mucuna covering their fields, and leave it as a mulch over the soil Most farmers in the study area rely on natural reseeding of Mucuna which occurs as the seed pods dry The maize seeds are introduced directly into the mulch a week or so after cutting During the course of the maize cycle, farmers control the resprouting Mucuna plants either by hand with a machete, or with herbicides At the end of the postrera cycle which occurs just prior

to the resumption of regular rainfall, the Mucuna plant spreads rapidly over the recently harvested plot forming a thick mattress of organic material capable of producing up to 9 tons/ha of dry matter (Buckles, 1994 3) According to Triomphe, the benefits from Mucuna are derived from the minerals which leach out from the layer of rotting biomass, rather than from its effect as a live cover crop (personal communication) The process of growth and the development of biomass continues throughout the rainy season until the plant is ready for cutting at the end of the vegetative period, the following November or December Thus farmers may return to the same plot each year without the need for longer fallow periods

The effect of the introduction of Mucuna is helping to transform the traditional pattern of maize production in the area In the past, fewer farmers produced maize in the postrera and those who did used a short bush fallow of one year known locally as a guatal This is less fertile than a Mucuna-fallowed area However, farmers employed, and continue to employ, the cut slash as a mulch to preserve moisture during the following dry season just as they do with Mucuna The use of a short fallow eliminates the need to burn since it is relatively easy to sow amongst the smaller stems present in the younger vegetation Moreover, burning at the end of the heavy rainfall period is exceedingly difficult Today, farmers in Rio Cuero, who do not use Mucuna, or who have insufficient Mucuna, generally use a short bush fallow or guatal for the postrera Since Mucuna introduction is rather recent in Rio Cuero (6 years of usage is the longest known case), and in-migration has been very heavy in the past few years, the pattern of adoption is still quite mixed Moreover, landlessness makes access to Mucuna plots more difficult, although a rental market does exist but the higher rents for land under Mucuna is prohibitive for some farmers[8]

CHART VII

Sample of Farmers planting in the Postrera Cycle in Rio Cuero

	No	%
Mucuna	50	60
Slash mulch	33	40
	83	100

The situation in Rio Santiago is quite different There are only two farmers who have sown Mucuna in their plots and most people interviewed were ignorant of the practice of using Mucuna Partly as a consequence of this, the productivity of land in the postrera is lower and fewer people elect to plant in this cycle in comparison with the spring cycle Low adoption is a reflection of the limited nature of population

[8]Land sown with Mucuna cost approximately one-third more to rent than land without it (viz 150 Lempiras/mz compared to 100 Lps in December 1993) However, as with most rental arrangements, the actual price depended upon the relationship between renter and landowner as much as it did the market

movement into the watershed which clearly negatively affects the flow of new ideas and technology While the difference in the degree of Mucuna usage between the two watersheds may not be wholly responsible for the variation in yield, since agricultural land in Santiago is generally more degraded than Rio Cuero by virtue of its older settlement pattern comparison of yields between the two adjacent watersheds is interesting since it points to the potential for yield improvement in the former case through the use of Mucuna

CHART IX

Yields in Santiago and Cuero Watersheds

	Rio Cuero		Rio Santiago	
	Yield kg/ha	No	Yield kg/ha	No.
Postrera				
In Mucuna mulch	1,768 88 kg/ha	50	1,193 72 kg/ha	2
In slash mulch	1,278,37 kg/ha	33	998 38 kg/ha	8
Primavera	1,166 59 kg/ha	78	1,172 0 kg/ha	16

While the very small number of farmers using Mucuna in the Santiago watershed does not allow us to draw any conclusions from the results, especially as one of the two farmers using it has only recently adopted it, the reasonably large sample size in Rio Cuero makes the finding quite reliable It should be pointed out that the sample includes farmers who have only sown Mucuna one year ago as well as farmers who have had it for six years, thus the yield increase of 38% over farmers who do not use the cover crop is substantial This figure is similar to Triomphe's (1 9 tons) estimated from 18 different plots in the same watershed through direct sampling in farmers fields (preliminary estimates, 1994)[9] and rather higher than that found by Buckles et al (1992 18), of 1,373 kg/ha This may perhaps be explained by the fact that Rio Cuero is not highly degraded and therefore recuperation of soil fertility with Mucuna is more rapid than in the communities selected by the CIMMYT/SRN study Nevertheless, both averages are well below the preliminary findings of 3 5 tons/ha in Triomphe's study conducted in the community of San Francisco de Saco, where some producers have had up to 20 years experience with Mucuna (preliminary results, 1994)

The effect of Mucuna usage has been to increase the area of maize sown in the postrera planting This may be grasped by comparing the average area sown by each producer with Mucuna versus the size of the average plot using short bush fallow (guatal) and indeed, the size of average plot in the primavera cycle

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[9]Triomphe warns us that the sampling method employed which extrapolates from a small area to one hectare likely overestimates production by 15-20% Triomphe also converts from on-the-cob maize estimates to grain weight using a 7 conversion factor, I converted at a more conservative 66 Clearly the conversion rate varies from year to year depending on how good the crop is

CHART X

Average Size of Plot in Postrera and Primavera Maize Planting, Rio Cuero

	Has	No
Postrera		
With Mucuna	1 95	50
With Slash Mulch	1 09	26
Primavera	1 00	78

Findings at the regional level show that output in the postrera harvest has increased in importance relative to the primavera harvest, from 35% of the total in the early eighties, to more than 50% of the total at the present time as Mucuna usage has increased (Sain, Ponce, Borbon, 1993 146) In Rio Cuero, as can be seen, average plot size under Mucuna is 79% larger than average plots without it in the postrera cycle and nearly 94% larger than average primavera maize plots In other words, the effect of Mucuna upon planted area in the Cuero watershed has been even more dramatic than at the regional level

Apart from the stimulus provided by the higher yields obtained by employing Mucuna, farmers also benefit from having access to higher prices in the marketplace from the postrera harvest because it is too dry in most regions of the country to produce crops during this season, this contrasts with the primavera cycle when producers all over the country harvest their maize approximately around the same time causing a seasonal price decline during the months of October to December In other words, Atlantic Littoral farmers have a comparative advantage over other parts of the country in the production of dry season crops Thus, for example, farm gate prices for maize in the 1990-1991 postrera cycle were approximately 23% above the average yearly price, compared to the primavera maize cycle when prices were 25% below that average (Sain, Ponce, Borbon, 1993 152)

The other advantage accruing to farmers in the Atlantic littoral from the postrera harvest is the much healthier nature of the crop because it is harvested in dry weather Losses during the primavera are high because farmers must take out their crop at the wettest time of the year when daily rainfall may reach levels of 200-300 mm or more Heavy rainfall in the October-December period also makes drying the maize cobs difficult and as a consequence the grain tends to have a high moisture content This affects the prices received by the farmer Yields calculated by farmers are often derived from on-the-cob estimates, we have used the conversion factor of 66 to arrive at the average grain estimate However, in years of poor harvest, the conversion factor may be higher, producing a lower cob-to-grain ratio (eg 1 5) Farmers commonly refer to the advantages of dry season cultivation because of the lower rate of crop loss From an environmental standpoint the postrera cycle is also more desirable than the primavera since notwithstanding heavy rainfall at the outset the soil surface is covered throughout -- both under the Mucuna system as well as in the slash mulch system, farmers do not burn vegetation because this is perceived as being

beneficial to moisture conservation as well as providing the soil with nutrients Mulching is also regarded as beneficial from the point of view of weed control and the Mucuna system, in particular, is highly valued in this regard as it effectively smothers most weed competitors, thereby reducing the labour-intensity of soil preparation Farmers, however, did not specifically mention the erosion-reduction effect of Mucuna Of more concern to farmers was the potential for land slides in very steep areas where Mucuna was planted Farmers recognized that Mucuna smothered most trees and therefore damaged the root systems that would otherwise help to hold the soil in place, some had planted Gliricidia sepium in their plots which, with some attention, seemed capable of withstanding the tangle of Mucuna vines From an environmental point of view there is clearly a need to develop agroforestry systems around Mucuna when this is planted on steep inclines, as it is throughout the Cuero watershed However, it must also be recognized that even with agroforestry systems in place, there are large areas with slopes that should not be cultivated under any system, other than forest Ensuring this will require community education and community policing

The Primavera Cycle

The primavera or spring cycle takes place after the rainy season begins, generally round mid-June Farmers select parcels for planting and cut and burn them in early May - usually the later the better since regrowth at the time of planting will be less, however, if they wait too long, the burn will be negatively affected by the onset of the rains The maize seed is not actually sown until June, following the bean planting However, farmers did not cite weed regrowth prior to planting as a problem necessitating prior herbicide use as in some regions As it may be seen from the rainfall distribution chart on page ? above, rainfall in the primavera is a good deal lighter than in the Fall and, indeed, at this time is no heavier than rainfall in the semi-arid zones of the country[10]

Farmers in the sample routinely selected secondary forest of three or more years for cutting and burning (71% of the sample) Those selecting secondary forest below this age did so because of lack of access to more mature bush Three years of regrowth produces a large amount of biomass with secondary forest as tall as 15-20 feet and tree girths reaching 6-8 inches Farmers select higher bush because the larger amount of

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[10]In Choluteca, apart from a marked canicula or, veranillo as it is known locally, in July and August when rainfall declines abruptly, rainfall between May and October is heavy - at times reaching levels of 300 cms per month This is also true of other southern and western departments of the country (SRN, N D) However unlike these departments where the rainy season comes to an abrupt halt at the end of October/early November the Atlantic littoral receives northers (cold fronts) throughout the period of October through to February It is these that produce such high precipitation levels in the area rather than the precipitation generated by southeasterly trade winds

biomass translates into a larger store of nutrients, mineralized through burning, to serve as fertilizer for future crops Land that is fallowed for longer also reduces the demand for weed control since grasses are less prevalent than in short fallowed land However, farmers constantly remarked on the abundance of vegetation in the area as a positive factor in milpa-making - not a negative one - notwithstanding the labour intensity of operations which are consequent upon this natural abundance This was generally compared to the dryness (arido) of the areas that they had left behind and the stunted nature of secondary forest development which contributed to low yields in the sending areas Finally, the selection of land which has been fallowed for three years or more allows farmers to better conserve soil fertility, if fallows of one year are repeatedly used, fertility will rapidly be exhausted

