The social origins and impact opf deforestation in centeral america

UNITED NATIONS RESEARCH INSTITUTE FOR SOCIAL DEVELOPMENT

Discussion Paper 24

THE SOCIAL ORIGINS AND IMPACT OF DEFORESTATION IN CENTRAL AMERICA

by

Peter Utting

May 1991

The **United Nations Research Institute for Social Development** is an autonomous body which conducts research on key issues of contemporary social development. Current research themes include **Crisis, Adjustment and Social Change; Environment, Sustainable Development and Social Change; Ethnic Conflict and Development; Social and Development Indicators; Political Violence and Social Movements; Refugees, Returnees and Local Society; Socio-economic and Political Consequences of the International Trade in Illicit Drugs** and **Participation and Changes in Property Relations in Communist and Post-communist societies.**

A list of the Institute's free and priced publications can be obtained from the Reference Centre.

United Nations Research Institute for Social Development
Palais des Nations
1211 Geneva 10
Switzerland

(41.22) 798.84.00/798.58.50
Fax (41.22) 740.07.91
Telex 41.29.62 UNO CH

ISSN 1012-6511

Preface

An important aspect of UNRISD's work on the social dynamics of deforestation in developing countries has involved carrying out case studies in Brazil, Nepal, Tanzania and Central America. This paper presents a preliminary assessment of the social origins and impact of deforestation in Central America. It is based on a wide body of secondary sources and several interviews with government officials, development and forestry specialists, and representatives of peasant and environmental groups.

The paper examines the principal processes underlying deforestation in the region. It focuses not only on the immediate "causes" of deforestation, such as the land clearance practices of graziers and shifting agriculturalists or the activities of logging companies, but also links these to broader processes of social, economic and technological change which characterize a particular style of development centred on agro-export production. In addition, it highlights the role played by government policies and land tenure systems in deforestation.

The author identifies a number of changes which have occurred in the mechanisms underlying deforestation during the 1980s and 1990s - changes associated, for example, with militarization, agrarian reform, and economic stabilization and adjustment policies.

The paper goes on to describe the way in which deforestation has affected the livelihood systems, living levels and lifestyles of different social groups and how people have responded individually and collectively when their livelihood and forest resources have been threatened. In order to examine the social impact of deforestation, the author describes three very different scenarios: the situation of peasant groups in agrarian frontier regions, traditional indigenous groups experiencing encroachment by logging companies and farmers, and the case of local populations in urban or more densely populated rural areas affected particularly by shortages of fuel wood.

The paper also refers to the experience of forest protection initiatives in the region and assesses briefly some of their strengths and weaknesses from the point of view of contributing to environmental rehabilitation and social development.

It concludes by outlining the content of a second phase of the research programme to be conducted during the first half of 1991, which will consist of several case studies in specific areas of Costa Rica, Guatemala, Honduras and Nicaragua. These studies will provide additional information on aspects associated with the social impact of deforestation processes and the role played by different types of forest protection initiatives in promoting sustainable development.

The author of this paper, Peter Utting, did his graduate work at the University of Essex. He has worked for a number of years on the problems of food security, agrarian reform and structural adjustment in Nicaragua and Third World countries. The project on the social dynamics of deforestation is being co-ordinated at UNRISD by Krishna Ghimire, with Solon Barraclough as senior consultant.

May 1991

Dharam Ghai
Director

Contents

Introduction

Throughout the 1960s and 1970s, Central America experienced one of the highest rates of deforestation in the world. Since the mid-1960s, the extent of forest cover in the region has been reduced from approximately 60 per cent to a third of the total land area. The scale and environmental consequences of this process of natural resource destruction are dramatic in every country in the region.

Panama is considered to be one of the Latin American countries most affected by soil erosion associated with deforestation. By the mid-1980s, some 90 per cent of the total land area suffered erosion while 16 per cent was seriously affected (FAO, 1986). The future existence of the country's economic lifeline - the Panama canal - is seriously threatened by sedimentation caused by deforestation in the upland areas of the canal zone watersheds (Alvarado, 1985; Rubinoff, 1982; Wadsworth, 1982).

In Costa Rica, the percentage of total land area covered by dense forest was reduced from approximately 75 to 20 per cent between 1940 and the mid-1980s (Silliman, 1981; Chacón, García and Guier, 1990). The exploitable forest area remaining outside of national parks and reserves amounts to just a quarter of a million hectares or 5 per cent of the national territory (Hedstrom, 1990). It is estimated that the commercial supply of forest resources could be exhausted by the mid-1990s if current trends persist (Finegan and Sabogal, 1988; MIRENEM, 1990).

During the 1960s and 1970s, Nicaragua experienced the highest rate of deforestation in the region, losing each year approximately 100,000 hectares of forest. In October 1988, Hurricane Joan destroyed 560,000 hectares of dense rain forest, 17 per cent of the country's total forested area. Deforestation has resulted in major environmental damage on the Pacific side of the country, causing serious erosion, flooding and changes in micro-climate.

Between 1964 and 1986, Honduras lost a quarter of its forest area. Average annual deforestation was of the order of 80,000 hectares (SECPLAN, DESFIL and USAID, 1990). Fires in pine forest areas in 1987 and 1988 destroyed an average 95,000 hectares each year. The environmental consequences of deforestation have contributed to serious water shortages in the capital city, Tegucigalpa.

El Salvador is generally regarded as the most environmentally degraded country in continental Latin America. Only 240,000 hectares of largely degraded forest remain (Mansur, 1990) while just 3 per cent of the country's original forest cover still exists. At current rates of deforestation, the country's entire stock of forest resources will be depleted by the year 2005. Erosion affects an estimated 77 per cent of the national territory (USAID, 1985; CESTA). Every major watershed and river basin is degraded. Floods and landslides are commonplace

and sedimentation threatens the country's hydroelectric system (Hall and Faber, 1989).

In 1960, 77 per cent of Guatemala was under forest cover; by 1980, only 42 per cent remained (Bradley et al., 1990). The country currently experiences one of the highest rates of deforestation in the region with some estimates putting the annual loss of forest area as high as 90,000 hectares (Bradley et al., 1990). An estimated one third of Guatemala's land mass is seriously eroded or degraded.

The economic and social crisis which has affected much of the region throughout the 1980s is intimately related to this process of environmental destruction. This paper presents a preliminary analysis of the social origins and impact of deforestation in Central America.[1] It is based on research that was conducted in Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama, during the latter half of 1990. The information derives from a considerable body of secondary sources as well as interviews with government officials, development and forestry specialists, academics and representatives of peasant, indigenous and ecology groups.

Part I examines the way in which "modernization" processes and "survival strategies" have contributed to extensive deforestation throughout this century. In addition, it considers the way in which contemporary phenomena such as military conflict, agrarian reform and economic stabilization policies have affected the use and abuse of forest resources. This section also examines some of the crucial institutional and policy determinants of deforestation, notably, agrarian structures, land tenure systems as well as government policies and legislation concerned with agrarian development and land use.

Part II analyses the social impact of deforestation, briefly examining processes of social differentiation and changes in living levels and livelihood of various social groups. Also treated is the question of how certain groups affected by deforestation have responded collectively when their livelihood and interests are threatened.

Part III looks at some of the initiatives that have been taken in the area of forest protection and comments on the strengths and weaknesses of certain programmes, policies and legislation.

A final section briefly outlines the nature of several local level studies being sponsored by UNRISD in the region. The findings of these studies will be presented in a more comprehensive report on the social dynamics of deforestation and forest protection initiatives to be finalized during the second half of 1991.

1. The author would like to thank Solon Barraclough and Krishna Ghimire for their comments on an earlier draft. This paper concludes the first phase of an ongoing research project on the Social Dynamics of Deforestation in Central America. Several of the issues addressed here will be examined in more depth in studies that will be conducted during 1991. As such, the ideas and analysis presented here provide a preliminary assessment of the situation in the region. The author would welcome any comments and criticisms which readers might have.

I. Deforestation in Central America

FAO data on land use in Central America indicate that the area under forest and woodland decreased from 56 per cent of the total land area during the first half of the 1960s to 35 per cent in 1986. Estimates of the current extent of forest cover and rates of deforestation are presented below. These are derived from data obtained at the country level and generally refer to both closed and degraded forest cover.

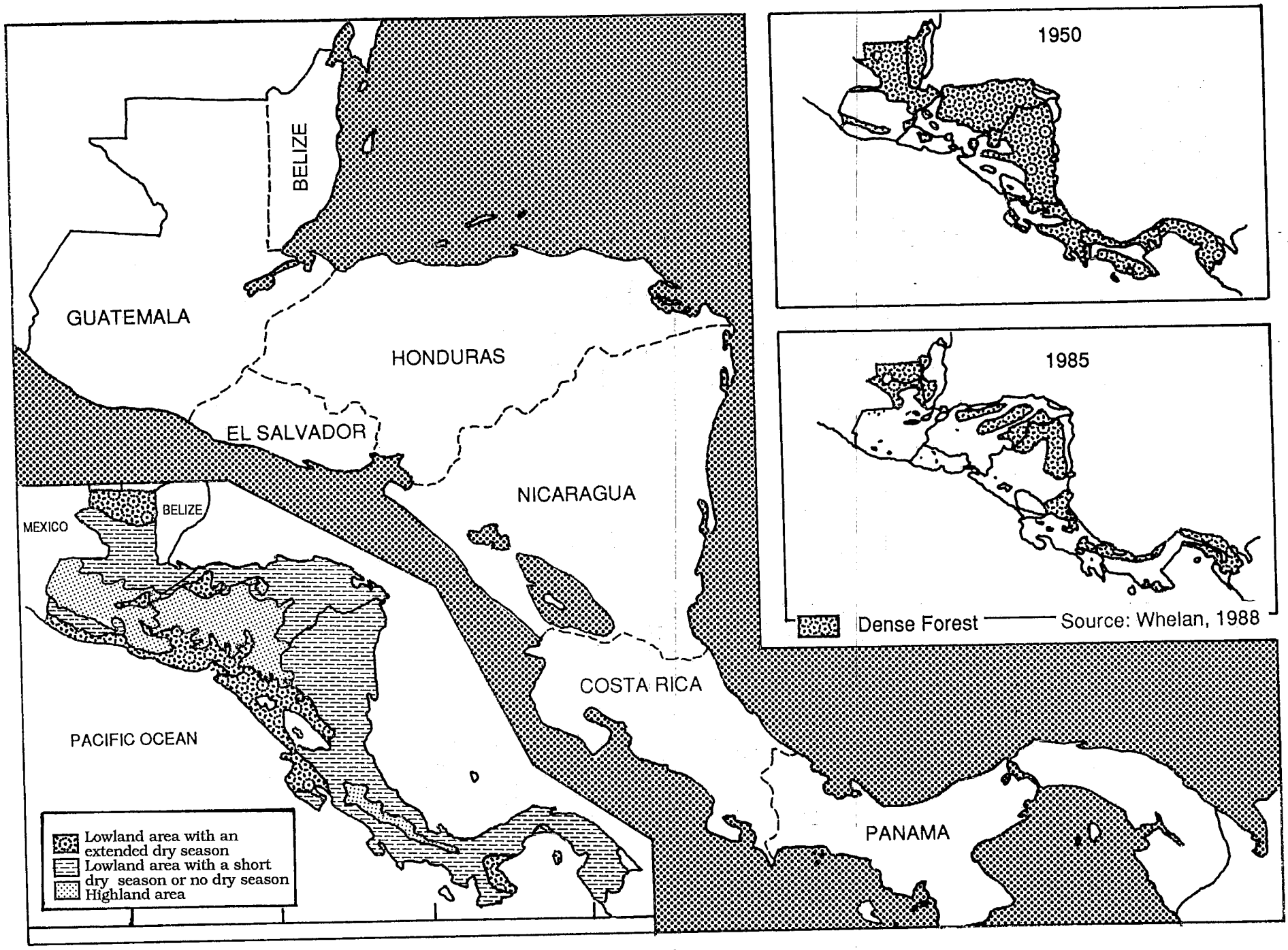
Central America: Estimates of Forest Cover

Country	Area (000 hectares)	Percentage of total land area	Annual deforestation (hectares)
Panama	3,147 (1)	41	50,000 (7)
Costa Rica	1,475 (2)	29	50,000 (8)
Nicaragua	4,140 (3)	30	70,000 (9)
Honduras	4,731 (4)	42	80,000 (10)
El Salvador	240 (5)	12	14,000 (11)
Guatemala	3,762 (6)	35	90,000 (12)
TOTAL	**17,495**	**36**	**354,000**

(1) Estimate for 1990 based on 1987 figure of 3,305,300 hectares cited in INRENARE, 1990.
(2) Estimate for 1989 cited in MIRENEM, 1990.
(3) Refers to closed and degraded forest (MAG, 1990).
(4) Estimate for 1990 based on COHDEFOR (SECPLAN, DESFIL and USAID, 1990).
(5) Mansur, 1990. Figures refer to closed and degraded forest.
(6) Government of Guatemala, 1990.
(7) INRENARE, 1990.
(8) MIRENEM,1990.
(9) MAG,1990.
(10) SECPLAN, DESFIL and USAID, 1990.
(11) Mansur, 1990.
(12) Bradley et al., 1990.