Farmers do not just select secondary forest on the basis of height - although they do tend to avoid stunted forest areas Rather they also look for a number of other characteristics in the vegetation that will steer them in the direction of good soils The colour of the vegetation is critical Farmers look for bright green vegetation and avoid the yellowy patches which indicate the presence of redder soils Red soils are regarded as ruined , meaning they have a nutrient deficiency By contrast, dark soils are rich in humus (abono), they are more humid and spongey in texture, with better drainage At a more detailed level, however, farmers look for certain plants to tell them about soil character A list of these indicator plants - both of good and poor soils - was collected from the farmers and then identified with help from a botanist A discussion of these indicator plants and their properties is given in a separate document (See Martinez, 1994) Although farmers are largely from other parts of the country, they generally have botanical knowledge which is also appropriate for identifying plants in the study region Most of the plants present in the area are also present in the low-lying valleys of the western departments (Martinez, personal communication), where the majority of these migrants originate Thus despite differences in rainfall regimes and soils, these migrants are nevertheless the bearers of cultural knowledge that is appropriate for helping them to make decisions within the new environment This is very different to the situation amongst those migrants to the Amazon, discussed by Moran (1985), where pioneers generally have limited knowledge of their environment and consequently tend to select very poor soils

The decision to use fallows of three or more years in the spring cycle makes burning a virtual necessity there is simply too much slash to be able to plant crops Indeed, even with two years of fallow this is true Thus the decision to burn in the spring cycle is virtually universal amongst farmers In addition to the difficulties of planting in so much slash, farmers also cite problems with plant disease particularly maize ear rot (**maiz muerto**) when they fail to burn, as well as animal damage because of the thick cover which provides refuge to forest animals Climatic conditions at this time of the year favour the development of **maiz muerto**, although studies have not proven that burning per se reduces the incidence of the disease - at least not in so far as reducing the presence of the inoculum (Rio and Caceres cited in

Bentley, 1990 23) Several local farmers, however, said that they had experimented and had proven that unburnt milpas (siembras en crudo) increased the incidence of the disease This seems entirely possible if the higher heat and humidity generated by the rotting vegetation serve to make the conditions more appropriate for development of the rot Whatever the case may be, this information is passed onto newcomers who continue to burn notwithstanding the fact that most have been able to observe, in origin and step-migration communities, the ill-effects that repeated burning produces Indeed some clearly articulated that burning year after year affects forest regrowth which eventually deprives the soil of humus, reducing the soil to a ruined arid condition However, yearly burning in the same area does not occur -- as yet Rather it is precisely because farmers recognize that with repeated soil exposure to the heavy rains that all the humus gets washed out (se lava todo el abono), hence the tendency to fallow after each cycle And fallowing produces such a mat of vegetation within a three-year period that farmers feel they must burn in order to be able to plant successfully Thus, until a better system is introduced farmers will continue to adhere to this traditional practice

Apart from the burn, the rest of the activities in the primavera cycle are similar to those in the postrera cycle farmers largely use the same seed (mostly Olotillo, and also some Tusa Morada - two landraces), they plant the same amounts (3-4 seeds per hole), and mostly use the same distancing (2-3 feet between plants) Most people use herbicide for weed control - as opposed to manual cleaning with a machete - both in the Mucuna system and in the forest fallow or milpa system In the former, herbicides are used as much to keep down weeds as to control the regrowth of the Mucuna In the sample, 67% relied on herbicides as opposed to manual control, for the first cleaning, 64% of the sample engaged in a second clearing at 1 1/2-2 months, and of those who did, 80% applied a second dose of herbicide, mostly Gramoxone Herbicides even those specifically designed to kill broadleaf plants, were applied without apparent ill-effect on the longterm health of the Mucuna, farmers claimed that it helped calm it a little, nothing more Very few farmers applied fertilizer either in the postrera or in the primavera

The only noticeable difference in activities the between two cycles is the tendency towards more superficial planting in the primavera The decision around planting depth is a tricky one Farmers must weigh up the odds of seed loss due to animal consumption (birds mice, forest animals) or to germination problems which are worsened by deeper planting If the farmer considers the first scenario to be the most probable he will adopt a deep planting strategy, if it is the second he will choose to plant close to the surface Heavy rains have the effect of clogging up the hole on top of the recently planted grain, preventing seed germination, or alternatively, the hole becomes water-logged and the seed rots By contrast seeds that are planted closer to the surface with a special stick (barreta tendida) which is used to open up a hole angled into the hill face generally avoid becoming water-logged and, in addition get more benefit from nutrients, such as organic matter calcium magnesium, most of which

are concentrated in the top soil However, the seed may also be eaten rather easily as it is rapidly extractable from such a position Deeper planting helps to prevent this and also acts to provide moisture to the seed Farmers using mulch systems, either Mucuna or a slash mulch in the postrera, run a higher risk of animal damage to the seed since mulches provide a refuge in which a host of animals may take cover Needless to say, given this set of circumstances, most farmers (85%) deep plant at this time In the primavera, by contrast, 46% of the farmers interviewed choose to shallow plant because they view the onset of the rains and the risk of a low germination rate to be greater than the risk of animal damage which is reduced by burning the vegetation cover

Future Research

Research might be productively focussed on the use of a cover crop for the primavera cycle in order to reduce the incidence of burning One farmer interviewed in the community of San Francisco de Saco planted the primavera crop in Mucuna directly after harvesting the postrera He did not report a problem with 'maize muerto' In this case, half of his land that was under Mucuna, was kept for the following postrera cycle and half was resown in the primavera The area set aside for the following postrera allowed for the production of Mucuna seed which could be used to resow the plot under use in the primavera, since double cropping and the need to prevent the Mucuna from overrunning the second crop meant that seed production in that plot would be minimal However, the disadvantage of this system was that it reduced the amount of land under Mucuna available for use in the postrera, which, as discussed, is the more profitable cycle Thus, the following year, this same farmer decided to rent land in the primavera in order to leave his whole area for production in the postrera cycle (Triomphe personal communication) This indicates the need for a separate cover crop system - preferably one that is less competitive than Mucuna - for the primavera cycle Farmers, however, are unlikely to abandon the primavera, at least in the foreseeable future, because of the risks involved in concentrating production in one cycle, and because labour is available in the springtime

BEANS CULTIVATION

Beans, like maize are sown principally in the primavera and postrera cycles However, while the most important maize cycle is now the postrera, the principal bean cycle continues to be the primavera In addition, a small number of farmers produce beans in October/November but this is largely for seed production purposes

The importance that farmers' place upon the primavera bean cycle, compared to the postrera, inheres in the higher yields obtained as may be seen below, even though the value of output per unit is considerably higher in the postrera because of price rises at this time

CHART XI

Comparison of Bean Yields and Area Planted, Rio Cuero Farmers

	Av Area/ Farmer	No.	Av Yield Kgs./Ha.	No.
Primavera	65	80	1,187	74
Postrera	44	72	811	56

The Postrera Cycle

Site selection in the postrera takes into account that the beans will likely be subjected to prolonged dry spells during the cultivation period As a consequence, farmers look for humid areas around mountain streams, either on slopes or flatter lands, and at lower elevations relative to the primavera cycle, as will be discussed below Notwithstanding the expectation of prolonged dry periods, more than half of the farmers (52%) reported burning the slash prior to planting as opposed to leaving it as a slash-mulch, even though 95% of the farmers select short fallows of one year only and which therefore would provide manageable ground cover The primary rationale behind the practice of burning the slash is the belief that beans are more susceptible to disease if they are close to rotting vegetation Thus, notwithstanding the expectation of dry weather during the cultivation period, over half the farmers engage in an activity that will be likely to exacerbate the rate at which the soil will dry out The deep-seated belief regarding the desirablity of removing all vegetation from the vicinity of beans may be gauged from the fact that of the three people who planted beans in Mucuna, two of them burnt the Mucuna prior to planting -- something that no farmer would consider doing in the maize/Mucuna system Nevertheless, 48% of farmers do not burn the slash at this time of the year, although for some this has more to do with the impossiblity of doing so, which is governed by the timing of cessation of the winter rains

Probably because of the commonly-felt need to burn the slash in the postrera bean planting, which means waiting until the winter rains ease somewhat, beans are generally planted later than maize with 87% of farmers planting in February, the remainder plants in January 90% of farmers plant Danli 46, a bush bean, although some of these also plant a 50-day bean at the same time and the remaining 10% of farmers prefers to plant only faster maturing varieties (50 day varieties) Unlike the predominance of deep-planting in maize production, 98% of farmers shallow-plant beans in order to avoid germination problems stemming from too much rainfall in the first week after planting and because animal damage is generally minimal with beans Moreover, farmers believe that beans root better in the looser top soil and also grow more quickly with more foliage, because of the concentration of nutrients contained in this top layer Surface planting also helps ease the task of uprooting at harvest time The predominant pattern

of planting four [illegible] per hole [illegible] is related to the expectation that germination will be less than 100% Finally, 78% of farmers employ a planting distance of one foot between plants This distancing reflects farmers expectations about the more limited size that plants will achieve in this cycle, in comparison with the primavera cycle in conjunction with the desire to provide soil cover in order to limit weed growth

Unlike maize cultivation, herbicides are not employed with beans Farmers weed only once by hand, at three weeks, with a curved scythe or machete The former, when used in conjunction with a slash-mulch, is employed under the mulch to sheer off the weeds without exposing the soil When the beans are ready for harvesting, the plants are uprooted and generally left to dry on the ground Occasionally, if the weather is wet, they are strung up in bundles and suspended between two trees, however, the latter practice is much more time-consuming and if the weather is sufficiently dry is not required Finally, the beans are beaten free of the pods on a large canvass supported between four poles

The Primavera Bean Cycle

Unlike site selection in the postrera which is oriented towards finding areas capable of moisture-retention, the main goal in the minds of farmers in site selection for the primavera is how best to get rid of excess moisture Farmers overwhelmingly select high areas on very steeply-sloped hillsides to encourage rapid run-off of rainfall In addition, east-facing slopes are chosen in order to receive the sun at sun rise which allows rainwater, which has collected on the plant from the previous day's rainfall, to evaporate before the heat from the sun cooks the water and the plant with it, on sites that receive the sun later on in the day this is effectively what occurs Soil should ideally be stoney and crumbly in texture and the soil colour dark, clayey soils are considered to be no good at all for producing beans because they retain too much water and hence, help to increase water-logging and relative humidity