While most authors generally agree on which agents are directly responsible for cutting down trees, they often disagree in their assessment of the appropriateness of land use patterns which are causing deforestation, the underlying social forces which determine such land use patterns and the question of who, if anyone, is to blame. Increasing pressure on the land, for example, is clearly a fundamental force underlying deforestation, but is it population growth or highly skewed patterns of resource distribution which are responsible? Are peasants at fault because they are cutting down the forest or are they the victims of a particular socio-economic system which has made access to land and other resources in areas of greater agricultural potential increasingly difficult? Do government policies, which encourage colonization, cattle raising and logging in rain forest areas, help or hinder the development process?

Deforestation in Central America



These questions are important not just for analytical clarity but because they raise crucial policy issues in what are often very contentious areas - population control, land reform, income redistribution, intensification of land use versus colonization of virgin areas, and so forth. The bottom line in much of the debate regarding deforestation is, of course, whether the way forward is along a path of technical and administrative innovations or "fixes" - creation of national reserves, reforestation, sustainable forest management, agroforestry schemes, etc. - or whether some fundamental restructuring of income, wealth and power is ultimately required.

• DEFORESTATION AND AGRO-EXPORT DEVELOPMENT

The specific "causes" of deforestation referred to above are all features of a specific type of development model which began to take shape during the late 1800s but which took off during the latter half of this century. They are, in fact, related to three processes of economic and social change which characterize the so-called agro-export model, namely, "marketization", modernization and marginalization.

Marketization operated at two levels. Firstly, national economies were drawn into the world market for primary goods, notably coffee, cotton, sugar, bananas and beef. In several countries, this process began during the latter half of the last century when world demand for Central American coffee rose sharply. The scale of deforestation and environmental deterioration associated with coffee expansion, though, was not as intense as that which occurred from the 1950s onwards when the countries of the region experienced booms in several agro-export product sectors, notably cotton and beef.

Secondly, peasant producers were increasingly drawn into national markets. The intensification of commodity relations meant that rural families not only had to produce much of the food they required but also a marketable surplus in order to obtain the income necessary to purchase production inputs and consumer goods and services. This led to an intensification of agricultural production which in many areas of Central America broke the fragile ecological equilibrium which characterized the traditional slash and burn system whereby land had to be left fallow for many years before it could be cultivated for relatively short periods (Heckadon, 1982). It also accelerated the conversion of forest areas to crop and pasture land.

Modernization was associated with cultural attitudes which saw the forest as a resource to be cut down. It involved the rapid conversion of forest to crop or pasture land and the introduction of new technologies which were often inappropriate for the type of ecological conditions prevailing in tropical forest areas. The use of such technologies often implied greater risk for many producers. Modernization was associated also with the development of economic infrastructure such as roads, railways and hydroelectric power

schemes. For certain groups and geographical areas, it also meant improved health care facilities and reduced levels of infant mortality, which in many rural areas meant larger families to feed, clothe and care for and hence the need to increase agricultural production and expand crop and pasture areas.

Marginalization refers to the highly skewed patterns of resource distribution which characterized the agro-export model and which left much of the region's population living in extreme poverty. Limited access to land, credit and other essential goods and services on the part of the mass of the rural population resulted from an intense process of social differentiation which occurred following the 1950s. The improved opportunities for commercial farming which accompanied the insertion of the Central American economies in world commodity markets prompted processes of land concentration and the displacement of peasant producers from the land. Interests (both national and foreign) involved in the production, processing and trading of agro-export products, as well as the financing of such activities, came to exert a dominant influence over national states. Government policies and development programmes generally favoured such groups and discriminated against peasant producers and indigenous groups.

What emerged from these processes were two types of dynamic which fuelled deforestation: one of **accumulation** involving the rapid conversion of forest to land uses associated with capitalist agriculture, the development of the lumber industry and infrastructual development; and one of **survival** or subsistence provisioning involving shifting slash and burn agriculture and fuel wood gathering. This "survival" dynamic also partly accounted for rapid population growth and related pressures on the land given that having many children made sense as "a hedge against poverty" (Hall and Faber, 1989).

• SPECIFIC "CAUSES" OR MICRO-PROCESSES

When reading about deforestation in Central America, one is usually presented with lists of causes which tend to highlight the role of shifting peasant agriculture, the conversion of forest to pasture, the expansion of certain commercial crops, logging activities and fuel wood gathering. These so-called causes of deforestation are, in effect, micro- or sub-processes of the broader model or style of development outlined above.

Agrarian Frontier Expansion and the Cattle "Boom"

Much of the land which has been deforested in Central America has been transformed either by shifting peasant cultivators or ranchers colonizing agrarian frontier regions. This process intensified notably in Costa Rica, Honduras and Nicaragua during the 1960s with the increased demand in the United States for Central American beef. As a result of the so-called "hamburger connection" (Nations and Komer, 1987), the area under pasture in the region increased from 3.9 million to 9.4 million hectares, or

nearly a fifth of the total land area, from the mid-1950s to the mid-1970s (Williams, 1986; Heckadon, 1984). While different methods were used to convert forest to pasture, it was common for ranchers to buy "improved land" from shifting cultivators or for landowners to allow peasant producers to clear land for basic grain production, farm it for one or two seasons and leave it ready for seeding before moving on to clear another plot.

Government policies have, until recently, openly encouraged the colonization of rain forest areas as part of both a modernization strategy and an attempt to ease social pressures. Colonization has been primarily of the "spontaneous" kind although a number of large planned colonization schemes have been implemented in Guatemala, Honduras and Nicaragua (Jones, 1988).

As Augelli observes when writing about Costa Rica: "Until the 1970s the same perception of land abundance, held by private citizens, influenced government planning and policies. The goals of the government were to populate the national territory, to increase farm output, and to defuse the problems of land hunger in the densely settled areas where commercial crops were produced. In the past the government frequently used public lands to pay municipal debts and to support construction of a transportation network." (Augelli, 1987:13) Even during the early 1980s, the law required colonists to clear the forest in order to acquire right of possession. Taxes on naturally forested land were higher than those on "improved" land (Silliman, 1981).

Costa Rica's agrarian reform and land titling legislation have also contributed to deforestation (Augelli, 1987; CEDARENA, 1990). Legislation passed in 1961, for example, barred land invasions and attempted to regulate land redistribution on an organized basis. It was assumed, however, that much of the land available for redistribution would be located in virgin forest areas still in the public domain (Augelli, 1987).

Governments in the region have generally organized agricultural support services for the benefit of larger commercial farmers. Credit policies, in particular, have been instrumental in encouraging the rapid conversion of forest to pasture land. The cattle "boom" of the 1960s and 1970s was also underpinned by the massive injection of foreign aid and investment, notably from the World Bank and the Inter-American Development Bank. Once beef imports to the United States began to increase, the government of that country actively encouraged bilateral and multilateral aid agencies, as well as private financiers and investors, to channel resources towards the cattle sector. According to one estimate, the value of cattle sector projects supported by these agencies amounted to approximately 500 million dollars by the late 1970s (Howard, 1987).

The prioritization of commercial farming enterprises in government agricultural support programmes has had the effect of restricting the access of the mass of rural producers to essential

goods and services for agricultural production, thereby fuelling the forces underlying migration and the colonization of agrarian frontier regions.

The marginalization of peasant producers is also intimately tied up with the type of agrarian structures and land tenure systems which exist in the region. The development of agro-export agriculture throughout this century stimulated processes of land concentration and dispossession of *ladino* peasants and indigenous peoples. Liberal states which emerged during the late 1800s and early 1900s fostered the growth of coffee production and introduced laws which tended to accelerate the disintegration of communal holdings. The profit opportunities associated with the cotton, beef and sugar booms of the 1950s, 1960s and 1970s further intensified processes of land concentration and landlessness. By 1970, approximately half of all rural families were either landless or farmed sub-subsistence plots of less than a hectare (Weeks, 1985).

Among the six countries considered here, however, there are a number of important differences in agrarian structure and land tenure systems. Land concentration is particularly extreme in El Salvador and Guatemala. A study carried out in Guatemala in 1979 found that 60 per cent of all farm units were less than 1.4 hectares (Barraclough and Scott, 1987).

Agrarian structure in Honduras and Nicaragua during the 1970s was somewhat different. The development of large-scale commercial agriculture during the 1960s and 1970s led to the formation of a large sector of landless labourers. Also important in the case of Honduras and Nicaragua, as in Costa Rica and Panama, is the existence of a significant group of middle-sized commercial farmers.

This latter feature of rural social structure has important implications for our analysis of the social dynamics of deforestation. Deforestation was intimately tied up with processes of social differentiation among the peasantry. The conversion of forest to agricultural land occurred, to some extent, via a process of "extensive accumulation" involving the acquisition of sizeable tracts of land in agrarian frontier areas. As a result of this process, there emerged a significant sector of "rich peasant" producers. The existence of this sector had important cultural implications which reinforced popular perceptions which saw the forest as a resource to be cut down and converted to other land uses. Here was living proof that the process of displacement from the land, migration and colonization of frontier regions did not necessarily reproduce poverty but, for some at least, held up the possibility of social advancement. Moreover, the fact that many of these producers were ranchers reinforced the notion that the key to success lay in cattle raising.

Throughout the region, much of the inhabited land area remains untitled. Because of the itinerant character of agriculture in frontier regions, the low value of land and the complicated legal and

administrative procedures for obtaining titles, few bothered about legal titles (Augelli, 1987; CEDARENA, 1990). The use and possession of untitled land have important implications for deforestation and forest protection schemes, several of which are identified in a CEDARENA study of the Tortuguero region of north-eastern Costa Rica (CEDARENA, 1990). Firstly, to prove possession, land is usually cleared of trees. Secondly, producers using untitled land are ineligible for bank loans. This both restricts patterns of land use and encourages producers to engage in activities requiring limited operational capital such as selling logs and raising cattle. Thirdly, without security of tenure, there is little incentive to engage in long-term natural resource protection practices. Moreover, in Costa Rica, forestry bonds are only issued for reforestation projects on titled lands. Fourthly, government regulations to regulate land and resource use are difficult to implement in situations where land surveys and legal possession are non-existent.

Logging

Both the pattern and ease of colonization of forest areas were determined to a large extent by the operations of lumber companies (Budowski, 1990; Nations and Komer, 1987). Official statistics indicate that sawnwood production only constitutes a significant economic activity in Costa Rica, Honduras and Nicaragua. Honduras is the only country where wood exports constitute a major foreign exchange earner. Levels of sawnwood production appear to have fallen in most countries throughout the 1980s. It should be pointed out, however, that these figures do not include petty commodity or clandestine production which, in countries like Guatemala, is considerable. Moreover, it could be the case that such activities are on the increase in certain countries where logging companies are subject to increasing controls.

In broadleaf forest areas, tree cutting is highly selective. It is usually the case that just two to three trees per hectare are removed. In Honduras the average for species such as mahogany is even less.[2] As Budowski explains:

> "Cutting the few valuable timber trees that can be found in a tropical forest on well drained soils does not destroy the forest *per se*, although in the process when the trees are felled and dragged out of the forest, a large amount of forest destruction takes place. Usually about ten times more trees of pole size or above are destroyed during the operation." (Budowski, 1990)

Nations and Komer make the point that "the damage wrought by commercial logging is not so much the result of what foresters remove from the forests as what they leave behind - namely, the roads they construct to enter and exploit the area" (Nations and Komer, 1987:161). Along these roads follow peasant farmers and ranchers who rapidly convert forest to crop land and pasture.