Farmers use a well-developed fallow of minimally two to three years, but preferably longer fallows of four years or more The plot is slashed in April and burnt before the rains are expected to arrive in May Plots which are high up and well-exposed to sunlight, dry more quickly and hence burn better And a better burn means less weeds and less disease according to farmers 85% of the farmers plant in May as soon as the first rains arrive Those who plant later in June or July often use a faster-maturing variety, the majority, however, use Danli 46, as in the postrera cycle which takes 2 1/2-3 months to mature Farmers, aim to have their crop in before the heavier rains of the Fall begin in September

As in the postrera, shallow planting is engaged in by nearly all farmers (97%), and 87% put four grains into each hole Planting distance, however, is wider than in the postrera with 87% of farmers leaving 1 1/2-2 feet between plants The rationale for this is the expectation of greater plant development is a consequence of the longer fallow period in combination with heavier rainfall and the need to provide the space in which this growth can occur Too little space between plants farmers believe, will increase moisture retention and relative humidity which is likely to provoke hielo

or Web Blight as well as helping to cook the plants Finally farmers have a tendency to plant with the slope because of the difficulties of contour planting on very steep inclines balancing themselves on the slope contours is more difficult than planting from bottom to top This practice, needless-to-say, aggravates the problem of erosion caused by the decision to plant on such steep inclines

As in the postrera, farmers employ only one cleaning at three weeks (92%), which is done by hand -- either machete or curved scythe At maturity, the beans are pulled up, tied by the stems and formed into bunches which are hung upside-down to dry on a line strung out between two trees The drying process takes three to four weeks and is undertaken because of difficulties of drying the beans during the rainy season If the daily rains are too prolonged and heavy, however, farmers risk their beans sprouting and of losing the harvest Once the beans are dry they are beaten with sticks to remove the shells, bagged and taken by mule to the farmer's house

October Cycle

Bean seeds from the primavera harvest will not last, under current post-harvest storage arrangements, until the postrera planting Farmers say they do not germinate well Hence the October planting is intended to provide fresh seed for the postrera cycle However, few farmers engage in it because yields are so low and those who do generally fail to obtain more seed than that planted, nevertheless, at a minimum farmers obtain fresh seed Planting conditions are similar to those selected for in the primavera although in this case the slash is generally too wet to burn The best soils for this very wet cycle are sandy soils which facilitate drainage

Farmers who do not plant in October must generally buy fresh seed, either from one of the farmers who did plant or from outside the area This sometimes leads to the sowing of inappropriate material or may involve travel to communities with a reputation for producing good bean seed, viz Rio Viejo in the Cangrejal Valley behind La Ceiba or some of the Yoro communities on the far side of the cordillera where rains are less heavy In general, however, there is a serious shortage of seed for planting in the postrera because of the length of time between plantings and the lack of adequate storage capacity for seed maintenance

Future Research Areas

The data collected on beans cultivation shows it to be an area requiring urgent research because of the serious consequences of current production The cultivation of beans is harming the environment because of the conditions under which farmers feel obliged to produce them in order to avoid disease, most seriously Web Blight Unlike the postrera maize cycle there is no covercrop system widely employed with beans and the few who do use Mucuna for this crop, tend to burn it because of disease concerns Bean germplasm has been consistently selected for the drier parts of the country while material more tolerant of the heat and humidity of the region is not available This forces farmers to plant on the highest, steepest slopes without any soil protection

during the rainy season As more and more migrants are driven from the drier parts of the country in search of land in the humid tropical hillsides these fragile hillsides will be subject to increasing degradation from traditional crops particularly beans that migrants will not easily abandon notwithstanding the lack of appropriate resources for producing them in the new environment

In spite of the lack of appropriate technology, bean yields compare very favourably with national averages, for example, average yields in Honduras in 1989/91 were 736 kgs/ha -- up from 595 7 kgs/ha in 1969/71 and 517 5 kgs/ha in 1979/81 (CIAT, 1993 67), while averages in the littoral area (in the years where information is available) were 1 1 tons/ha 1975/76 and 810 kgs/ha 1977/78 (SRN 1980 20, 21), indeed, in the late seventies, the Atlantic littoral had the highest bean yields in the country (SRN, 1980 10) As discussed in Chart XI above, in Rio Cuero average yields are 1,187 kgs/ha and 811 kgs/ha in the primavera and postrera, respectively Bean trials conducted through participatory research with farmers in Rio Cuero produced an estimated 1,817 kgs /ha from one of the varieties This suggests considerable potential for bean production for the region Indeed, one study estimates that 48% the beans consumed in La Ceiba, the country's third largest city, comes from a few watersheds in the Atlantic littoral area, not far from the city (Matute, 1992 36)[11] Moreover, because north coast farmers harvest in May and August as opposed to November when the majority of the farmers put their bean crop on the market, they avoid low prices due to seasonal market gluts[12] Thus, Atlantic littoral farmers generally have a comparative price advantage in beans production in Honduras The issue is how to make bean production compatible with the need for environmental conservation

The question of post-harvest storage is vital because unless beans can be conserved from August until the February postrera planting, farmers will be forced either to buy what sometimes amounts to inappropriate seed from elsewhere, or to plant in October The latter option, which occurs when the rains are at their heaviest

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[11]According to Matute, 9 67% come from Piedras Amarillas, 37 11% from Yaruca, and 1 61% from Yaruca Descombras (1992 35) These figures do not take into account a number of other watersheds in the vicinity, such as Rio Cuero, which are also bean producers In addition, according to Matute, 19 34% of the beans arriving in La Ceiba orginate from Colon As with the area under discussion, Colon lacks appropriate bean germplasm This suggests considerable potential for the northern region in bean production given the development of germplasm which is humidity tolerant

[12]In August, however, North Coast farmers must compete with farmers from the main bean producing areas, viz Paraiso F Morazan and Olancho, where there is also a harvest at this time Moreover, these farmers benefit from the presence of the canicula in their area which enables them to harvest the beans during a relatively low rainfall period, the canicula is not apparent in the north and therefore beans from the area are of a lower quality

however, should not be promoted - at least not on the hillsides, where erosion and landslides could not be contained at this time Instead, technology should be sought to allow farmers to conserve seed which maintains moisture at constant levels Experiments are currently being conducted with the farmer research team in Cuero in order to compare germination rates under three different kinds of storage systems

RICE CULTIVATION

According to respondents, rice is produced by only 13% of farmers, however, this may be underreported because it is mostly cultivated in only very small amounts for household consumption and therefore goes unrecorded The low rate of cultivation is culturally as well as environmentally determined, however, most importantly it is determined by cost factors

Migrants from the western departments are mainly maize and bean producers and consumers, as might be expected given the Maya tradition, and rice does not play a pivotal role in this, this is in contrast to the coastal diet in which rice is the principal staple Most migrant families consume rice but only in approximately equal proportion to beans -- the main protein source and a much higher value crop Maize tortillas are the preferred starch accompaniment to beans

Since maize and beans are the preferred foods, families are less willing to devote time to rice production which coincides with peak labour demands in the production of the other two crops Rice is sown in May after the first rains and, depending on the variety sown, is either harvested in August or October/November Either way it competes with the primavera harvests of beans and maize Moreover, most local farmers claim that rice can only be successfully produced in well-burnt forest fallows, short fallows do not function to guarantee a good rice crop While the need for fertile soil may be partially responsible for the demand for forest fallow for rice, most importantly, it is the issue of weed control which determines farmer decision-making Competition from weeds, and particularly grasses, such as Rotboelia cochinchinensis, which are more pervasive in shorter fallows, makes rice production too labour-intensive, or too costly if herbicides are employed, to be worthwhile -- given the cultural preference in favour of maize and beans

Nevertheless, in areas of forest fallow, rice is the preferred crop since the land is considered to be too humid for either maize or beans and farmers will often sow rice in the first cycle after deforestation However, once that is completed and farmers begin to rotate their land around shorter fallows, rice is likely to disappear from the system Those who do continue to cultivate rice tend to plant on soils that retain moisture well such as somewhat clayey soils, some people even use coloured soils (red soils) In other words rice does not generally compete for land with the preferred maize and beans crops since these are not planted under the same soil conditions

Finally, rice, like other spring cycle crops, is harvested in wet weather This reduces the quality of the crop and the price the farmer will receive for it The Atlantic littoral is a substantial rice producing region Rice is mainly produced on lowland properties along the coastal plain and many of the producers are large viz farmer cooperatives and private producers, and therefore local intermediaries are accustomed to buying in volume As a consequence the small upland producer whose grain is generally of a low quality has no bargaining power with buyers at harvest time Moreover, most lowland producers face lower cost curves due to mechanized production and much lower transportation costs This latter issue is particularly critical since upland rice producers typically are far from the main road In other words, those producing rice at the forest frontier, where environmental conditions are considered by farmers to be most suitable for this crop because of lower weed competition and greater humidity, must pay the highest transportation costs based on location As a consequence rice is simply not profitable and is infrequently produced for sale

OTHER FOOD CROPS

In addition to the principal food crops discussed above which are eaten on a daily basis, many farmers also grow root crops, especially cassava, as well as bananas (guineos) and chayote (pataste, patastillo), for household consumption, these crops are almost never sold The tendency is to grow them close to the house where they can be harvested as the need arises They can also be planted at more or less any time of the year and therefore do not compete with labour at peak times Moreover, owing to the close proximity to the house, women and children are more likely to be employed in some aspects of cultivation (viz harvesting) thereby avoiding the withdrawal of male labour from grain crops

COMMERCIALIZATION OF GRAIN

Farmers sell the portion of their crop which is not being retained for household consumption directly after the harvest This prevents spoilage and price reductions consequent upon the poor quality of the grain Grain to be stored for household consumption, particularly beans, is normally dried for longer periods - ideally to around 12% humidity to prevent it from becoming wormy, this extra drying is not undertaken for the entire crop because of the difficulties of patio-drying a large amount of grain As a consequence, spring crops taken out during the rainy season, are subject to price reductions because of the high moisture content This is especially true of spring maize since the local harvest coincides with havesting time in the rest of the country where conditions are better owing to the cessation of the rains much earlier than on the north coast

Residents of the Cuero and Santiago watersheds all factor in the cost of transportation from their fields to their houses and also from the household to the

main road where prices are more competitive than in the villages As discussed at the outset households are generally grouped together at lower elevations and farmers' land is distributed up the hillsides The more valuable the land is closer to human habitation and access routes, the poorest farmers tend to have land that is two hours or more from their houses Still others prefer to live closer to their land up near the source of the river Cuero even though this means that their children will not be able to attend one of the schools because of distance and difficulties in crossing rivers Either way, farmers must pay a good deal for transportation to markets

Families who have lived for some time in the watershed generally own their own mules, mules are a critical resource since without them families must rent from others and during harvest periods the cost of rental rises with demand For those who live high up in the watershed above the community of San Marcos, the cost of transporting a sack of maize of 200 lbs (carga) by mule to the main road in the Fall of 1993 was equivalent to approximately one-quarter of the crop's sale price A mule costs around US$250 (2,000 Lps) which is a large expense for most families whose entire average annual income may be no more than $600 (see below) Those without their own animals often sell to buyers in Santa Fe, which is accessible to trucks or tractors during the dry season (February-May) and sometimes until later in the year, depending on the rains These buyers simply deduct the cost of mule transportation from the final price

Most of the more recent arrivals, however who are landless and rely on rented land for planting their crops, do not own their own mules they have neither the capital nor the land on which to pasture animals It is these individuals, who pay the highest rents on capital, who are most negatively affected by the poor communications of the area Nevertheless, amongst all those interviewed in the communities of San Marcos and Santa Fe, the most pressing community problem was considered to be the lack of an all-weather road connecting the communities with the lowlands Residents seemed unconcerned, or oblivious to the fact, that a road would undoubtedly increase the amount of cattle ranching in the watershed with negative effects on the landless and indeed, ultimately on the forest, as small farmers and the landless find themselves forced further afield in search of land for crop production

COSTS OF PRODUCTION

Maize Costs in the Postrera Cycle with Mucuna

Land Rental Mucuna plot		150 Lps
Land preparation (8 man-days)		120 Lps
Planting	(4 man-days)	60 Lps
Seed	(25 lbs)	20 Lps
Cleaning 1st	(2 man-days)	30 Lps
	(herbicide - 24D)	30 Lps
	(backsprayer rental)	30 Lps

Cleaning 2nd	(2 man-days)	30 Lps
	(Gramoxone)	45 Lps
	(backsprayer rental)	30 Lps
Doubling	(4 man-days)	60 Lps
Cob harvest	(6 man-days)	90 Lps
Transportation by mule to house (based upon av yield of 24 cargas on the cob)		
	(12 mule days)	240 Lps
	(4 man-days)	60 Lps
Shucking	(12 man-days)	180 Lps
Transportation to point of sale (16 cargas at 20 Lps per carga from above San Marcos to main road)		320 Lps
Total Costs		1525 Lps
Total Sales based on av sale prices - on main road - in Spring 1994 of 140 Lps/c and av yields of 16 cgs /mz		2240 Lps
Profit/mz		715 Lps
	In US$/ha	$107

Maize Costs in Slash/Mulch System

(Costs in Slash/Mulch system are slightly less than in the Mucuna system because of lower land rental costs, and lower harvesting/transportation costs based on lower av yields Nevertheless land preparation costs and weed control costs are slightly higher than with Mucuna)

Estimated Costs	1,185 Lps
Total Sales based on av sale prices 140 Lps and av yields of 11 78 cgs /mz	1,649 Lps
Profit/mz	464 Lps
In US$/ha	$69

Primavera Maize Cycle

The primavera maize cycle is more labour-intensive than the postrera cycle in land preparation (slash and burn) and sale prices are lower Costs are marginally higher than the Slash/Mulch System

Estimated Costs	1,158 Lps
Total Sales based on av sale price 100 Lps and av yields of 10 75 cgs /mz	1,075 Lps
Loss/mz	[83]Lps
(October 1993 exchange rate 7 Lps/$)	
In US$/ha	[$ 12]

Not surprisingly, farmers who plant large areas in this cycle using hired labour complain that there is no money in it Indeed, there is not and farmers take a loss However, since most are employing family labour, this is not evident Interestingly all farmers who provided information on production costs put a price on labour-time

Bean Costs in the Primavera Cycle

Estimated using local measurements (to be adjusted to hectares and US$) (US$=7 Lempiras, August, 1993)

Cost of rental of one manzana		100 Lps
Cutting and slashing fallow	(approx 16 man-days)	208 Lps
Burn	(2 man-days)	26 Lps
Seed	(100 lbs)	250 Lps
Planting	(6 man-days)	78 Lps
Cleaning	(3 man-days)	39 Lps
Pulling up, bundling and stringing for drying	(5 men for 5 days, i e 25 man-days)	325 Lps
Beating, shelling and bagging beans	(3 men for 4 days, i e 12 man-days)	156 Lps
Transport by mule to house	(5 mule-days)	65 Lps
	(2 muleman-days)	26 Lps
Transport by mule from San Marcos to main road (11 cgs @ 20Lps each)		220 Lps
Total Costs		1493 Lps
Av selling price August/93 (330 Lps /cga)		3630 Lps
Estimated profit based on av of 11 cargas/mz		2137 Lps
Estimated profit/mz in US$		$305
	US$/Ha	$365

Postrera Bean Cycle

Estimated average costs/mz for postrera cycle (derived from lower land preparation costs and lower labour/transportation costs based on lower yields) Prevailing exhange rate=8 Lps/US$	1150 Lps
Av selling price May 1994 (530Lps/cga) x Av yield of 7 5 cga/mz	3975 Lps
Estimated profit/mz	2825 Lps
Estimated profit/mz in US$	$353
US$/Ha	$422

ESTIMATED AVERAGE HOUSEHOLD INCOME AND CONSUMPTION DERIVED FROM GRAINS PRODUCTION

In order to estimate household income and consumption we defined a modal household derived from information on 31 households where we had detailed consumption data Since the average number per household in this smaller sample was 7, rather than 6 as in the larger sample (127), the consumption figures are somewhat overestimated, hence we have adjusted them downwards to take this difference into account

Based on the subsample, we compiled an index in which children in school and preschoolers were given half a point, as were non-school children under the age of 12, the rest of the sample population was given a full point This index yielded a modal household comprising 5 5 consuming units, this was adjusted to 4 7 consuming units in order to calibrate it to the average household with a membership of 6 people

Average Maize Consumption/Household	11 42 cargas
Average Beans Consumption/Household	2 71 cargas

Average Beans Production per Household

	Av Area	Av Yield	
Postrera	53 mz x	7 43 cargas=	3 93
Primavera	78 mz x	10 94 cargas=	8 53
Total Produced/Household/Yr		=	12 46 cargas

Average beans receipts/household
(Profits after consumption = US$325
based on adjusted prices)

Average Maize Production per Household

	Av Area	Av Yield	
Type 'A'			
Mucuna syst	2 33 x	16 3 cargas=	37 98
Primavera	1 2 x	10 75cargas=	12 9
Total produced/Type 'A' Household/Yr		=	50 88
Type 'B'			
Slash mulch	1 3 x	11 78 cargas=	15 31
Primavera	1 2 x	10 75 =	12 9
Total produced/Type 'B' Household/Yr		=	28 21

Average maize receipts/household
(Profits after deducting consumption)

Type A (Mucuna) Households	=	209
Type B (Non-Mucuna) Households	=	75

*It is assumed that the primavera harvest is consumed since this is produced at a loss and that the postrera is sold

Maize Income (Mucuna system)	=	US$209
Maize Income (Slash system)	=	US$ 75
Beans Income	=	US$325

Income Beans/Maize-Mucuna Household	=	US$534
Income Beans/Maize-Slash Mulch Households	=	US$400

In reality, since most farmers are not paying labour costs, nor rents on capital (land, mules, etc) cash income will be higher than this This represents the minimum that is likely to be earned If the value of food consumed is added to this, the value of farmers' production was $899 or $755 However, since purchased grains are necessarily priced above those of grain sales, the real value of production - once imputed consumption costs are included - is higher than this This amount is superior to that earned by villagers working on the road in the watershed (about 40 people), which nets them only $686 Moreover, since the road crew is never paid on time, most workers are forced to sell their monthly pay vouchers to intermediaries who forward them a percentage of their pay cheque and keep the other percentage for themselves - whenever it comes through This reduces the annual salary for road building to around $500 However, in reality most of those working on the road also produce their own food either by assigning the task to other family members or by working themselves on weekends

CATTLE PRODUCTION

Cattle production in the area is essentially of two kinds that which is carried out by people living in the lowlands who pasture their animals in the hillsides and that which is carried out by migrants who live in the watershed itself The former is part of a larger system of production which is oriented towards selling milk to the Leyde dairy in La Ceiba, the latter is generally small in scale and is mainly for the production of milk for sale in the watershed and/or for the manufacture of cheese which is sold in the lowlands once a week

The production of milk for sale in the national market demands access to the main road artery that runs along the coast where the milk collection centres are located Most of the milk will be sold to the Leyde factory although there are some smaller dairies which are mainly involved in cheese manufacture In order to understand the nature of cattle ranching in the area, it is necessary to analyse the structure and history of local milk marketing

Leyde was founded in La Ceiba in 1972 by two partners with a start-up capital of US$15,000 and it initiated operations the following year with 30 suppliers At that time production was in the order to 5,000 litres per day Prior to the opening of the Leyde factory, milk production was generally in the hands of small dairies The most important in La Ceiba was Inlacta which was later absorbed by Leyde Inlacta was itself purchased from from the Standard Fruit Company which had previously run the dairy for the use of its employees By 1974, however, Leyde was buying 3 000 000 litres per year and this had risen to 35,000 000 litres by 1989 (internal document Leyde, p 43) (See

Chart XIII on the following page)