2. Interview with Dr. Gerardo Budowski, Head, Natural Resources and Quality of Life, University for Peace, San José, Costa Rica, November 1990.

Often the first person to follow the tree fellers is the land speculator who is likely to be closely allied with those engaged in logging operations. The speculator will mark out a specific area, provide advance money to peasants to clear the land and farm it for one or two years, and in the meantime deal with the national and local level bureaucracy to obtain legal rights to the land. Once the peasant has spread grass seed, the land or the "improvements" (*mejoras*) are likely to be sold for ranching activities.[3]

3. Interview with Dr. Gerardo Budowski, Head, Natural Resources and Quality of Life, University for Peace, San José, Costa Rica, November 1990.

Throughout this century concessions have been granted for commercial lumber exploitation with little or no regard for reforestation and sustainable forest management. As explained by Budowski when examining the causes of deforestation in Costa Rica:

> "There is no management, no silvicultural treatments to favour natural regeneration or the growth of existing regeneration such as valuable saplings or of other trees that have not yet reached commercial size. Indeed the forest is typically visualized as a non-renewable resource and logging of valuable species is often labelled as a 'mining' operation." (Budowski, 1990)

The environmental impact of such an approach was particularly dramatic in pre-revolutionary Nicaragua where the operations of United States lumber companies left large areas of the northern Atlantic coast region deforested. The situation in Honduras appears to be equally dramatic. According to a USAID report: "Logging is marked by waste and inefficiency at every step from the stump to the mill. In the broadleaf forests only about 10 percent of a given stand is logged." (Campanella et al., 1982:10) The report goes on to highlight the "lack of operational standards and procedures governing what slopes and soils can be logged without incurring site degradation, or where and how logging roads should be constructed" (Campanella et al., 1982:11).

Coffee, Bananas and Cotton

The expansion of cash crop production for the export market also had important implications for deforestation. The area under export crops doubled between the early 1950s and the early 1970s from approximately 800,000 to 1.7 million hectares (Brockett, 1990; FAO, 1986). Three crops in particular - coffee, bananas and cotton - have had important implications for deforestation. The expansion of each of these crops was intimately tied up with the development of one of the three major climatic zones of the region (see map on page 4).

Coffee production expanded primarily in central highland areas during the latter half of the 1800s in Costa Rica, El Salvador, Guatemala and Nicaragua and during the second half of this century in Honduras. The fact that coffee plants were grown in combination with shade trees mitigated to some extent the negative environmental

impact of coffee expansion. Also coffee plantations constituted an important source of fuel wood.[4]

In several respects, though, coffee expansion was intimately tied up with the processes of modernization and marginalization underlying deforestation. Such expansion, for example, was accompanied by the construction of road networks which, as discussed below, greatly facilitated the colonization of agrarian frontier regions. It was also associated with the dissolution of communal land tenure institutions which had provided a degree of security for Indian populations and forms of social organization which in certain contexts protected forest resources. As access to communal lands was restricted and land concentration took place, large numbers of peasant producers were displaced and forced to clear more marginal lands for grain production often located on forested hillsides. Many had to migrate to towns or agrarian frontier regions.

Migration was sometimes in the direction of the banana plantations which had been established during the second half of the nineteenth century in Costa Rica and the early 1900s in Guatemala and Honduras. In El Salvador, Nicaragua and Panama, banana production remained relatively unimportant. In the former group of countries, governments granted large concessions to (what were to become) the United Fruit and Standard Fruit companies mainly in sparsely populated Caribbean lowland areas (Woodward, 1985). By the end of 1918, the United Fruit company owned or leased half a million hectares of land in the region (Brockett, 1990). The large-scale deforestation which accompanied the expansion of the banana plantations resulted not only from the conversion of forest to crop land but also from the fact that the banana companies also took on the task of railroad construction. The generous concessions often carried with them the commitment to construct railroads. As such, deforestation was also associated with the massive increase in the demand for railroad sleepers.

Cotton production soared from the early 1950s to the mid-1960s, experienced a six-year slump and then took off again until the 1980s. From the late 1950s, the number of cotton growers in the region increased from 2,000 to 10,000 in less than two decades (Williams, 1986). Cotton production expanded in the Pacific coastal slopes and plains on what are often the best soils in the region. Much of this land, however, had already been cleared. In some cases, though, the expansion of cotton led to the rapid depletion of dry forest areas. The cotton boom of the 1950s and 1960s in El Salvador, for example, saw the virtual elimination of the last remaining areas of dry tropical forest in the Pacific plains (USAID, 1985).

The primary impact of the cotton boom on forest areas, however, was more indirect. As the area under cotton expanded, many peasants were displaced from the land while ranchers moved out of the Pacific area. As indicated earlier, these developments accelerated the colonization of agrarian frontier regions.

4. An FAO study in El Salvador (Mansur, 1990) estimates that a hectare of coffee plantation yields 6.5 cubic metres of fuel wood per annum. The total coffee area yields 1.3 million cubic metres or approximately a quarter of the country's fuel wood requirements.

Infrastructural Development

The expansion of the public road network greatly facilitated colonization of forest areas. Particularly important during the second half of this century was the construction of the Inter-American highway which was to link North and South America. Construction of this road accelerated during the early 1960s as part of the Central American Common Market initiative and by 1964 reached as far south as Panama (Woodward, 1985). In Costa Rica, it has been estimated that the rate of deforestation on the Pacific side of the country increased fivefold following the construction of the highway (Silliman, 1981). Similarly, deforestation on the Atlantic slope expanded rapidly following the building of the road linking the capital, San José, with the Caribbean coastal town of Limón (Silliman, 1981).

The attempt to complete the construction of the Inter-American highway, passing through the Darién region which links Central and South America, has been an important factor conditioning contemporary patterns and rates of colonization in Panama (McKay, 1982; Sarmiento Chia, 1985). Rapid colonization in western Panama during the early 1980s was facilitated by the opening of new access roads for mining and oil pipeline maintenance (Jones, 1988).

At the local level, farmers often enter into "road-for-timber" agreements with loggers (Budowski, 1990). How this process operates in Costa Rica is described by Budowski:

> "In some areas, the various owners of forest land will happily sell out to logging companies because they will build a badly needed road, even if such a road may not last long since it was essentially built to take out only one crop of trees. In certain areas ... the local community which established itself (illegally) on the steep slopes made a contractual agreement with a local owner of a tractor. In exchange for opening the road he could take all the available timber growing relatively close to the road. Such an arrangement is extremely common in Costa Rica and many roads owe their origin to a 'road-for-timber' barter." (Budowski, 1990)

Fuel Wood Collection and Urbanization

Fuel wood gathering has caused serious forest degradation in certain countries and, more specifically, in particular regions of individual countries. A study published in 1984 (Dulin, 1984) found that the availability of fuel wood was "very critical" or "critical" in 38 per cent of the Central American territory (excluding Nicaragua) notably in areas of high population density and in agricultural areas in Pacific coastal regions (Martinez, 1986). The situation is particularly serious throughout much of El Salvador, around several of the region's major cities, the northern Pacific region of Nicaragua and in densely populated rural areas such as the Altiplano in Guatemala.

Studies conducted by CATIE indicate that nearly three quarters of all Central American households (72 per cent) use fuel wood. Daily per capita consumption in the region is approximately 2.5 kilograms (Martinez, 1986; Reiche, 1986). Of the region's total energy consumption, fuel wood accounts for more than half. Manufacturing, agro-industrial, food processing and artisanal activities account for 31 per cent of total fuel wood consumption (Martinez, Bauer and Jones, 1983).

Estimates for Honduras indicate that annual collection and consumption of fuel wood account for an equivalent of 22,500 hectares of forest (Campanella et al., 1982). In El Salvador, where up to three quarters of all homes use fuel wood, its gathering now constitutes the principal cause of deforestation and forest degradation (Heckadon, 1989). Moreover, per capita fuel wood consumption in El Salvador is the highest in Central America (3.1 kilograms/per capita/day), partly due to the low efficiency of traditional open hearth cooking fires which experience up to a 90 per cent heat loss (Heckadon, 1989). It has been estimated that the fuel wood sub-system which supplies the capital, San Salvador, involves collection and marketing circuits that extend up to 100 kilometres away. In addition, the country is now having to import fuel wood, often illegally, from Honduras and Guatemala.[5]

5. Interview with Ricardo Navarro, director of the Salvadorian Centre for Appropriate Technology (CESTA), October 1990.

Rural to urban migration and high rates of population growth have led to a sharp increase in urban populations in recent decades. The situation is particularly alarming in Honduras and Nicaragua where rates of urban growth are of the order of approximately 5 per cent per annum. While there is a positive correlation between processes of urbanization and economic development and reduced fuel wood consumption levels, high levels of fuel wood consumption persist in the more developed countries and urbanized areas of the region. In Costa Rica, the most prosperous country in the region, half the population still uses fuel wood (Gewald, 1980; Martinez, Bauer and Jones, 1983). In urban areas, it is common for a third of the population to continue to use fuel wood. A Guatemalan study of fuelwood consumption in two categories of urban centres (with populations above and below 15,000) found that 32 and 52 per cent of the families continued to use fuel wood, respectively (Bogach, 1981).

• DEFORESTATION IN THE 1980s AND 1990s

A number of changes in the mechanisms underlying deforestation in Central America have occurred during the past decade. Three phenomena, in particular, have had important implications for deforestation, namely, war, agrarian reform, and economic stabilization and adjustment programmes.

Throughout the 1980s, El Salvador, Guatemala and Nicaragua experienced civil wars. In certain contexts, war has restricted the rate of deforestation. War zones are often located in agrarian frontier or forest areas. Given the risks to human life and economic

infrastructure, as well as the disruption of marketing circuits, peasants, commercial farmers and logging companies generally refrain from penetrating such areas. Moreover, hundreds of thousands of people fled the war zones or were obliged by the state to resettle elsewhere (as in Guatemala and Nicaragua). Such processes have relieved population pressure in agrarian frontier areas. Figures on displaced persons in El Salvador range from half a million to one million people. In Guatemala, the number of refugees from civil violence was put at 220,000 in 1989 (Bradley et al., 1990). In Nicaragua, an estimated 350,000 people migrated internally or fled into neighbouring Costa Rica and Honduras (Barry and Serra, 1989).

Displacement, however, can exacerbate problems of deforestation in neighbouring countries. Some 40,000 Guatemalan refugees are located in Mexico. The number of Salvadorian and Nicaraguan refugees believed to be living in Honduras at any one time oscillated between 30,000 and 50,000 during the 1980s (SECPLAN, DESFIL and USAID, 1990). During the early 1980s, between 18,000 and 30,000 Miskito Indians fled Nicaragua for Honduras. While attempts were made to locate much of this population in camps, many dispersed to take up shifting cultivation and cattle raising in the forested areas of eastern Honduras (Campanella et al., 1982). By the late 1980s, it was estimated that farming and military activities, as well as fuel wood gathering and human settlement patterns of some 10,000 Nicaraguans in eastern Honduras, had caused serious environmental destruction in an area of 400 square kilometres (SECPLAN, DESFIL and USAID, 1990).

Military operations in El Salvador and Guatemala have led to serious degradation of forest areas. In both countries, the army has operated a scorched earth policy. While information regarding the situation in Guatemala is hard to come by, it is known that military operations have caused widespread deforestation in certain highland regions such as Quiche and Huehuetenango. Extensive strips of forest lining roads in rural areas have also been cleared by the army to diminish the risk of ambush by guerrillas.