Most of Leyde's output is sold on the domestic market although some of it is exported by special contract to Nicaragua, Salvador and Guatemala However, Leyde does not claim to have an export policy and their products are not available generally in the stores outside of Honduras Nevertheless, milk, processed into cheese, is sold by other smaller local manufacturers outside of Honduras, particularly in El Salvador Smaller dairies buy milk from local producers to make 'quesillo', or small cheese, an intermediate processed cheese, which is reprocessed for sale, particularly in El Salvador Trucks from El Salvador which arrive in the north coast to collect bananas, pineapples and other tropical fruits, will also carry such milk products back with them Local milk producers remark on how prices change depending on whether it is raining or not in El Salvador when the dry season begins there, milk prices rise and vice versa In this way, north coast producers who benefit from the year-round availability of pasture, supply the semiarid zones of the isthmus, such as El Salvador

Nevertheless, the majority of larger milk producers sell their output to Leyde which, at the present time has 2,500 suppliers who produce approximately 250,000 litres per day, or on average, 100 litres per supplier By selling to Leyde these

CHART XIII
MILK PURCHASES BY LEYDE DAIRY, LA CEIBA, BETWEEN 1973-1990

producers benefit from technical assistence, especially in the area of animal reproduction, health and hygiene, and credit for feed stuff, equipment, etc , the cost of which is amortized over the bi-monthly receipts received by the farmer from his sales minus the cost of transportation The milk is handed in to Leyde at one of five collection centres or via the milk trucks which work in the recieving area This takes in all of the department of Atantida, the eastern section of Yoro and the accessible areas of Colon (viz Tocoa, Sava, Corocito) Collection centres are located in Jutiapa, Olanchito, San Juan Pueblo, Lean and Hicaque and a sixth is being completed in Tocoa These centres have the capacity to receive between 15,000 and 30,000 litres each

The majority of the producers who sell to Leyde are also share holders of the company Thus the organization functions in much the same way as a cooperative whose members receive a share of the profits on a yearly basis - following a ten-year waiting period after buying into the company At the present time Leyde is poised to begin the construction of a separate cheese-making facility which suggests that in the future the company will begin to move into the area that the smaller cheese producers previously occupied - which may include exporting to neighbouring countries

The nature of commercial milk production makes it essential that larger milk producers be situated close to the main ateries through which the milk truck passes Thus the majority are located in the lowlands However dry cows, belonging to the larger owners, are increasingly being pastured up on the hillsides where they are

maintained until being brought into production again These larger owners rarely live up in the watershed but rather will hire migrants to look after their animals while they run milking operations in the lowlands It is these bigger farmers, who sometimes own several hundred hectares where they may pasture up to a similar number of cows, who are responsible for much of the rise in prices of the flatter hillside properties located near the rivers, which, as mentioned earlier may be four-times the price of the land on steeper slopes Small farmers with flatter properties mentioned constant pressure on them by the larger producers to sell their lands And, for a small crop farmer, an offer to buy his land at four times the price of a neighbour's property, may just be too tempting to resist

Local cattle owners who live in the upper watershed itself are likely to have far fewer head of cattle, mostly because they are too poor, but also because they do not have access to the milk collection centres - which may be 3 or 4 hours walk away These farmers generally have to convert their milk to curds for cheese-making This means producing curds on a daily basis and making them into cheese once a week for sale in the lowlands Farmers receive around US$1 per pound of cheese It takes approximately 6 litres of milk, the average daily output of a local milking cow, which is worth about 22 cents/lit , to make this The wey residue is used for fattening pigs Some of the milk may also be sold up in the watershed Cows stay in milk production for upto 7-8 months after calving and local farmers typically have only one-quarter of their animals in production at a time although most cite 50 50 as the ideal ratio between dry and producing animals

Small farmers aspire to owning cows because the work involved in looking after them is so much less onerous than hillside crop production and much lower risk For example, if farmers have three animals in production producing 15 litres of milk per day between them, which will yield approximately 15 lbs of cheese per week, farmers will earn $780 per year from sales (assuming there is constant milk production over the year) In addition there will be the sale of young bullocks - maybe two per year - which will bring in another $280 Labour inputs involve one daily milking, bathing every 8-10 days, and various veterinary exercises, such as deparatization, vaccination, plus two weed control sessions per year to maintain the pasture area
This will yield the farmer close to what the average family produces from grains, once the consumption bill is included, with considerably less expenditure of effort

However, the average amount of land required for producing grains is considerably less than that required for cattle production, as currently organized, even taking the fallow periods required for grains production into account Farmers estimate about 2 manzanas (1 7 hectares) per head of cattle or 24 mz for our hypothetical herd of cows in comparison to around 10 mz to produce the average yearly area under grains including fallow areas Once farmers have acquired the necessary start up capital, however, it is relatively easy to build up the herd The main constraints are the steep nature of a good deal of the land which makes it generally unsuitable for pasture and the distance from the main road which makes fresh milk sales problematic The major

dynamic in both the Cuero and Santiago watersheds is towards the development of dairy herds - either small herds for local farmers or much larger herds for lowland farmers seeking land for maintaining dry animals The less labour-intensive nature of dairying, as currently practiced, contrasts strongly with hillside cropping systems which demand considerable amounts of labour and, perhaps more importantly, back-breaking amounts of labour Anyone who has watched a hillside farmer hauling sacks of grain up 80% slopes can readily understand the deeply-felt desire that many have to switch to cattle production Moreover, the risks from inclement weather are so much lower with cattle than with crops Even transportation, despite the problems with milk, are surmountable since cheese-making provides an option Unfortunately, cattle production, as currently practised, does not absorb sufficient amounts of people to provide an economically sustainable system for the region

An improvement in pastures could increase stocking rates, however, without ready access to markets there would seem to be little incentive for larger farmers to adopt such intensification practices in the hillsides However, pasture improvement in the flatlands might obviate the need for pasturing in the hillsides as well as reducing the time between calvings At the present time, most farmers employ Guinea grass (Panicum maximum), African Star Grass (Cynodon niemfuensis?), signal grass (Brachiaria brizantha?) and Alicia (?) as well as pasturing their animals in guamilo, or in other words, in low secondary forest regrowth A few farmers also employ Napier or King grass ( ) but only one interviewed used it as a cut-and-carry system as opposed to a grazing system This farmer claimed to have raised milk output by 25% as a consequence of maintaining his animals stabled and cutting and chopping the fodder Moreover, while under his previous extensive form of production (1 animal to 2 mz), only one person was employed per 18 mz , under the cut-and-carry system which allowed for 6 animals per mz , labour demand rose to 1 person per 3 mz or, in other words, six times previous levels However, in this case the farmer, who lived in the community of Santiago Arriba (which is easily accessible to the mainroad), carried out all the chopping activities himself, one wonders if larger farmers would be interested in such a labour-intensive system which clearly requires far more intensive management Moreover, such a forrage system requires nitrogen inputs since the absence of animals in the system means that urea and other animal excretia are not being returned to the soil

SMALL LIVESTOCK

Pigs and chickens are commonly found in the economies of most households in the area, although the poorest households may only contain the latter While pigs generally represent a form of saving for most families - akin to putting money in the bank - which serves in particular as an emergency fund against illness and other unexpected demands for cash, chickens are kept mainly for the day-to-day consumption of eggs and the occasional consumption of meat by the household, poultry and egg sales,

however, do occur, particularly in the poorest households where nearly all the eggs may be sold rather than consumed by the domestic unit Most families interviewed however do not consume meat (chicken or pork) more than twice a month at the most, unless this is supplemented with local game Where there is a hunter in the household, game from the forest may be eaten with a certain regularity

The care of small livestock falls into women's domain since these are located close to the home where women may easily combine childcare with productive activities There are few women[13] who work in crop activities because of the distance of these activities from the villages This is associated with the nucleated nature of settlement patterns, discussed earlier in the document, in combination with the extensive nature of agriculture The raising of small livestock and the cash which it generates, either through the sale of meat or of eggs, provides women with a source of income, over which they generally exercise control This may be used for the purchase of household necessities (matches, cooking oil, washing powder, etc) but most importantly it is often used for medicines and food supplements for children such as dairy products which might otherwise be omitted from the weekly household shopping list when this is purchased with funds obtained from the sale of grain or from labour activities In other words, women's income allows for purchases which might not be undertaken when the proceeds come solely from income generated by men

While nearly all those interviewed regarding small livestock - both men and women - wanted to increase the number of livestock owned by them in order to improve family nutrition and raise cash incomes, they identified a number of serious limitations in so far as doing this was concerned The most frequently cited problem associated with raising the number of pigs was the damage that pigs wrought upon neighbouring properties, and the social tensions that this in turn engendered within the community It was not uncommon to find machete wounds on pigs as enraged neighbours whose property had been damaged took out their anger on the animals rather than confronting the pig owner directly Many of those interviewed cited the need to build pig pens in order to prevent pigs from rampaging over neighbouring properties, nevertheless, virtually no one ever engaged in this activity The reason is simple it costs much more to feed pigs once they are fenced in than when they can roam freely around the house eating refuse and human waste The same argument pertains to chickens, although in this case, it was not damage to neighbouring properties but rather damage to the

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[13]The few women who did work in cropping activities were to be found amongst early migrant families - the wives and daughters of the pioneers This was particularly true of some of the women in Santiago In this case, however, the strong family networks provided the women with a good deal of childcare support which wasn t always readily available to women in the other communities These same women also worked in bringing felled logs downstream - a dangerous occupation which recently led to the death of someone in San Marcos

animals themselves, caused by mountain cats, which necessitated the building of chicken coops

Resistence to fencing in animals is primarily related to the issue of economic risk given the high incidence of mortality and disease amongst small livestock While having a few animals, which eat refuse and human waste supplemented with maize, represents a low investment, this is no longer the case once larger amounts of animals must be fed on scarce foodstuffs which might otherwise be consumed by humans The most frequently cited illnesses are cholera in pigs and pox in chickens While most people knew that vaccination could prevent the latter, most did not have the funds to buy the vaccines, while the lack of refrigeration made the efficacy of the vaccines questionable in many people's minds

Feedstuff for small livestock - outside of waste products - consists mainly of maize (although some people fed a variety of root crops eg yams, cassava, taro, as well as bananas to their pigs) which, as already discussed, is produced by the males of the household This means that small livestock production, which is women's work, is ultimately dependent on output from men Increasing women's income, therefore, depends upon men's cooperation, namely willingness to increase output or, alternatively, to reduce direct grain sales and hence, the income which normally accrues to them -- which may or may not go for household use The high rate of alcoholism amongst men in the communities means that a good portion of income earned by them is not directed towards the wellbeing of the household Thus, while men and women in general stated that they wanted to increase the livestock under their control, and hence, household food supply and income, this may not be possible without making other changes in the system of landuse and social organization

The COHDEFOR/CIDA forestry project tried to organize women into groups around different projects, which included collective poultry undertakings As with virtually all collective endeavours, it was not a success Independent of the questionable wisdom of employing commercial feedstuffs and pure-bred chickens from outside the area -- given the circumstances of the communities -- the difficulty of organizing women to perform collective activities was insurmountable These poor Honduran women exercise so little control over their own lives that being able to absent themselves from the household at agreed-upon times was impossible As a concequence, only a handful would show up at any given time leading to conflicts between project members and the eventual dissolution of the group The project now works with individual women, however, without addressing the fundamental conflict of interest between men and women over the destination of grain crops

One possible way to overcome this conflict would be to position women to produce their own animal feedstuff However, this would have to be accomplished in a way that was compatible with their domestic responsibilities One promising avenue that we examined was the production of pigeon pea (Cajanus cajan) which, because it is bush-like and grows quite high off the ground, could be produced close to the house and yet out of the range of the poultry It could also be used for firewood and hence would

reduce the labour involved in its collection (although this is not women's work in the area) Bananas for use in fattening pigs, normally grown close to the home, provide another good example, cassava also has this potential since it is likely to be grown nearby where it can be harvested at any time Another alternative is to examine whether green manures, such as *Mucuna beans*, can be safely processed into feed CIDICCO is currently doing experiments in this area Cowpeas (Vigna unguiculata) offer another option, although there may or may not be a conflict between the crop as food versus fodder, depending on cultural values since some groups hold it in low regard while others place it on a par with beans However, our experiments in the area with several varieties of cowpeas showed them to be so productive and disease resistent that conflict over output would seem to be unlikely -- independent of *cultural preference* If manures can be employed as feedstuff, as well as providing nitrogen for grains, grounds for a conflict of interest would be reduced and hence, women's income increased

Other Female Activities

In addition to the care of livestock, women also derive small amounts of income from the sale of bread in the communities, a few wash and sew clothes, and, in the more prosperous households where there are cows, women are also involved in cheese-making Recently, substantial numbers of women, along with children, have also been involved in harvesting Tabasco chile peppers, a new commercial crop in the region, which I shall discuss in a later section This activity is mainly carried out by women and children because men are said to be too impatient to do it well The work requires a good deal of manual dexterity and fortitude in the face of pepper burn In 1994, following the success of a few innovators the previous year who introduced the crop to the watershed, many producers began to produce it which put considerable pressure on labour supply at harvest time As a consequence wages were forced up to 40 centavos/lb which meant that women and children could make around US$2 5 for half a day's work, which was in fact above what men were earning (20 Lps compared to 15 Lps) However the harvest encompasses only a two month period at the end of the dry season

Production of Tabasco peppers is likely to grow considerably in the future opening the way to higher wages due to labour supply shortages at harvest time, this will provide new income-earning opportunities for women and children

Finally there is some outmigration of young women to work as domestics nearby in La Ceiba or in Tela These are either single women or single parents In the latter case, the women leave their children behind with their mothers For the most part, as in other frontier areas (Townsend, 1993) however there are few local income-earning opportunities available to women The isolation and distance from markets make commercial undertakings *extremely difficult* especially given the cultural trappings of machismo which mean that women are subject to constant suspicion from their spouses, making even short absences from the home difficult to arrange Most importantly, however women are simply not in a position, because of their high fertility, to accept

work outside the home, while the absence of employment opportunities means that there is little incentive to try to regulate fertility should the option become available

FORESTRY

Forest conservation, in the absence of an effective national or municipal policing service to prevent unauthorized interventions demands that local communities derive benefits from common property as a incentive to preserve it for the common good In Honduras, the notion of protected areas, is simply that a notion -- there is no effective institutionalized means of enforcing legislation designed to prevent incursions into the country's forests The most efficient deterrent appears to be a military presence although in the area of study this has only been sporadic Nevertheless, the few weeks that members of the local battalion did spend high up in the Cuero watershed in 1993 and 1994, showed this to be a highly effective weapon against deforestation Informants bent on deforestation all commented on their reluctance to go ahead with their plans for fear of reprisals by the military A well-trained 'green brigade' for forest protection would seem to be an excellent institutional development - independent of collective policing of community forests

The necessity for outside support for community forest protection stems from the fact that new migrants to the area, as well the offspring of ealier migrant families, have goals which conflict with those of established migrants whose livelihood is partially dependent on logging This leads to tremendous tensions within the communities that might be more easily resolved with outside mediation On the other hand, the community of Santiago, which alone has prevented outsiders from deforestation in the community forest, represents a case of successful community resolution of a serious problem However, as already mentioned, this method may have tragic consequences as when a member of the woodcutters co-op recently killed a poor rancher over a dispute involving deforestation

The whole question, however, of forest conservation raises tremendously difficult ethical issues when one is discussing the right of extremely poor people to a make a livelihood and support their families To deny these people their basic human rights is simply not tenable and environmental NGOs whose only concern is conservation are making a serious error However, it is also true that these migrants infringe on the rights of other poor people, those who make their livelihoods in the forest This is a particularly thorny issue with indigenous people who have historically lived in these forest areas and who face massive incursions into their communal lands from 'ladinos' from the west This conflict cannot be resolved at the point of in-migration it has to be tackled at the source This means dealing with land use issues in the west - particularly the issues of extensive cattle production and environmental degradation it means an active campaign dealing with reproductive health issues for women in combination with the expansion of industrial employment opportunities for both men and women At the present time the lack of attention to broader development concerns is

producing a serious situation which pits the poor against one another in the struggle for survival The whole issue of tropical forest conservation cannot be divorced from these complex questions

The COHDEFOR/CIDA project as well as the Littoral Atlantic woodcutters cooperative, COATLAHL finds itself immersed in the midst of this intractable problem Management plans drawn up on the basis of careful inventories of community forests, which are demanded under the Agricultural Modernization Law before any cutting takes place, may be rendered worthless as inventoried trees may already have been axed and burnt by cultivators by the time woodcutters arrive to cut them While those Santiago residents who are coop members have defended their territory steadfastly over the years, other communities, where the members are less united owing to shorter periods of residence (See Chart III) and who derive a greater portion of their livelihood from agriculture rather than forestry, are unlikely to risk their lives defending the communal forest, or indeed, even to risk a rift within the community defending it The community of Santiago is distinctive by virtue of the dominance of three families - all of which share in the woodcutting tradition - which have long lived there and whose points of view predominate over those of newer migrants This is not the case in the more recently populated and diverse communities which form the bulk of the settlements in the Littoral Atlantic hillsides

The communities of San Marcos, El Recreo, and Santiago all have access to community forests within the buffer zone of Pico Bonito National Park, these vary in size from 8,471 has in the case of San Marcos to 900 has for each of the latter (PDBL, 1993, personal communication with F del Gatto, COSPE) More recently, however, pressure from cooperativists in San Marcos allowed for selective logging inside the nuclear zone of the park, thereby extending the communal forest boundaries This surprising decision was presumbly related to the gradual disappearance of valuable hardwoods inside community forest boundaries and the high cost of transportation from San Marcos which makes the extraction of lower value non-traditional woods, less viable for this community

The issue of traditional (high value 'coloured' woods, eg Honduras mahogany, Spanish cedar) versus non-traditional (lower value woods, eg Sta Maria, varillo, marapolan, rosita) woods is at the crux of understanding the future profitability of logging and, along with this the willingness of people to defend the country's broadleaf forests At the present time the traditional woods are in danger of extinction in Honduras (IFC 1993), while the non-endangered, non-traditional ones have only a very limited market Unless outlets can be found for the latter, forests will be perceived to have little value to local people The development of an international green forestry movement which aims to promote sustainable logging including the promotion of these little-known lumber species is a step in this direction This allows for lumber extraction to be concentrated in small areas of the forest, leaving other areas undisturbed for longer periods (TTJ 1994 25) Such an approach is being promoted by the recently formed Smart Wood Program, which was set up by the Rainforest

Alliance, to certify woods which are harvested according to agreed-upon standards that allow for sustainable forest use Nevertheless, these programs are still in their infancy and, at present, the reality is the loggers working with non-traditional wood face low prices

Another impediment to raising the income of local woodcutters is the technology used in logging COHDEFOR demands that woodcutters, who are members of the co-ops and AMIs (integrated management areas) under its control, use pit saws since it is believed that once the loggers get hold of chain saws, they will log their way to the furthest reaches of the Mosquitia In other words, the labour intensiveness of operations is regarded as the only known way to brake the pace of logging While the concern may be justified about the woodcutters prolivity to ignore sustainable cutting regimes once armed with chain saws, the reality is that other groups and individuals working in the forest are not, and cannot be, prevented from using them and, as a consequence, their output per unit of labour is much higher than those of coop and AMI members This puts cooperativists at a considerable disadvantage and increases their dissatisfaction with logging while reducing their interest in forest protection Since the new forest management plans, which are part of the Agricultural Modernization Law, require that inventories of trees to be cut have to be submitted and approved prior to cutting, it would not seem unreasonable to allow the sawyers access to mechanical saws in order to reduce the time required to cut trees as per the plan This would allow cooperativists to engage in other activities and to increase their incomes Clearly, if they cut more than was permitted by the management plan, then they would be penalized accordingly However, this presupposes enforceable controls which may not be available At the present time the management plans, based on hand saws, are organized around the concept of one person/hectare/year Thus, for example, a coop with 20 members will work within a 20 hectare-inventoried area in a given year Based on the estimated 30-year time span deemed necessary to allow cut areas to fully recover, a 20-member coop would require a 600 hectare communal forest (PDBL 1993, F del Gatto, personal communication COSPE)