In El Salvador, guerrilla strongholds in forested areas around the Guazapa Volcano, Morazan, Cabañas, and Chalatenango have, according to one report, "become virtual wastelands, with the landscape scarred with bomb craters, crops destroyed, and burnt forests reduced to secondary scrub or rock" (Hall and Faber, 1989). Community leaders from a town in Morazan placed an advertisement in one national newspaper which read:

> "We are very worried by the damages caused by the devastating forest fires caused by aerial bombing and indiscriminate mortar fire, as well as by soldiers carrying out patrols and operations. The armed forces commonly burn the forest during the dry season, accelerating the destruction of resources in the zone .... Because they have deforested large areas in our zone, the scorched

> earth and bombing campaigns have notably affected rainfall patterns. The length of the rainy season has shortened, and the levels of streams and rivers has dropped. The situation is becoming more critical, and we are worried now because it is affecting us directly. Our crops have diminished and this worsens our already agonizing economic situation." (**El Mundo**, 24 February 1988, cited in Hall and Faber, 1989:9)

War has also prevented governments and private agencies in the region from implementing reforestation, forest protection or agroforestry projects. This is partly due to the sheer difficulties and risks involved in working in frontier or forest areas affected by fighting. It is also a result of the fact that governments having to contend with war and economic crisis are unlikely to give priority to environmental programmes.

Nicaragua not only experienced a civil war but also a trade and and aid embargo imposed by the United States in 1985. One effect of this was that important environmental studies and projects supported by USAID in most countries in the region were not carried out in Nicaragua.

The ending of civil wars can also have negative implications for deforestation as depopulated agrarian frontier and forest areas are recolonized. As the director of the Nicaraguan Natural Resources Institute (IRENA) remarked in an interview: "It is a curious fact that the war was kind to the forest while peace has brought increased natural resource destruction." While the rate of deforestation had declined as a result of the war, it looked set to increase sharply now that the war had ended. United States companies were once again requesting large territorial concessions to extract lumber while the demobilized *Contras* and thousands of returnees were proving reluctant to resettle in rural development poles and were gradually moving back to agrarian frontier areas.

In El Salvador and Nicaragua, agrarian reform programmes were also implemented during the 1980s. Such programmes appear to have had contradictory effects in terms of deforestation. In the case of Nicaragua, for example, land redistribution, greater security of tenure provided through land titling programmes, plus easier access to cheap credit, modern farming inputs and social services probably eased the pressure on agrarian frontier expansion by shifting cultivators in certain areas of the country and hence contributed to the reduction in the rate of deforestation experienced during the Sandinista era. In certain areas of the country, however, the process of land redistribution took little account of the type of land which was handed over to peasant producers, co-operatives or state enterprises. As such, it appears that significant areas of forest land were subsequently converted to crop or pasture land. According to the current director of IRENA: " Too much emphasis was placed on the idea of 'agrarian' reform while no one paid attention to the need for an 'agro-forestry' reform."[6]

6. Interview with Jaime Incer Barquero, Director of the Nicaraguan Natural Resources Institute (IRENA), September 1990.

The Salvadorian agrarian reform, which (according to a 1988 report) redistributed over a third of a million hectares to nearly 80,000 beneficiaries between 1980 and 1987, proved to be even more ecologically unsound. An estimated 45 per cent of the land available for redistribution under Phase I (which nationalized several large estates) was so-called "non-productive" land with some woodland or forest cover (Hall and Faber, 1989). Much of this was cleared by co-operatives for agricultural purposes. Less than 30,000 hectares were officially retained as reserves.[7] Lack of support services to the programme's beneficiaries and increasing indebtedness have forced many to overexploit the lands they received (Hall and Faber, 1989).

7. Data provided by FAO consultant Antonio Monzón.

Stabilization and adjustment policies have also had important implications for deforestation. Partly as a result of these policies, new "non-traditional" agro-export sectors have emerged which, in some areas, have displaced basic grain producers further towards forested hilltops and the agrarian frontier. This is particularly apparent in certain highland regions of Guatemala.

The fuel wood crisis has also been compounded by economic stabilization policies which have attempted to eliminate distortions in relative prices which derive from subsidies and exchange rates which overvalue local currencies. To the extent that currency devaluations and the reduction or elimination of subsidies increase the cost of petroleum-based fuels, this is likely to have pushed up the demand for fuel wood.

Stabilization programmes intent on cutting fiscal deficits have often imposed severe restrictions on government expenditures. In some cases this has severely limited the budgets of environmental agencies. Such a situation affected, for example, the Nicaraguan Natural Resources Institute (IRENA). When the Sandinista government introduced stringent austerity measures in 1988, IRENA not only experienced significant budget and personnel cuts but also lost its autonomous status, becoming just another department of the Ministry of Agriculture and losing in the process considerable influence in the policy decision-making arena.

II. The Social Impact of Deforestation

Deforestation and its enviromental consequences have had major effects on the livelihood, living levels and lifestyles of millions of people located in or nearby deforested areas. In order to analyse the social impact of deforestation in Central America, it is useful to distinguish a number of scenarios which are commonly found throughout the region. The first relates to the impact of deforestation on the peasantry and traditional peasant farming systems in areas where there is considerable pressure on forest resources due primarily to land scarcity and fuel wood requirements. The second relates to the situation of peasant populations in agrarian frontier areas where deforestation has occurred as a result of colonization processes. The third

concerns the situation of Indian groups in forest areas affected by deforestation and encroachment by outsiders. The fourth concerns the impact of deforestation on groups living near or in urban centres or densely populated rural areas.

• DEFORESTATION AND THE CRISIS OF PEASANT AGRICULTURE

For centuries, peasant agriculture in Central America was based on the slash and burn or *roza* system. Such a system can yield important social, economic and ecological benefits under conditions where both the person-to-land ratio and the cash and consumer demands of the peasant household remain low (Heckadon, 1982). It not only provided peasant families with their basic food requirements but also minimized risk given that few or no costly modern inputs were required and indebtedness was restricted. By burning the dense covering vegetation of forest areas, the peasant transformed this biomass into nutrient rich ashes which fertilized crops. The *roza* system, however, depended on the possibility of leaving land fallow for long periods of time given the impossibility of continuing production on the same plot under conditions of declining fertility and prolific weed growth (Heckadon, 1984).

Such a system, however, is extremely fragile and liable to break down as pressure on the land and the rate of deforestation increase. When this occurs, the impact on agricultural production and productivity, employment, livelihood and social relations can be dramatic. These relationships have been analysed in some depth by Heckadon in a study of colonization processes in Panama (Heckadon, 1982, 1984 and 1985).

The crisis of peasant agriculture first manifests itself in the breakdown of the system of subsistence agriculture. As access to forested land becomes more restricted and the demands of the peasant family for food and cash income increase, the producer generally opts out of the *roza* system and converts the land to pasture for cattle grazing in the belief that this activity will provide greater cash income (Heckadon, 1984). Moreover, the vulnerability of the peasant household increases not only as subsistence food production declines but also given the fact that traditional institutions of labour exchange and credit based on mutual trust tend to be phased out.

Many small producers who take up cattle raising soon embark on a cycle of economic decline:

> "Soil erosion, resulting from the summer burning of fields, overgrazing, and the mechanical action of the cattle moving up and down the slopes, becomes a serious problem. Weed control becomes a costly struggle which, after a time, the majority of the small and medium-sized producers cannot endure. The cattle grow slowly,

> and what is worse, productivity, like income, gradually declines. Moreover, the marketing system operates against the small producer since the greatest profits are obtained by large scale producers and above all by middlemen [...] In the cattle zones people consume less meat and milk than they did a generation ago." (Heckadon, 1985:50)

The third stage of the crisis cycle manifests itself in increasing unemployment and landlessness. "Many of the smaller and medium-sized landowning *campesino* settlers begin to sell their land to larger producers. As the land tenure system becomes more unequal, it leads to greater social differentiation among the peasants themselves. Moreover, when in the frontier most lands have been transformed to pastures for cattle, unemployment and underemployment become serious social problems." (Heckadon, 1984:277) Members of peasant families are often obliged to engage in sharecropping as a means of obtaining additional plots of forest land or to seek employment as wage labourers.

It is often the case, however, that the dynamic sector in the local rural economy is cattle raising which provides relatively few employment opportunities. This is brought out clearly in a study of the cattle industry in Honduras and Nicaragua where the employment ratio per hectare of pasture during the early 1980s was approximately 5 or 6 person/days per annum. This compared with 202 person/days in the case of coffee and 73 for maize in Honduras (Howard, 1987). The upshot of this situation was that the cattle boom which occurred in several Central American countries generally led to intense processes of out migration to urban or agrarian frontier regions.

Erosion and declining yields pose a serious threat to peasant agriculture throughout much of Central America. This is particularly the case in hilly and mountainous areas where peasant production has been pushed into the hills and where the use of animal traction and the plough often constitute inappropriate technologies from the ecological point of view (CIERA, 1984).

The crisis of peasant agriculture in such a context has been described in various studies. According to a USAID report on Honduras:

> "Deforestation by the shifting cultivator clearing high forest in Yoro and Olancho is dramatic and well-publicized. The human tragedy is even more serious for the many thousands of campesino families living on degrading lands in the Choloteca Valley and the western departments bordering El Salvador. The forest cover has been peeled back leaving a threadbare patchwork of grazed bush fallow and cultivated plots [...]"
>
> "Given existing technology, this mountainous land is not likely to be a major source of products for national

> and export markets. Therefore, the tendency is to abandon this land and its campesinos, and invest existing resources in improving agricultural production among more sophisticated farmers on the better valley soils. Such a course of action will have serious social, economic and environmental effects." (Campanella et al., 1982:8)

As indicated above, one of the most pervasive socio-economic forces underlying deforestation in Central America relates to processes of colonization of rain forest areas. As is well known, the introduction of technological practices unsuited to rain forest environments has had serious effects on agricultural productivity and the livelihood of peasant families who inhabit such areas.

When analysing the question of social impact of deforestation in agrarian frontier regions it is important to distinguish between the situation of "spontaneous" settlers and those participating in organized colonization schemes. Some studies have found that, contrary to what might be expected, the environmental and social consequences of colonization have been far worse in the case of government-sponsored colonization schemes than in the case of spontaneous colonization.

This is illustrated in a study of colonization in the central part of Nicaragua's Atlantic coast region:

> "While the process began fairly recently (approximately 30 years ago) and has accelerated in terms of the increasing numbers of inhabitants one finds in the area, it has nevertheless been gradual. This fact has enabled the families involved to minimize the risk of failure. Immigrants take advantage of family ties and friendships, they learn the secrets of the mountains and land from those who arrived previously (... where to find the best plots of land, where the river floods, etc.) while the head of the family usually finds an appropriate spot before the rest of the family arrives. This process facilitates not only adaptation to the natural environment but also social and economic integration ...." (CIERA, 1981:259-260)

• DEFORESTATION AND INDIGENOUS GROUPS

While estimates vary widely, the Indian population of Central America probably accounts for about 15 per cent of the region's 30 million inhabitants. The vast majority of this population is concentrated in Guatemala where nearly 50 per cent of the national population is Indian (Burger, 1987). In the other countries of the region, the Indian population ranges from 0.1 per cent (Costa Rica) to approximately 10 per cent of the national population (El Salvador) (Burger, 1987; Bozzoli, 1986; Chapin, 1989).

Much of this population is located in or near forest and agrarian frontier regions or in areas which have experienced extensive

deforestation in recent decades. The penetration of lumber companies, plantation and mining enterprises, ranchers and peasant farmers into such areas has often had a dramatic impact on the livelihood and living conditions of indigenous groups. The exploitative character of labour relations in extractive enterprises, the marginalization of Indian groups in most government social programmes and vulnerability to the difficult physical conditions which characterize many rain forest areas has meant that in all countries Indian groups usually experience the worst living conditions.

When analysing the social impact of encroachment on indigenous groups, two scenarios stand out: one relating to the impact resulting from the penetration of large "extractive" enterprises (notably lumber and mining) and another resulting from settlement by ranchers and peasants.

Given the failure of most lumber companies and national governments to undertake significant reforestation and adopt effective sustainable forest management practices, the operations of such companies in a particular area often assume a "boom and bust" character. Nowhere is this more apparent than in the Atlantic coast region of Nicaragua where United States companies cleared an estimated 240,000 hectares during the early and mid-1900s. As Solis points out:

> "While in 80 years of activity US logging companies extracted more than one billion board feet from the Atlantic Coast, the value of exports between 1945 and 1964 alone were worth an estimated 50 million dollars ... However, because the Somoza administration required no investments in restocking or reafforestation, in environmental protection, nor in infrastructure and productive activity that might provide long-term employment to break the vicissitudes of the boom-and-bust cycle, the extractive nature of the Atlantic Coast enterprises had a long-term impact on the local population." (Solis, 1989:491)

The arrival of the lumber and other resource extraction companies transformed the lives and livelihood of local indigenous populations which had previously formed part of subsistence economies dedicated to hunting and gathering, fishing and domestic agriculture. The Indian population was quickly drawn into the market economy both as wage labourers and as consumers.