Finally, in this discussion of the means to safeguard community forests, is the issue of social organization As mentioned already, forest dwellers were integrated into groups, following the formation of COHDEFOR in 1974, as part of the state's social forestry program The Federacion Hondureña de Cooperativas Agroforestales (FEHCAFOR), was created by the state to represent a series of regional cooperatives COATLAHL (Colon Atlantida, Honduras, Limitada), formed in 1977, represented north coast woodcutters The AMI concept, introduced in 1986, was designed to bring about integrated forestry development in given areas this incorporates some of the co-operatives, but not all - as in the case of Santiago However, despite the government's stated intention with the creation of COHDEFOR, to control and employ the country's forestry resources for the social wellbeing of communities the reality was that local people were not guaranteed long term access to those resources and as a consequence, took very little responsibility for conserving the resource base This

insecurity of tree tenure derived from the fact that the state, as lawful owner of country's forest resources, reserved the right to sell timber concessions on community land - and indeed, on anyone's land (Vallejo Larios, 1992 3-5) Needless to say, this did little to aid in conservation or in the important task of reforestation (ACDI-COHDEFOR cited in Vallejo Larios, 1992 23) With the introduction of the neo-liberal, Agricultural Modernization Law, which once again allowed for private ownership of forest resources, the way was opened for communities to acquire juridical rights over communal forests and, with support from the PDBL project, this has now being achieved in some of the AMIs in the Atlantic littoral region

Notwithstanding the amelioration of serious contradictions in the legislation governing community forests, organizational problems remain which serve to alienate local people from woodcutting as an occupation Thus the number of individuals actively participating in the forest sector in each of the three study communities with community forest resources is less than expected, for example, Santiago currently has 16 members, down from 22 at the outset, San Marcos began with 64 members but this declined to 17 in 1987 (COATLAHL, 1988), at the time of the study it had 63 members but half were threatening to leave over a seizure of wood, Recreo had 18 members (PDBL, 1993 PDT) although those actively participating in woodcutting was considerably less Nearly all those interviewed who participated, or who had participated, in forestry activities complained about organizational problems and petty theft from local and regional leaders

Organizational problems are to be found at all levels At the lowest level there are problems between members who must work in pairs since woodcutting involves two people to handle the pit saws At the level of local leadership, accusations of theft revolve around the illicit use of profits which are supposed to be returned to the members at year end, following the sale of the wood by the coop Local leaders are believed to underreport these to members and have, on at least one occasion, absconded with them altogether Finally there are problems at the regional level over the prices actually received for the sale of the wood The suspicion is that the leadership underreports sales receipts and pockets the difference Because literacy is limited, leadership is generally concentrated amongst the few people who can read and the members are purposefully kept ignorant of what is occurring This in fact tends to occur in all projects -- not just the ones involving forestry Moreover, the large distance of most of the coop locals from headquarters means that often only one representative (the local leader) ever attends meetings This puts him in a position to report whatever he wants to the members on his return and they may never be the wiser Nevertheless, there are nearly always suspicions and a good deal of ill-feeling The woodcutters association in Recreo is not afiliated with COATLAHL and it may sell wood where it can obtain the best price The group is supported by the PDBL project and has access to one of its vehicles for moving the wood While this cuts out one layer of bureaucracy, it has not succeeded in allaying suspicions of graft

At the highest level of organization are problems with COHDEFOR For months in 1993-94, all the woodcutters associations were prevented from cutting wood while individual management plans were prepared and approved for each group under the terms of the Agricultural Modernization Law Foresters who were qualified to carry out these plans naturally gravitated towards the private sector where the pay was highest and it took months before the plans could be drawn up for the cooperative sector In Santiago, where many of the members of the coop are landless, this caused considerable hardship since there were few local employment alternatives available No sooner had the plans been approved, and the wood cutters returned to work, than a truckload of high quality wood belonging to San Marcos was seized and impounded because it did not correspond to the woods approved in the management plan While it transpired that the error was in the loading of the truck, not in the wood actually cut, COHDEFOR did nothing to help resolve the issue and infuriated coop members began selling their remaining wood whereever they could and were threatening to desert the coop in droves at the conclusion of the study Meanwhile, wood illegally cut is transported with impunity all over the country if the transporters of the wood have sufficient funds to pay off the guards at the various check points, co-op members do not have the necessary resources to ensure safe passage of their lumber

Another commonly heard complaint against woodcutting is the nature of the work itself it is extremely arduous and dangerous and makes agricultural activities seem tame by comparison Because of the steepness of the slopes mules sometimes cannot be used and the pit sawyers must carry the wood on their backs to the river in order to float downstream However, when it is far from the river, or when the individuals in question do not own mules, it has to be carried -- there is no other way Older men are generally incapable of transporting such weights over long distances and must either pay someone to do it or abandon logging Depending on the value of the wood, and the distance it has to be carried, paying someone may make logging an unprofitable activity

In spite of all these drawbacks, people who choose to engage in woodcutting argue that it is less risky, in an economic sense, than agriculture Moreover, only those people in Santiago who are landless work almost exclusively in forestry, most combine the two since it is well-known that the high cost of buying food up in the communities will rapidly eat up the cash benefits acquired from logging Thus, for most people woodcutting is an activity which they fit in around agriculture, which may occupy 3-4 months per year According to information collected in 1993, woodcutters earned anything from 1,000-2,000 Lps (approximately US$143-285) per month depending on the type and quality of wood cut This is certainly more than could be earned from the average plot in agriculture in a month but, given the numerous hurdles faced by woodcutters mentioned above, it is unlikely to provide a reliable income Agriculture is risky because of the unpredictable nature of the weather and damage by pests nevertheless farmers are likely to have a greater sense of control over production than in the case of forestry when the government can forbid them to cut from one day

to the next or decommission their wood without recourse Thus despite the risks inherent in agriculture, virtually all those interviewed preferred agriculture to forestry, logging, when undertaken, was nearly always regarded as an adjunct activity-not as a substitute for agriculture

HORTICULTURE AND AGROFORESTRY- FUTURE GROWTH AREAS

When questioned about future priorities, farmers regularly mentioned the desire to expand or upgrade commercial tree crops, particularly cacao and fruit trees This tendency was the strongest amongst those in the PDBL project where it was virtually universal In the area of horticultural crops, Tabasco chile pepper was the most frequently-mentioned item earmarked for future growth

Tabasco Chile Pepper Production

The production of Tabasco chile peppers is a new and rapidly growing activity in the River Cuero watershed In 1992-3, only a couple of families in San Marcos produced chile, in 1993-4 most of the entrepreneurial households in the watershed were engaged in producing it and interview discussions showed that many more households will enter into chile production during the up-coming season 1994-5 The largest production area under chile which was recorded in the area was two manzanas, some producers had as little as one-quarter of a manzana Nevertheless, chile production is competing for labour time with beans in the postrera planting and is reducing the amount of beans planted for commercial purposes

The local market for Tabasco chile pepper is a sauce-making and bottling factory in nearby-San Juan Pueblo The factory owner buys freshly-picked peppers and advances seed and cash to contracted producers However, to qualify for cash advances, producers must be able to carry the plants through the early months of production with their own resources Around the time of flowering, producers wishing to enter into a contract with the factory are visited by a technician to assess the health of the crop and to estimate the harvest If the owner passes this test and signs the contract agreeing to sell his crop to the factory (there are no other local purchasing outlets), he will receive advances on the harvest with which to buy the necessary chemical inputs required for the remaining period of production Production costs are considerable as can be seen from the records taken from one manzana given below, which were recorded by two farmers working on a joint plot during 93-94 Notwithstanding the high costs and longer period of production relative to other crops, eg beans, the profits accruing to these two farmers were high

Tabasco Chile Pepper Production on 1 Manzana of Land
(9,000 pepper plants/mz)

Land Rental	100 Lps
Seed Bed Preparation and Cleaning	
12 m-days @ 14 Lps	168
Land Preparation	
Slash - 20 m-days @ 14 Lps	280
Application herbicide 3 m-day @ 14	42
Planting	
38 m-days @ 14 Lps	532
Resow 3 m-days	
Weed control	
Hoeing - 9 m-days @ 14 Lps	126
Fertilization, disease control	
124 m-days @ 14 Lps	1610
Inputs	
2 backsprayers	819
1 litre of MTD	70
1 kg copper	40
1 litre of Bayfolan	22
2 Kg Counter	40
2 qq formula	144
1 bottle Pillaron Insecticide	70
1 kg Champion Fungicide	45
4 qq formula @ 72L/each	288
1 gallon Fungicide	280
1 1/2 gallons Gramoxone 187 Lps each	280
1 ltre Folidol	54
1 litre Bayfolan	24
1 litre Matador	45
2 litres Trodan	168
4 qq urea	260
1 litre Tamaron	70
Harvest	
Up to the second-to-last harvest - 9636 lbs	
at 35 Lps/lb - labour	3372 6
Final harvest expected - 1000 lbs	
at 35 Lps/lb - labour	350
Transportation @ 10/lb	1063 6
Mule (4 mule-days)	60
Total Expenses	10423 2
Value/lb @ 2 30	
Total Sales 2 3 Lps x 10,636 lbs	24,452 8
Profits (sales minus expenses)	14,029 6
US$/Hectare	US$2113 0

The production of chile peppers is a high risk crop for farmers because of the level of capital required in conjunction with the risk of disease Central American and Mexican tomato and pepper production is seriously affected by Gemini Virus which is vectored by whitefly Farmers have worsened the problem by over-spraying to control the disease which has resulted in pest resistence and an explosion of whiteflies throughout the area - and, of course, the disease Because of the isolation of the area under study and the limited use of chemicals, Gemini Virus has not become a problem in the watershed However, there was evidence of it in a some of the plants in 1994 suggesting that chemical overuse will lead to problems in future years This will almost certainly make production non-viable over the long term

In the meantime, those entrepreneurs who spearheaded the entree into peppers have made relatively large sums of money by local standards This money is being put into improved housing (cement structures with cement flooring) and, amongst those who have sufficient land, for investment in cattle (pasture improvement and the purchase of animals) One farmer, who was not amongst the group of pepper producers, but who had savings from other entrepreneurial undertakings, planned to buy an old pick-up to transport the peppers to the factory in the following season At the present time, this activity is carried out by individuals from towns in the lowlands