The cultural implications of this change were dramatic. As hunters, gatherers, fishermen and subsistence agriculturalists, work in the traditional Miskito communities had been irregular, itinerant and often combined with leisure. This was a far cry from the conditions which characterized work in lumber activities (CIERA, 1981).

Many Indians chose to work for the lumber companies on a seasonal basis, returning to their communities until economic hardship obliged them to work again as wage labourers. The need to return was to a large extent related to the fact that Miskito families had been drawn into the market economy. As manufactured products, wages and new cultural influences penetrated northern Zelaya purchases of manufactured clothing, tools, metal cooking utensils and tinned foods increased, often replacing traditional products.

The need to return constantly to find work as wage labourers was also related to the fact that the capacity of certain families and communities to generate cash incomes on the basis of certain traditional activities decreased. Historically trade had been limited to the exchange of skins, medicinal plants and tortoise shells for such items as clothing and arms. The devastation of large forest areas and the growth of coastal populations which accompanied the lumber and banana boom reduced the availability of many traditional marketable products (Jenkins, 1986).

When analysing the situation of Indian populations and their relations with outside forces, there is a tendency to generalize about the plight of the Indian. Certain anthropological studies, however, reveal the extent of social differentiation within Indian tribes or communities. This has important implications for our analysis of the social impact of deforestation. One such study of the Xicaque Indians in central Honduras found that the 23 tribes which inhabit the area are stratified into four different socio-cultural groups. Lumber companies which operate in the area enter into agreements with the Federation of Xicaque Indians and in accordance with government legislation must pay stumpage to the Indians. Under the terms of the Social Forestry System promoted by the state forestry corporation COHDEFOR, such resources are supposed to benefit the entire Indian community. It has been found, however, that control of the Federation and appropriation of the benefits derived from stumpage are largely in the hands of just one of the four social groups.[8]

Encroachment and deforestation have at times resulted in considerable social conflict. In Nicaragua, for example, an estimated 100,000 people moved into agrarian frontier regions throughout the 1950s, 1960s and 1970s. This process led not only to environmental deterioration as peasant farmers used to Pacific coastal ecological conditions took up farming in fragile rain forest conditions but also to conflicts over land. As Solis observes:

> "The spiralling depletion of natural resources was accelerated as the expanding indigenous population was forced to move along the rivers also seeking new lands. The inevitable friction resulted in some deaths prior to [the Sandinista Revolution of 1979], specifically of Indians killed by Spanish-speaking migrants ...." (Solis, 1989:492)

8. Interview with Honduran anthropologist, Manuel Chavez, November 1990.

Indian groups have sometimes responded through collective forms of protest to encroachment and deforestation. National security agencies have often countered such actions with the use of force. Perhaps the worst instance of repression occurred in 1932 in El Salvador when Indians wanting to maintain communal lands and resist the encroachment of coffee plantations joined an uprising led by Farabundo Marti and occupied several towns in the country's coffee growing region (Burger, 1987). The army responded by massacring 30,000 Indians and peasants.

Unfortunately, such extreme responses are not a thing of the distant past. In 1978, 400 Kekchi Indians were murdered or injured when fired upon while protesting in a town square at attempts by large landowners to evict them from lands they had farmed for decades but to which they had no title (Burger, 1987). The indiscriminate shooting of Indian people by the Guatemalan military has continued to the present day.[9]

9. Even as this paper was being concluded (December 1990), there were reports from Guatemala that the military had shot 13 Indians and wounded several others during a peaceful protest in the town of Santiago de Atitlán.

Organized protest and opposition by Indian groups has on occasion yielded positive results. This was particularly apparent in the case of the Kuna Indians of Panama. Following a long history of conflict with the government, including an armed revolt in the 1920s, the Kuna now enjoy a high degree of autonomy and full legal title to their land, located east of the Panama canal on the Caribbean coast (Gradwohl and Greenberg, 1988; Burger, 1987).

More recently, indigenous groups in Nicaragua obtained considerable rights under the Sandinista government's initiative to grant autonomy to the Atlantic coast regions of Nicaragua. This initiative came after several Miskito Indian organizations had encouraged the local population to resist the government through diverse means, including taking up arms.

Despite the degree of repression of the Indian population in Guatemala, there are instances where indigenous communites have organized successfully in defense of their interests. A study conducted by Veblen in 1978 sought to determine why the province of Totonicapan in the central highlands of Guatemala had, unlike other provinces in the region, remained forested despite a long history of intense population pressure. He found that local groups of artisans, woodcutters and carpenters whose livelihood depended on the use of forest resources constituted an effective pressure group which ensured that local authorities protected municipal and communal forest holdings and punished those who cut wood illegally (Veblen, 1978).

A major problem in Honduras has been the high incidence of illegal forest fires which according to some are "set out of spite because the *campesino* believed COHDEFOR (the Honduran Forestry Development Corporation) has usurped his forest" (Campanella et al., 1982).

During the late 1970s and 1980s, numerous Indian organizations were formed in Honduras. Many, however, experienced considerable instability. A Pan-Indian movement was established in 1977 to defend Indian lands. Control of the organization, though, was largely in the hands of *ladinos*, and it was soon disbanded (SECPLAN, DESFIL and USAID, 1990). Prior to 1985, the organizational efforts of the Xicaque Indians in Yoro experienced similar difficulties. During the mid-1980s, both the Xicaque and Pech Indians formed what appear to be stronger organizations, (SECPLAN, DESFIL and USAID, 1990).

The capacity of these organizations to operate as effective pressure groups, however, has remained fairly limited. The 1982 USAID report on the environment in Honduras noted that, in spite of the fact that the rights of Indian groups to maintain their cultural forms and land base were recognized in law, it was clear during the early 1980s that "they have little serious support from the National Agrarian Institute" (Campanella et al., 1982). During the late 1980s, indigenous groups in Honduras were successful in getting the state to formulate the Law for the Protection and Development of Ethnic Groups of Honduras which was intended both to protect indigenous populations and regulate the use of natural resources in areas where such populations were located (SECPLAN, DESFIL and USAID, 1990).

• THE SOCIAL IMPACT OF THE FUEL WOOD CRISIS AND "URBAN DEFORESTATION"

Deforestation around towns and cities caused by urban sprawl, the growth of commercial agriculture and the increased demand for fuel wood has affected the lives of millions of people living in or around major cities as well as in densely populated rural areas. Water shortages, problems to health caused by wind erosion, the increasing cost of fuel wood, flooding of urban areas and destruction of drainage systems, declining agricultural productivity in green belt areas, changes in micro-climate and the increasing incidence of drought conditions can all be linked to the process of deforestation around urban areas.

In El Salvador, the fuel wood trade centred on the capital threatens not only national parks like El Espino located near San Salvador but also the mangrove forests along the Pacific coast. This has damaged local marine life and the livelihood of coastal fishing communities. Pressure on fuel wood supplies has increased in recent years as a result of the acceleration of rural to urban migration during the war years. Moreover, it is common for migrants, including children, to cut and sell fuel wood as a means of acquiring money (UNICEF, 1988).

In Nicaragua, the fuel wood trade to supply Managua has led to serious deterioration of the capital's southern watershed. Throughout much of the past decade, Managua has experienced flooding as a result of silting of the city's drainage system as soil is washed down from the hills. Agriculture in the capital's green belt

area is also threatened by declining yields and in some areas in the surrounding hills erosion has been such that the soil cover is too thin to grow crops.

The fuel wood trade has also affected other rural areas near Managua. The main source of the capital's fuel wood supply is found to the east of the city (Gewald, 1980; Reiche and Van Buren, 1984). This is one of the most environmentally devastated areas in Nicaragua. Widespread deforestation over the last 20 years has not only affected agricultural productivity but led to changes in micro-climate. Drought conditions regularly ruin harvests. Famine conditions threatened 32 communities in the area during 1990 (**Barricada**, 1990).

The situation is also dramatic in the northern Pacific region of Nicaragua where the cities of Leon and Chinandega are located. In this, the cotton heartland of the country, an important reforestation project was implemented during the early 1980s. In order to tackle the serious problems of wind and rain erosion which diminished fertility in the area, over 1,200 kilometres of windbreaks were planted. By 1987, half remained. Two years later, less than 400 kilometres of largely degraded windbreaks existed while a recent estimate for 1990 claims that only 90 kilometres are in a good state[10] (**Revista del Campo**, 1990).

10. Interview with FAO consultant, Antonio Monzón, San Salvador, October 1990.

The cost of fuel wood has risen sharply during the past two decades. Fuel wood markets have expanded and families must allocate an increasing proportion of their limited cash incomes to fuel wood purchases. The implicit labour cost has also risen as families devote more time to gathering. In rural areas in Guatemala, rural families were found to spend between half a day and two days per week collecting fuel wood (Zanotti, 1986). In certain areas of the northern Pacific region of Nicaragua and elsewhere in Central America, fuel wood gatherers must now travel distances of more than five kilometres to find fuel wood. This situation affects men, women and children alike. This is particularly so in Nicaragua where 42 per cent of fuel wood gatherers are women or children (19 and 23 per cent, respectively). In Guatemala and Honduras, over a fifth of the time allocated to fuel wood gathering is taken up by women and children. Having to allocate increasing time to fuel wood gathering can have a negative social impact in terms of child care, and the nutritional status and education of child gatherers (Martinez, 1986). In rural areas of Costa Rica, where fuel wood collection is undertaken almost exclusively by men, some 22 man/days are lost each year as a result of this activity (Reiche, 1986).

Shortages of fuel wood and the increasing value of this commodity have also generated social tensions and conflict. In El Salvador, it is common for those involved in fuel wood collection for commercial purposes to undertake these activities armed and at night. Under such conditions, it becomes extremely dangerous for forest rangers or other interested groups to attempt to defend protected areas. Increasing social tensions have also arisen in rural areas between landowners and local fuel wood gatherers. Heckadon

describes the situation in rural El Salvador, where traditionally fuel wood is regarded by the rural poor as common property:

> "As shortages and prices of forest products increase, landowners become less tolerant of traditional practices. But even so, with or without the permission of landowners, the people continue to cut trees for fuel wood. In the coffee zones of the central and western regions, men, women and children mobilize at night .... to cut shade trees for fuel wood. In rural zones, conflicts over the right to use the diminishing stock of forest resources constitute one of the principal issues of legal disputes." (Author's translation, Heckadon, 1989)

III. Reversing the Trend ? Forest Protection Initiatives

Both public and private concern regarding deforestation and other environmental problems have clearly heightened throughout the region during the past decade and important forest protection initiatives have been taken in most countries.

With the exception of El Salvador and Nicaragua, governments in the region have now completed Tropical Forest Action Plans. Natural resource policy inventories have also been drawn up in Costa Rica, Guatemala, Honduras and Panama. Organizations like CATIE have been active in experimental research and training in areas associated with agroforestry, forest protection and sustainable forest management schemes.

Since the early 1970s, the number of protected wildland areas in the region has increased dramatically from just 30 in 1970 to more than 300 in 1987 (Morales and Cifuentes, 1989). This rate of expansion has accelerated in recent years and, while accurate data are difficult to come by, it would appear that somewhere in the region of 7 million hectares, or 14 per cent of Central America's total land area, are now officially designated as protected areas.

Of a total land area in Panama of 7.5 million hectares, 1.1 million now form part of the country's national parks and reserve system. In 1980, Honduras established what was then one of the region's largest protected areas, the Río Plátano Biosphere Reserve (Morales and Cifuentes, 1989). In 1987, some 37 areas of Honduran cloud forest were legally designated as protected areas (SECPLAN, DESFIL and USAID, 1990). Major initiatives in forest protection were taken in 1990 in both Guatemala and Nicaragua. The Mayan Biosphere Reserve in Guatemala's Peten region was established and covers an area of 1.4 million hectares (CONAP, 1990). The national area now protected or designated as reserved represents one third of the total land area (Bradley et al., 1990). That same year saw nearly half a million hectares of south-eastern Nicaragua declared as national reserve or protected wildlife area. (Centro Científico Tropical, 1988).

Since the enactment of the 1969 Forest Law, more has been done in Costa Rica to protect forest resources than in any other Central American or indeed Latin American country. One and a half million hectares or 29.3 per cent of the national territory are now legally constituted as protected areas (MIRENEM, 1990). During the past three years, "debt for nature swaps" have played an important part in this process. By mid-1989, Costa Rica accounted for over three fourths of the total value of the world's debt for nature swaps (Barraclough and Ghimire, 1990). Between 1987 and 1989, some 72 million dollars of national debt was converted into 36 million dollars of local currency commitments to finance environmental protection initiatives including the purchase of national park and reserve land and intitutional support for environmental organizations (**La República**, 1990).

Some criticism of these types of arrangements, however, is being voiced in the belief that they provide good press for the international donor agencies and commercial banks but detract from efforts on the part of debtor nations to achieve a comprehensive solution to the debt problem. Moreover, debt for nature swaps have added to inflationary pressures and their attractiveness has lost ground with certain "stabilization-conscious" governments.

While much has been done on paper to protect forests, the possibilities of effectively implementing progressive environmental legislation are generally quite limited. As Green points out:

> "The steady growth in the number of parks and reserves has created the illusion that stretches of forest have been rescued from the onslaught of shifting agriculture. But there is an enormous gulf between legislating reserve status and enforcing it. Honduras and Guatemala, for example, struggle to manage two national parks apiece, while their numerous other protected areas are by and large abandoned to their inexorable fate. Indeed, the bitter truth is that throughout the isthmus many parks and reserves exist on paper alone, and the assault on the forest is often as severe within the parks as without." (Green, 1990:123-124)

Since the 1960s, numerous laws have been introduced in Costa Rica to protect forests. A study recently conducted by the Costa Rican environmental group CEDARENA has shown, however, the limited effectiveness of much of this legislation. While legislation passed in 1961 (Ley de Tierras y Colonización), for example, attempted to bring a halt to spontaneous settlement of public lands, "this provision in the law has been largely ignored by settlers and weakly enforced by the government ... The history of toleration of mass invasions of public lands in the three decades since the public domain was placed legally off limits to settlers ... suggests that the state is not serious about excluding settlers from state land" (CEDARENA, 1990).

Most national natural resource and environmental agencies in the region, however, experience major budgetary restrictions - restrictions that have increased with economic stabilization programmes. As a result, many agencies are unable to effectively protect national parks, reserves and watersheds. Panama, for example, has just 60 forest rangers to patrol over a million hectares. Whereas deforestation, erosion and sedimentation pose a major threat to the future of the Panama canal, the government is reluctant to raise taxes to pay for watershed protection. Each ship that passes through the canal discharges approximately two million litres of water (Collins, 1990). The Canal Zone authority, however, is reluctant to pay for the water. A proposal by the natural resources institute, INRENARE, to raise the canal toll by three cents per ton would secure 9 million dollars for protection schemes of the Rio Chagres watershed. This proposal, though, has met with opposition from certain government agencies.

The reluctance of governments throughout the region to increase taxes and budgetary outlays to pay for environmental protection has led to an extreme dependency on foreign aid. As international concern regarding tropical rain forests increases, along with availability of external funding, the pressure is taken off governments to look to their own devices to tackle environmental problems.

Many other projects and programmes in the area of forest protection are at a very early stage and face serious difficulties. As regards agroforestry programmes, there is the problem of how to make the qualitative leap from model farms and demonstration plots to widespread diffusion of alternative production systems and techniques among peasant and commercial farmers. Faced with limited access to land and the pressing need to produce food and cash crops to meet essential needs, it is not surprising that the diffusion of agroforestry schemes has been slow (Dulin, 1985; Dittborn, 1988; Jones, 1982). Moreover, the ministries of agriculture which have responsibility for extension services tend to give priority to commercial farming sectors and not peasant producers in frontier regions.

Relatively little has been done in most countries to encourage reforestation and sustainable forest management practices. In 1980 forest plantations accounted for just 25,000 hectares. By 1987, there had been only a slight increase in this figure (Hedstrom, 1990). In Honduras, where deforestation accounts for 80,000 hectares annually, government reforestation programmes replaced just 2,000 hectares annually during the mid-1980s (Hernández, 1986). While this ratio of 40 to 1 was probably the highest in the region, in other countries the area deforested each year vastly exceeds that which is reforested. In Nicaragua the ratio is reported to be 20 to 1 (**Revista del Campo**, 1990). Even in Costa Rica, which is often held up as a forestry protection showpiece, it was reported in 1982 that the ratio

of deforested to reforested land was 12 to 1 (Brockett, 1990). By the end of 1986 only 10,083 hectares of forest plantations existed (Finegan and Sabogal, 1988).

Since the late 1980s, however, the rate of reforestation in Costa Rica has increased as a result of credit and fiscal incentives. A new Forestry Law passed in 1986 provided important incentives for reforestation on private lands by introducing forestry bonds for reforestation projects. Stricter controls on the use of forest resources on private lands were also introduced (CEDARENA, 1990). By government decree, the Costa Rican government declared a state of Forestry Emergency in 1988 in order to halt deforestation. Fewer incentives are now being provided for cattle expansion while ranchers are encouraged to convert pasture to forest. It was expected that during 1988 and 1989 approximately 20,000 hectares would be reforested under the fiscal incentive scheme (MIRENEM, 1990).

In Guatemala, the government has also introduced a fiscal incentive programme which enables companies or individuals tax concessions of up to 50 per cent on their taxable income (DIGEBOS, 1990). While such schemes seem attractive on paper, they have experienced considerable limitations. While the area reforested under the Guatemalan programme has increased significantly in recent years it still only accounts for approximately 1,000 hectares a year. The private companies involved in promoting and executing the programme have found that their market is somewhat limited given the tradition of tax evasion that has existed in the country and the unwillingness of many firms to risk channelling funds into long-term investments during difficult economic times.[11] Under these conditions, it appears that the companies and individuals which are prepared to participate in such a scheme are often the large conglomerates and their executive directors. Several United States transnational corporations have been particularly interested in the programme. Several companies use their participation in such schemes for publicity purposes with media advertisements which show how the company is saving the country from environmental destruction. What is not mentioned, however, is that the law permits those participating in the scheme to completely clear all the reforested area after just nine years.

11. Interview with Manuel Aragón of Agroforest S.A.

Serious problems have arisen regarding the sustainability of reforestation schemes throughout the region. In several countries, funding has been available for planting but not for maintenance. This was the case in El Salvador during the early 1980s when funding from USAID led to areas of between 50 and 100 hectares being planted with trees on many of the farms that formed part of the agrarian reform programme. In all, a total of 8,400 hectares were planted. The initial funding, however, included nothing for maintenance and many of the trees planted during 1980 and 1981 perished. A top-down approach to project design and implementation also led to serious problems. Many of the intended beneficiaries failed to see what benefits could be gained from planting trees on

land that could be used for food or other crops. Animosity towards the project was such that instances arose where local farm residents set fire to areas recently planted with trees.[12]

Many positive initiatives in the field of forest protection have been thwarted by the actions of specific interest groups or the inaction of certain state agencies. It is often the case that interest groups with a stake in deforestation can take the sting out of legislation and policies designed to protect forests. This has been particularly apparent in Honduras where a powerful lumber lobby has been able to force major changes in government policy (Hernández, 1986).

When civilian government was restored to Guatemala in 1985, some advances were made in the area of social and environmental policy. In 1989, a new Forestry Law and the Protected Areas Law came into effect. A new municipal code passed by the Guatemalan Congress in October 1989 identified specific roles for municipal governments in the area of environmental protection. It remains to be seen, however, whether much will be achieved on the ground. Economic and political power remain highly concentrated in the hands of large landowners, a few industrialists and the military. Such groups constitute powerful interest groups which can effectively undermine progressive legislation and government policies (Bradley et al., 1990). While several initiatives were taken by the Cerezo government in the area of environmental protection, there is considerable doubt regarding the government's capacity to implement relevant legislation and policies. As stated in a recent USAID report on natural resource policy in Guatemala:

> "The country's legal base, institutional framework and citizen participation in the policy process are too weak to effectively implement policies related to environmental issues .... Laws are often outdated ... fines for violations are too low, license systems arcane, environmental impact assessments are not required, educational programs are not included, and mechanisms for enforcement of the law nonexistent .... Institutions mandated to implement policies lack both the credibility and the long-term financing necessary to be effective ... Instead of an integrated and coordinated legal system to protect the environment, each institution involved ... issues its own individual and often outdated policies. ... Centralized decision making, erratic actions, and biased political agendas would make any rural population highly skeptical of any official central government programs. However, the case in Guatemala is acute. The skepticism of the Indians, generated from a long history of centralized decision making dominated by Ladinos, broken political promises, and outright exploitation and violations of human rights has translated into apathy and non-participation in the political arena." (Bradley et al., 1990:II, 23-24)

12. Interview with José Roberto Denys, Director of the Natural Resources Centre, El Salvador, October 1990.

Costa Rica's forest protection initiatives have also experienced serious limitations. The conservation drive began in earnest in 1969 with the enactment of the Forestry Law. Throughout the 1970s, however, authorities could do little to contain deforestation and reforestation proceeded slowly (Silliman, 1981). While most of Costa Rica's forests are now located in protected areas, expropriation of private holdings in such areas still has a long way to go. Hence, according to the recently completed Tropical Forestry Action Plan: "real protection in many of these areas is relatively weak" since current regulations still permit land owners to exploit forest resources (MIRENEM, 1990:5).

Given the inherent weakness of national institutions with responsibility for forest protection, it is often the case that positive initiatives in this area result from the fact that the temporary occupant of a key government post (or the spouse of a president) happens to be concerned about environmental issues. The major driving force behind many environmental protection initiatives are the pressures and inducements associated with certain types of external aid. The increasing amounts of foreign aid now available for environmental protection projects and programmes will no doubt mean that the scale and scope of forest protection schemes will expand considerably into the 1990s.

Such aid, however, is not without its drawbacks and a number of problems characterize donor-recipient relations. Some of the more technical difficulties associated with project design and implementation, as well as the clash of interests and priorities have been identified by Green (1990). Other, perhaps more serious, problems relate to the fact that many national institutions simply do not have the budgets or personnel to fulfil their counterpart obligations. This was borne out clearly in an evaluation of Swedish aid to the Nicaraguan forestry sector (Budowski and Vieman, 1989). The same evaluation detected other important problems which characterized the donor-recipient relation, notably the tendency to transfer uncritically to the tropical conditions of Nicaragua knowledge and techniques appropriate to the temperate climate of northern Europe, the insufficient attention paid to sustainable forestry management on the part of Swedish agencies supporting the local forestry industry and the tendency to draw up over-optimistic plans which failed to consider the complex array of social and economic forces underpinning deforestation (Budowski and Vieman, 1989).

Conservation and environmental groups have grown in strength during the past two decades and in most countries now constitute effective pressure groups. Moreover, certain groups in countries such as Costa Rica and Guatemala actually administer major forest protection schemes. The approach of such groups towards environmental and development issues, however, varies considerably. One, which may be labelled "conservationist" and which appears to prevail in countries like Guatemala and Honduras, tends to see forests, flora and fauna as the victims of man's inhumanity to

nature. Man is considered the culprit and his activities need to be strictly controlled. Another approach which appears to characterize the activitites of certain ecology groups that are active in Nicaragua and El Salvador, tends to see natural resource destruction in the context of man's inhumanity to man. What is basically at fault is a specific social system characterized by skewed resource allocation and exploitative social relations. As such, programmes to protect the environment must go hand in hand with development programmes which address broader social problems associated with poverty and inequitable resource allocation.

It would seem to be the case, however, that on the ground experience brings with it a considerable degree of social awareness. Several groups which at the outset assumed a purely "conservationist" stance now realize that forest protection must go hand in hand with development projects and programmes that provide alternative livelihood opportunities for the rural poor. This transition has been particularly apparent in Costa Rica where, through time, a number of environmental organizations appear to have adopted a more balanced approach.[13]

13. Interviews with Steve Mack of CEDARENA and Juan Carlos Godoy of CATIE, November 1990.

Ongoing Research

As indicated in the introduction, this paper provides a preliminary assessment of the social origins and impact of deforestation in Central America. Several studies or rapid field appraisals, currently under way in four countries of the region, will shed more light on key aspects associated with the social impact of both deforestation and forest protection initiatives.