As discussed earlier, Tabasco pepper production requires large labour inputs at harvest time Planting takes places in September so that the harvest may be collected during the dry season This means that everyone harvests Tabasco pepper at approximately the same time Each plant should ideally produce a pound of peppers and a density of 10,000 plants per manzana is recommended (FHIA, n d) If approximately 50 lbs are harvested per person in half a day, which is probably as much as can be expected given the extreme heat during the harvest period, it will require 200 (half) work days to complete the harvest on one manzana This is likely to be more labour time than most families can provide, especially since it is also when households will be bringing in the bean and maize postrera harvests For this reason, individual families will almost certainly be restricted in the amount that they can grow As mentioned above, the employment of women and of school children does help to ease the labour supply shortage but, since the factory will only receive chile up to a day after picking, and then only the red fruits, this does not allow for a great deal of flexibility around the harvest (See chart on the following page showing the distribution of annual farming activities)

CHART SHOWING LAND USE ACTIVITY SCHEDULE

AGROFORESTRY

The Canadian/Honduran project is actively promoting agroforestry, particularly that involving fruit trees, which it supplies to individuals participating in the forestry program for use in their orchards It is mainly intended for household consumption, for improving nutrition, since the distance from markets would make all but a few high value fruits[14] difficult to market profitably Trees seedlings come from a germplasm bank developed by the PDBL program in the agricultural school of the national university, Centro Universitario Regional del Litoral Atlantico (CURLA) located in La Ceiba The project is also collaborating with the Fundacion Hondureña de Investigacion Agricola (FHIA), especially in the area of cacao systems, bananas, and plantains In its local experiment station in La Masica, in the lowlands of the Cuero watershed, FHIA has done extensive research on cacao associations One of the most successful is the cacao-black pepper association, grown in conjunction with Gliricidia sepium, to provide a system which is sustainable both in the ecological and the economic sense Cacao is extremely well adapted to the high humidity of the region but, like other tree crops, viz coffee, suffers from prelonged bouts of low prices By intercropping with a high value crop like black pepper, farmers have an alternative resource to help tie them over periods of depressed cacao prices and, as a consequence, are less likely to cut down their trees Other agroforestry systems involving cacao currently being tested by FHIA include the use of high value wood species, eg mahogany, laurel, teak and fruit trees[15]

Cacao is commonly produced in the area by local farmers and is amongst the list of priorities commonly cited by farmers for expansion and improvement Improved production would increase labour demand in cacao over the presently-practised, low-maintenance, low-yield system Upgrading the system would involve the replacement of local varieties with improved, higher yielding ones, regular pruning exercises, and the thinning of shade trees to reduce humidity and to regulate light Intercropping with

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[14]Rambuttan and mangosteen are two fruits which could probably be produced in the watershed and sold at a profit These fruits are light to transport, are extremely high value and have a good market in La Ceiba Fruits from trees provided by the PDBL, such as oranges, avocados, lemons, etc are much more difficult for people to market locally because of their weight and generally rather low prices

[15]FHIA is also working with hearts of palm germplasm This offers a good market opportunity and is a crop which is well-adapted to the region Moreover, given that palm heart requires the cutting down of the palm stem whilst leaving the roots intact, it may be that this provides an opportunity to combine a tree crop in a system with annual crops since shade would not pose a problem if cropping coincided with the period after the tree was cut (personal communication, R Rodriguez)

a legume (eg Gliricida sepium, Erythrina sp), would help to obviate the need for chemical nitrogen inputs in this much higher yielding system (FHIA, 1988)

At the present time yields are generally extremely low, and because of the predominant use of a local variety, the harvest period is generally restricted to a few months in the fall Those who used a hybrid had year-round production, albeit with a greater concentration of output in the fall In 1993-4, the price of cacao rose to 2 30 Lps/lb, up from 1 50 Lps the previous year FHIA estimates that average dry output per manzana should reach 1,900 lbs/mz (FHIA, 1988) While the potential for profit-making is lower in cacao than in chile pepper production, so too are the risks, while the long cacao harvest offers far greater flexibility for employing family labour than does pepper production[16] The trick will be to increase system profitability by associating cacao with high value crops

Agroforestry, in conjunction with the maintenance of natural forest in some areas is certainly the most desirable future landuse for the area because of its compatibility with the steep terrain and hence its role in watershed protection Nucleated residence patterns, however, make the production of higher value crops, especially of fruits, a risky undertaking since theft is common when the owner is living far away from the property Fruit grown in the backyard is relatively safe, however, fruit grown outside the immediate village is considered common property, even cassava may be stolen Maize and beans by contrast are not items of theft since everyone grows them The introduction of higher value tree crops will almost definitely lead to an increase in petty theft Since Tabasco peppers can only be sold at one outlet, and then, generally under contract, theft has not been an issue Fruits such as mangosteen and rambuttan, or black pepper, which can be sold anywhere in La Ceiba would almost certainly lead to increased pilfering This threat would likely reduce the tendency to plant high value crops on the steep hillsides where soil protection is most urgently required One way around this is to try to introduce these new crops into the communities on a rather broad scale in order to reduce the incentive to pilfer the neighbour's harvest Alternatively the potential for profit-making from these new

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[16]Since no one interviewed was carrying out cacao production as per the recommended FHIA practices, I have been unable to calculate the costs of production as in the case of Tabasco peppers Notably however, the price per lb of Tabasco pepper and cacao was 2 30 Lps during the research period However while output per manzana of the peppers should approach 10,000 lbs, in the case of cacao it was less than 2,000 lbs Moreover, cacao is costly to transport because of its weight Drying it raises the sale price and helps to reduce weight Nevertheless those lacking a cement patio or a sufficently flat open area to dry it on, often sell it wet to local intermediaries who dry it prior to selling It can be floated by sack down river (Sanchez personal communication) but I never observed this in the area nor heard it mentioned as a means of transport

crops may be sufficient to bring about a less-nucleated pattern of settlement

RECOMMENDATIONS AND ON-GOING WORK

There are no easy and obvious solutions to the land use problems in the hillsides under study in northern Honduras Poverty, which is fuelling deforestation in the area, is so widespread in Honduras that the stream of migrants into the area will, if left unchecked, continue until there are no trees left to fell The problem cannot be solved at the receiving end of this migrant stream Rather it means putting in place changes of policy which fundamentally alter landuse in the country Extensive cattle production, which covers some 80% of land under use, cannot be expected to absorb rural labour in sufficient amounts to adequately raise welfare levels in order to slow down outmigration The lack of economic progress and of the development of alternative outlets for labour in more productive areas also means that children are often the only source of security for couples, and especially for women, in their later years when economic resources are out of reach, poor families invest in human resources Thus economic stagnation at a low level of development and a burgeoning population, go hand in hand The remaining areas of broadleaf forest provide one of the few refuges to which the poor have access and which allow large families to stay together

Agricultural technology cannot be expected to resolve this dilemma in the tropical hillsides under study However, improved living standards due to higher productivity and/or higher value crops, in conjunction with sound agricultural management practices will slow land sales to cattle producers Our experience during 1993-94 with participatory farmer research in the communities of Recreo and Santiago leads us to believe that this approach is an effective means for introducing farmers to new forms of production, whilst simultaneously linking these to indigenous methods and knowledge The outcome is a form of syncretic technology generation which is much more likely to be of use, and therefore adopted, than one that is exogenously generated and later transferred down to the farmer Most importantly participatory research is a capacity-building process which helps to imbue farmers with a strong sense of their own ability to resolve different technical problems as they arise

The emphasis on farmer-led research will almost certainly produce the first efforts in the area of improved output - not in improved conservation Nevertheless, this approach does lend itself to naturally underscoring the social impact of production because of the degree of community involvement While the role of the technician or para-technician is to help reinforce the importance of environmental impacts and to suggest different means for overcoming problem areas most importantly CIAT's Hillsides Program will collaborate with the farmer teams in helping to develop more 'land-friendly' systems than are currently in use

Experiments currently being undertaken by the farmer teams in El Recreo and Santiago include bean germplasm improvement, maize varieties, legumes/cover crops,

integrated pest management in beans, post-harvest seed conservation Experiments involving tree crops are more difficult to organize because of the length of time required to get results and because germplasm used in one farmer's plot is likely to lead to long term benefits for that farmer In order to avoid favouring certain individuals in the testing of tree germplasm, it is recommended that this be carried out on common property, such as in school grounds, so that the long term benefits of the germplasm may accrue to the common good Use of the school yard would also allow students to participate with farmer-researchers in testing the new technology and in receiving the benefit of technical support

It is important that participatory research not become a factor in increasing wealth differences in the communities The different structures of power and the social dynamics in the communities have the potential to convert what is a community project into one that serves only the experimenters themselves Our experience in Santiago has been entirely different to the one in Recreo In the former the leadership is extremely altruistic and the team has expanded to include approximately half the community's farmers In Recreo, by contrast, the experimenters have the tendency to want to reserve information gathered through crop testing for the exclusive use of the four-person team without sharing it with the rest of the community This may simply be part and parcel of the community dynamic in Recreo, it may also be the direct effect of the PDBL project since resources provided to participants have helped to exacerbate wealth differences Inequalities can easily worsen if other projects fall into the same mode of operation To avoid this will require a very careful use of resources, particularly when conducting experiments with crops that have long term benefits

It is recommended that the participatory research project work closely with PDBL personnel in the different AMIs to train project agronomists in the methodology and that promising technology tested in Recreo and Santiago be offered to farmers in other communities for participatory research and evaluation This process has already been set in motion and discussions for a training workshop are being planned Once the IPCA (Investigacion Participativa en Centroamerica) project is set up and running, hopefully by the end of 1994, there is also the potential for training PDBL personnel directly by CIAT in conjunction with the International Institute for Rural Reconstruction (See IPCA project proposal) The IPCA project also includes plans to offer a course in CURLA to train agronomy students in the research methodology and to provide scholarships to students to assist directly in participatory research Once funding is in place, IPCA will be coordinated by the Program for Rural Reconstruction in Santa Barbara, although its personnel will continue to be headquartered in La Ceiba We believe that this approach, which is one of building up research capacity both in local technicians and the farmers themselves, will be an important contribution to resolving the very difficult problems confronting land use in the littoral Atlantic hillsides discussed in this report

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