A study in a densely populated area of the western highlands of Guatemala (Totonicapan) will examine the way in which deforestation has affected the livelihood and lifestyles of local populations which depend heavily on forest products. The study will also inquire into the way in which different land tenure institutions and social forms of organization have contributed to varying rates of deforestation in the area and consider the social impact of regulations and controls governing the use of forest resources on groups which have traditionally depended on the consumption and marketing of such products. In another area of the western highlands (Huehuetenango), a smaller study is being conducted to look at the contrasting situation of two communities, one of which enabled a logging company to deforest large areas and another which organized to defend the forest.

A study in the southern interior region of Nicaragua (Río San Juan) will look at the way in which migratory agriculture and deforestation in agrarian frontier regions have been affected by three stages or styles of development which have characterized this region in the last 20 years, namely traditional agro-export development prior to the Sandinista revolution, radical transformation involving agrarian reform and resettlement of

shifting agriculturalists during the 1980s, and the current attempt to control land use patterns by declaring much of the area a national reserve.

A study in central Honduras (Yoro) will inquire into the situation of Indian groups and agroforestry co-operatives in Yoro province. Particular attention will be focused on the way in which the operations of lumber companies and the Honduran forestry corporation have affected the situation of such groups.

A study in Costa Rica will examine the nature of social tensions and conflicts, involving local communities, business enterprises, government agencies and conservation groups, which have arisen in areas in or around two national reserves.

Two papers by regional specialists will assess the experience of certain forest protection initiatives in Central America, notably those involving the creation of protected areas and the implementation of agroforestry schemes.

List of Acronyms

CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (Costa Rica) Centre for Research and Training in Tropical Agriculture
CEDARENA	Centro de Derecho Ambiental y de los Recursos Naturales (Costa Rica) Environmental and Natural Resources Law Centre
CELADE	Centro Latinoamericano de Demografía Latin American Demographic Centre
CESTA	Centro Salvadoreño de Tecnología Apropriada Salvadorian Centre for Appropriate Technology
CIERA	Centro de Investigación y Estudios de la Reforma Agraria (Nicaragua) Centre for Research and Study of Agrarian Reform
CIM	Comité Intergubernamental para las Migraciones International Committee for Migration
COHDEFOR	Corporación Hondureña de Desarrollo Forestal Honduran Forestry Development Corporation
CONAP	Consejo Nacional de Areas Protegidas (Guatemala) National Council for Protected Areas
CRIES	Coordinadora Regional de Investigaciones Económicas y Sociales (Nicaragua) Regional Coordinating Office for Economic and Social Research
DEI	Departamento Ecuménico de Investigaciones (Costa Rica) Ecumenical Department of Research
DESFIL	Development Strategies for Fragile Lands
DIGEBOS	Dirección General de Bosques (Guatemala) Forestry Division
ECLAC	Economic Commission for Latin America and the Caribbean
EPOCA	Environmental Project on Central America
FAO	Food and Agriculture Organization of the United Nations
FLACSO	Fundación Latinoamericana de Ciencias Sociales Latin American Social Science Foundation
IAN	Instituto Agrario de Nicaragua Nicaraguan Agrarian Institute
ICATA	Instituto de Ciencia Ambiental y Tecnología Agrícola - Universidad Rafael Landivar (Guatemala) Institute of Environmental Sciences and Agricultural Technology - Rafael Landivar University
IFAD	International Fund for Agricultural Development
IICA	Instituto Interamericano de Cooperación para la Agricultura (Costa Rica) Inter-American Institute for Agricultural Co-operation

IIED	International Institute for Environment and Development
INDIAP	Instituto de Investigación Agropecuaria de Panamá Panamanian Institute for Agricultural Research
INRENARE	Instituto Nacional de Recursos Naturales Renovables (Panama) National Institute of Renewable Natural Resources
IRENA	Instituto de Recursos Naturales (Nicaragua) Natural Resources Institute
IUED	Institut Universitaire d'Etudes du Développement (Switzerland)
MAG	Ministerio de Agricultura y Ganadería (Nicaragua) Ministry of Agriculture and Livestock
MIDA	Ministerio de Desarrollo Agropecuario (Nicaragua) Ministry of Agricultural Development
MIDINRA	Ministerio de Desarrollo Agropecuario y Reforma Agraria (Nicaragua) Ministry of Agricultural Development and Agrarian Reform
MIRENEM	Ministerio de Recursos Naturales, Energía y Minas (Costa Rica) Ministry of Natural Resources, Energy and Mines
ROCAP	Regional Office for Central America and Panama
SECPLAN	Secretaría de Planificación (Honduras) Planning Secreariat
UNAH	Universidad Nacional Autónoma de Honduras National Autonomous University of Honduras
UNES	Unidad Ecológica Salvadoreña Salvadorian Ecological Unit
UNICEF	United Nations Children Fund
UNRISD	United Nations Research Institute for Social Development
UNU	United Nations University
USAID	United States Agency for International Development

Bibliography

Alvarado, L.
"La sedimentación del lago de Alhajuela", in Heckadon and Espinosa (eds.), op.cit., 1985.

Augelli, J.
"Costa Rica's frontier legacy", **The Geographical Review**, Vol. 77, No. 1, 1987.

Barraclough, S. and K. Ghimire
The Social Dynamics of Deforestation in Developing Countries: Principal Issues and Research Priorities, Discussion Paper No. 16, UNRISD, Geneva, November 1990.

---------- and M. Scott
The Rich Have Already Eaten: Roots of Catastrophe in Central America, Transnational Institute, Amsterdam, 1987.

Barricada
Managua, 21 October 1990.

Barry, D. and L. Serra
Diagnóstico nacional de Nicaragua sobre refugiados, repatriados y población desplazada 1988, Cuadernos de Pensamiento Propio, Serie Documentos No.5, CRIES, Managua, 1989.

Bogach, V.S.
A Fuelwood Policy for Guatemala, Van Meurs & Associates Ltd., Ottawa, 1981.

Bozzoli, M.
El indígena costarricense y su ambiente natural: Usos y adaptaciones, Editorial Porvenir, San José, 1986.

Bradley, T. et al.
Guatemala Natural Resource Policy Inventory (2 volumes), USAID/ROCAP, Guatemala City, 1990.

Brockett, C.
Land, Power and Poverty: Agrarian Transformation and Political Conflict in Central America, Unwin/Hyman, Boston, 1990.

Budowski, G.
Deforestation in Central America: Causes, Effects and Possible Ways to Reverse the Trend, mimeo, 1990.

---------- and S. Veiman
Misión de evaluación de la cooperación forestal sueca Swedforest/Interforest en Nicaragua, mimeo, San José, 1989.

Burger, J.
Report from the Frontier: The State of the World's Indigenous Peoples, Zed Books/Cultural Survival Inc., London, 1987.

Campanella, P. et al.
Honduras: Country Environmental Profile - A Field Study, USAID, 1982.

CEDARENA
Tortuguero Region Case Studies, mimeo, San José, 1990.

Centro Científico Tropical
Propuesta para la creación del sistema internacional de áreas protegidas para la paz (Si-a-Paz) en el área del Río San Juan, San José, 1988.
CESTA
Information brochure, San Salvador.
Chacón, I., J. García and E. Guier
Introducción a la problemática ambiental costarricense: Principios básicos y posibles soluciones, EUED, San José, 1990.
Chapin, M.
The Indians of El Salvador, mimeo, 1989.
CIERA
La Mosquitia en la revolución, CIERA, Managua, 1981.

Nicaragua:... y por eso defendemos la frontera, CIERA-MIDINRA, Managua, 1984.
Collins, M. (ed.)
The Last Rainforests: A World Conservation Atlas, Oxford University Press, New York, 1990.
CONAP
Reserva de la Biósfera Maya, Guatemala City, 1990.
DIGEBOS
Proyectos de reforestación, MAG, Guatemala City, 1990.
Dittborn, A.
Algunas actitudes de los agricultores hacia la reforestación en áreas seleccionadas en Honduras, El Salvador y Guatemala, CATIE, Turrialba, 1988.
Dulin, P.
Situación leñera en los países centroamericanos, CATIE, Turrialba, 1984.

Análisis de siete proyectos de reforestación en pequeñas fincas de ladera en Honduras, CATIE, Turrialba, 1985.
El Mundo
San Salvador, 24 February 1988.
FAO
Informe preliminar: Examen y análisis de las políticas y estrategias para el desarrollo rural en Panamá, Rome, 1986.
Finegan, B. and C. Sabogal
"El desarrollo de sistemas de producción sostenible en bosques tropicales húmedos de bajura: Un estudio de caso en Costa Rica", **El Chasqui**, No.17, CATIE, 1988.
Gewald, N.
The Importance of Fuelwood in Central America: An Appraisal and Plan for Action, mimeo, CATIE, Turrialba, 1980.
Government of Guatemala
La contribución del sector forestal al desarrollo, Plan de Acción Forestal para Guatemala, Guatemala City, 1990.
Gradwohl, J. and R. Greenberg (eds.)
Saving the Tropical Forests, Earthscan Publications, London, 1988.

Green, G.
"Conservation through the looking glass: The case of Central America", in M. Palo and G. Mery (eds.), **Deforestation or Development in the Third World?**, Vol. III, Bulletin 349, Finnish Forest Research Institute, Helsinki, 1990.
Hall, B. and D. Faber
El Salvador: Ecology of Conflict, Green Paper No. 4, EPOCA, 1989.
Heckadon, S.
"La colonización campesina de bosques tropicales en Panamá", in Heckadon and McKay (eds.), op. cit., 1982.

Panama's Expanding Cattle Front: The Santeño Campesinos and the Colonization of the Forests, Ph.D. thesis, University of Essex, 1984.

"La ganadería extensiva y la deforestación: Los costos de una alternativa de desarrollo", in Heckadon and Espinosa (eds.), op. cit., 1985.

"Los viveros comunales en El Salvador", **El Chasqui**, No. 20, 1989.
--- and J. Espinosa (eds.)
Agonía de la naturaleza, INDIAP/Smithsonian Tropical Research Institute, Panama City, 1985.
--- and A. McKay (eds.)
Colonización y destrucción de bosques en Panamá, Asociación Panameña de Antropología, Panama City, 1982.
Hedstrom, I.
Volverán las golondrinas? La reintegración de la creación desde una perspectiva latinoamericana, DEI, San José, 1990.
Hernández, A.
Subsistema forestal de Honduras, UNAH, Tegucigalpa, 1986.
Howard, P.
From Banana Republic to Cattle Republic: Agrarian Roots of the Crisis in Honduras, Doctoral Thesis, Ann Arbor, 1987.
INRENARE
Plan de acción forestal de Panamá, Panama City, 1990.
Jenkins, J.
El desafío indígena: El caso de los Miskitos, Editorial Catún, Bogotá, 1986.
Jones, J.
Socio Cultural Constraints in Working With Small Farmers in Forestry: Case of Land Tenure in Honduras, mimeo, CATIE, Turrialba, 1982.

"Colonization in Central America", in W. Manshard and W. Morgan (eds.), **Agricultural Expansion and Pioneer Settlements in the Humid Tropics**, UNU, Tokyo, 1988.
La República
San José, 4 August 1990.

MAG
Incremento de la productividad agropecuaria y conservación de recursos suelo, aguas y bosques, Managua, 1990.
Mansur, E.
Plan nacional de reforestación de El Salvador, FAO, San Salvador, 1990.
Martinez, H.
El problema de la leña en las zonas secas de América Central: Necesidades de investigación, mimeo, CATIE, Turrialba, 1986.
----------, J. Bauer and J. Jones
Fuelwood in Central America and the Regional Fuelwood and Alternative Energy Sources Project, CATIE, Turrialba, 1983.
McKay, A.
"Colonización de tierras nuevas en Panamá", in Heckadon and McKay (eds.), op.cit., 1982.
MIRENEM
Plan de acción forestal para Costa Rica: Documento base, San José, 1990.
Morales, R. and M. Cifuentes
Sistema regional de áreas silvestres protegidas en América Central: Plan de acción 1989-2000, CATIE, Turrialba, 1989.
Nations, J. and D. Komer
"Rainforests and the hamburger society", **The Ecologist**, Vol. 17, No.4/5, 1987.
Reiche, C.
La leña en el contexto socioeconómico de América Central, mimeo, CATIE, Turrialba, 1986.
--------- and A. Van Buren
Wood Fuel Commerce in Nicaragua, mimeo, CATIE, Turrialba, 1984.
Revista del Campo
(Supplement of **Barricada** newspaper), Managua, 12 January 1990, p.4.
Rubinoff, I.
"Los problemas ambientales que confronta Panamá", in Heckadon and McKay (eds.), op. cit., 1982.
Sarmiento Chia, M.
"Metetí: Una comunidad que abre la selva del Darién", in Heckadon and Espinosa (eds.), op.cit., 1985.
SECPLAN, DESFIL and USAID
Perfil ambiental de Honduras 1989, Tegucigalpa, 1990.
Silliman, J. (ed.)
Draft Environmental Profile of the Republic of Costa Rica, Arid Lands Information Center, Tucson, 1981.
Solis, P.
"The Atlantic coast of Nicaragua: Development and autonomy", **Journal of Latin American Studies**, Vol. 21, 1989.
UNICEF
Infancia y guerra en El Salvador, UNICEF, Guatemala City, 1988.

USAID
El Salvador: Perfil ambiental de campo, Washington, D.C., 1985.
Veblen, T.
"Forest preservation in the western highlands of Guatemala", **The Geographical Review**, Vol. LXVIII, 1978.
Wadsworth, F.
"La deforestación, muerte del Canal de Panamá", in Heckadon and McKay (eds.), op. cit., 1982.
Weeks, J.
The Economies of Central America, Holmes and Meier, New York, 1985.
Whelan, T.
"Central American environmentalists call for action on the environment", **Ambio**, No. 17, 1988.
Williams, R.
Export Agriculture and the Crisis in Central America, University of North Carolina Press, Chapel Hill, 1986.
Woodward, R.
Central America: A Nation Divided, Oxford University Press, Oxford, 1985.
Zanotti, J.
Implicaciones Sociales de los Programas de Plantaciones para Leña en Guatemala, mimeo, CATIE, Turrialba, 1986.

References

Bonilla Durán, A.
Crisis ecológica en América Central, Ediciones Guayacan, San José, 1988.

Budowski, G.
"Aspectos ecológicos del bosque húmedo", **Primer seminario sobre recursos naturales y del medio ambiente**, IRENA, Managua, 1980.

"The socio-economic effects of forest management on the lives of people living in the area: The case of Central America and some Caribbean countries", in E.G. Hallsworth (ed.), **Socio-Economic Effects and Constraints in Tropical Forest Management**, John Wiley and Sons, Chichester and New York, 1982.

Castañeda, C.
Interacción naturaleza y sociedad guatemalteca: Introducción a su conocimiento, Ediciones IIA-FAUSAC, Guatemala City, forthcoming.

CATIE
Agroforestería, Turrialba, 1981.

CELADE and CIM
Proyecto de solicitud de asistencia al FNUAP: Sistemas nacionales de información sobre poblaciones desplazadas en América Central, mimeo, Managua, 1989.

Chapin, M.
The Indians of Guatemala: Problems and Prospects for Social and Economic Reconstruction, mimeo, 1987.

Dickinson, J.C.(ed.)
Honduras: Perfil ambiental del país, estudio de campo, JRB Associates, McLean, 1982.

ECLAC
Notas sobre la evolución del desarrollo social del istmo centroamericano hasta 1980, Mexico City, 1982.

Fundación Defensores de la Naturaleza y El Fondo Mundial para la Vida Silvestre
Estudio técnico para dar a Sierra de las Minas la categoría de reserva de la biósfera, Guatemala City, 1989.

Gallardo, M.E. and J.R. López
Centroamérica: La crisis en cifras, IICA/FLACSO, San José, 1986.

Gente
(Supplement of **Barricada** newspaper) Managua, September 1990.

Hartshorn, G. et al.
Costa Rica: Perfil ambiental, Tropical Science Center, San José, 1982.

Healy, R.
"Problemas de desarrollo y de la conservación de los recursos naturales en Centroamérica", in W. Ascher and A. Hubbard (eds.), **Recuperación y desarrollo de Centroamérica**, Duke University, San José, 1988.

Hedstrom, I.
Somos parte de un gran equilibrio: La crisis ecológica en Centroamérica, DEI, San José, 1988.

---------- (ed.)
La situación ambiental en Centroamérica y el Caribe, DEI, San José, C.R., 1989.

Hernández, A.
"Migración de colonos en Darién", in S. Heckadon and A. McKay (eds.), **Colonización y destrucción de bosques en Panamá**, Asociación Panameña de Antropologia, Panama City, 1982.

IAN
Proyecto Rigoberto Cabezas I Etapa, Managua, 1972.

ICATA
Environmental Profile of Guatemala, URL/AID-Guatemala/ ROCAP, Guatemala City, 1984.

IFAD
Informe de misión especial de programación a la República de Guatemala: **Estrategia para el desarrollo de la producción campesina en el altiplano occidental**, Rome, 1984.

IRENA et al.
Plan de desarrollo forestal de la República de Nicaragua, Informe principal, Stockholm, 1985.

Jones, J.
Land Colonization in Central America, CATIE, Turrialba, 1985.

Larson, A.
"Ecología y política: Los problemas 'verdes'", **ENVIO**, No. 97, September 1989.

Leonard, H.J.
Recursos naturales y desarrollo económico en América Central: Un perfil ambiental regional, IIED, San José, 1985.

Lohmann, L. and M. Colchester
"Paved with good intentions: TFAP's road to oblivion", **The Ecologist**, Vol. 20, No. 3, May/June 1990.

Marroquín, A.
"El problema indígena en El Salvador", **América Latina**, Vol. 35, No. 4, 1975.

McCreery, D.
"Coffee and class: The structure of development in liberal Guatemala", **Hispanic American Historical Review**, 56 (3), 1976.

McGaughey, S. and H. Gregersen (eds.)
Forest-Based Development in Latin America, Inter-American Development Bank, Washington, D.C., 1983.

McGhie, J.
"Reclaiming a natural legacy", **The Ecologist**, Vol. 17, No.4/5, 1987.

MIDA

Proyecto desarrollo rural integral Rigoberto Cabezas II Etapa, Vol. I, Managua, 1980.

Nations J. and H.J. Leonard

"Grounds for conflict in Central America", in A. Maquire and J. Welshbrown (eds.), **Bordering on Trouble**, Alder and Alder, Boston, 1986.

Peters, R.

Estimación de la deforestación en Nicaragua, mimeo, IRENA, Managua, 1985.

Poole, P.

Desarrollo de trabajo conjunto entre pueblos indígenas, conservacionistas, y planificadores del uso de la tierra en América Latina (translation of 1989 World Bank report), CATIE, Turrialba, 1990.

Poore, D. (ed.)

No Timber without Trees: Sustainability in the Tropical Forest, Earthscan Publications, London, 1989.

Reiche, C.

Implicaciones económicas del componente agroforestal, mimeo, CATIE, Turriaba, 1983.

Socio-Economic Approach and Analysis of Agroforestry Systems Applied on Demonstration Farms in Central America, paper presented at symposium "Fragile Lands in Latin America: The Search for Sustainable Uses", XIV Congress of the Latin American Studies Association (New Orleans, 17-19 March 1988).

Rivas, C. (ed.)

Memoria de la conferencia de especialistas en extensión - América Central, CATIE, Turrialba, 1988.

Simons, P.

"Costa Rica's forests are reborn", **New Scientist**, 22 October 1988.

UNES

Propuesta del Cerro Verde, San Salvador, 1990.

UNRISD

Food Systems and Society: Problems of Food Security in Selected Developing Countries, Geneva, 1986.

Valenzuela, I.

Technologie Appropriée, Quelle Alternative pour le Développement? Postgraduate Thesis, IUED, Geneva, 1989.

Vogt, W.

The Population of El Salvador and Its Natural Resources, Pan American Union, Washington, D.C., 1946.

LIST OF AVAILABLE DISCUSSION PAPERS

- DP 1 **Economic Growth, Structural Change and Labour Absorption Africa: 1960-85,**
  Dharam Ghai, December 1987

- DP 2 **The Peasant Question and Development Policy in Nicaragua,**
  Peter Utting, February 1988

- DP 3 **Promoting Youth Employment: Policies and Programmes,**
  Dharam Ghai, May 1988

- DP 4 **Inside Megalopolis: Exploring Social and Spatial Diversity of Provisioning Structures in Mexico City,**
  Cynthia Hewitt de Alcántara and Gabriel Vera, June 1990

- DP 5 **Participatory Development: Some Perspectives from Grass-roots Experiences,**
  Dharam Ghai, June 1988

- DP 6 **Some Reflections on Human and Social Indicators for Development,**
  Dharam Ghai, Michael Hopkins and Donald McGranahan, October 1988

- DP 7 **The Crisis of the 1980s in Africa, Latin America and the Caribbean: Economic Impact, Social Change and Political Implications,**
  Dharam Ghai and Cynthia Hewitt de Alcántara, July 1989

- DP 8 **From "Orthodoxy" to "Reform": Experiences of Dependent Transitional Economies,**
  Peter Utting, July 1989

- DP 9 **Self-Sufficiency and Exile in Mexico (Report on a field study among relocated Guatemalan refugees in south-east Mexico, August-November 1988),**
  Finn Stepputat, August 1989

- DP 10 **The New System of Food Marketing in Pakistan,**
  Sartaj Aziz, May 1990

- DP 11 **Seeking Food and Seeking Money: Changing Productive Relations in a Highland Mexican Community,**
  George A. Collier, June 1990

- DP 12 **Barabaig Natural Resource Management: Sustainable Land Use under Threat of Destruction,**
  Charles Lane, June 1990

- DP 13 **Constraints to Environmental Rehabilitation through People's Participation in the Northern Ethiopian Highlands,**
  Michael Ståhl, July 1990

- DP 14 **Eléments pour l'approche des indicateurs sociaux en Côte d'Ivoire,**
  José Trouvé, July 1990

- DP 15 **Qualitative Indicators of Development,**
  Donald McGranahan, Wolf Scott and Claude Richard, November 1990
- DP15F **Indicateurs qualitatifs du développement,**
  Donald McGranahan, Wolf Scott and Claude Richard, April 1991

- DP 16 **The Social Dynamics of Deforestation in Developing Countries: Principal Issues and Research Priorities,**
  Solon Barraclough and Krishna Ghimire, November 1990

- DP 17 **Refugee Self-settlement versus Settlement on Government Schemes: The Long-term Consequences for Security, Integration and Economic Development of Angolan Refugees (1966-1989) in Zambia,**
  Art Hansen, November 1990

- DP 18 **Authoritarian Rule and Democracy in Africa: A Theoretical Discourse,**
  Yusuf Bangura, March 1991

- DP 19 **Beneficiaries of the Illicit Drug Trade: Political Consequences and International Policy at the Intersection of Supply and Demand,**
  LaMond Tullis, March 1991

- DP 20 **Organización social y lucha ecológica en una región del norte de México,**
  Julio Moguel and Enrique Velázquez, April1991

- DP 21 **Illicit Drug Taking and Prohibition Laws: Public Consequences and the Reform of Public Policy in the United States,**
  LaMond Tullis, April 1991

- DP 22 **Greening at the Grassroots: People's Participation in Sustainable Development,**
  Jessica M. Vivian, April 1991

- DP 23 **Ruining the Commons and Responses of the Commoners: Coastal Overfishing and Fishermen's Actions in Kerala State, India,**
  John Kurien, May 1991

- DP 24 **The Social Origins and Impact of Deforestation in Central America,**
  Peter Utting, May 1991

- DP 25 **Development Data Constraints and the Human Development Index,**
  Christopher J.L. Murray, May 1991

- DP 26 **Structural Adjustment and Multiple Modes of Social Livelihood in Nigeria,**
  Abdul Raufu Mustapha, June 1991

- DP 27 **Economic Reform and Citizen Entitlements in Eastern Europe: Some Social Implications of Structural Adjustment in Semi-Industrial Economies,**
  E.V.K. FitzGerald, June 1991