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NATURAL RESOURCE MANAGEMENT IN COSTA RICA:
A STRATEGY FOR USAID

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LIST OF ACRONYMS

AID	U. S. Agency for International Development
BANCOOP	National Cooperative Bank
CABEI	Central American Bank for Economic Integration
CATIE	Tropical Center for Agricultural Research and Training
CCSS	Costa Rican Social Security Fund
CODESA	Costa Rican Development Corporation
DGF	General Directorate of Forests
EARTH	Agricultural College for the Humid Tropics
EPA	Environmental Protection Agency
ESF	Economic Support Fund
FAO	Food and Agriculture Organization of the United Nations
GOCR	Government of Costa Rica
ICAA	Costa Rican Institute of Water and Sewage
ICE	Costa Rican Electric Utility
ICT	Costa Rican Tourism Institute
IDA	Agrarian Development Institute
IDB	Inter-American Development Bank
IFAM	Institute for Development of Municipal Administration
ITCO	Lands and Colonization Institute (now known as IDA)
JAPDEVA	Board for Port Administration and Economic Development of the Atlantic Zone
MAB	Man and the Biosphere (UNESCO)
MAG	Ministry of Agriculture and Livestock
MIRENEM	Ministry of Natural Resources, Energy and Mines
NGO	National Government Organization
OTS	Organization for Tropical Studies
ROCAP	Regional Office for Central American Programs (AID)
SENARA	National Irrigation and Drainage Service
SNE	National Electric Service
SPN	National Park Service
TSC	Tropical Science Center
UCR	University of Costa Rica
UNDP	United Nations Development Programme
UNED	University Extension
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWF/US	World Wildlife Fund/U. S.

USAID/Costa Rica

NATURAL RESOURCE MANAGEMENT IN COSTA RICA:

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1. INTRODUCTION

1.1 Objective of this document

The objective of this document is to provide USAID/Costa Rica with the background information, problem analysis and options for intervention, necessary for integrating natural resource considerations into the Mission's Action Plan and medium term development strategy for Costa Rica.

1.2 Background

The USAID Mission in Costa Rica is revising its strategy for AID development assistance to the country over the coming five years. As a foundation for this integrated strategy the Mission has assigned a series of specialized studies in various fields. It has requested Henry Tschinkel, ROCAP Regional Forestry Advisor and Frank Zadroga, ROCAP Regional Environmental Management Specialist to prepare this background document describing the natural resource management situation in Costa Rica and suggesting a strategy for AID support in this area over the planning period. This document is the result of the work by the two specialists under the guidance of the Mission's Acting Deputy Director, Kevin Kelly and Rural Development Officer, Ross Wherry from mid-June until December 1987. Forest Economist, Thomas McKenzie of the ROCAP/CATIE Tree Crop Production Project worked full-time on this effort during three weeks in October 1987.

The abundant literature on the natural resources of Costa Rica was a point of departure for this document. Throughout the work the authors discussed the subject and options with numerous experienced individuals, many of whom contributed with suggestions and critical comments (Annex 1). The authors are grateful to all of them and this document has profited greatly from their varied viewpoints.

1.3 Related current planning efforts

Two GOCR planning exercises are currently in progress that relate to the subject of natural resources. The first is the study on the "State of the Environment" being carried out by the Fundación Neotropica with support from The Conservation Foundation. The Fundación Neotropica has commissioned eight descriptive background studies on natural resources, which have been fused into a draft document. This study analyzes the interaction of resource management with economic development in Costa Rica, a task the Fundación Neotrópica hopes to complete before the end of 1987 and to publish in January 1988. The reader interested in greater detail on the state of natural resources and their management than that presented in Chapter 3, is referred to this study.

The second planning effort is the "National Conservation Strategy" being prepared under the direction of the Ministry of Natural Resources, Energy and Mines (MIRENEM). This is an ambitious effort, scheduled for completion in mid-1988 which will use the "State of the Environment" study as a base to propose an integrated strategy for action in a dozen sectors of the economy. An equal number of working groups are preparing their respective specialized reports, meeting periodically to coordinate and interact. Unfortunately results to date are not sufficiently advanced to be of much use for the present document

These two documents, especially the latter, would be the ideal foundation from which USAID could formulate a strategy for intervention. Unfortunately, the more urgent timing of the USAID planning effort precludes taking full advantage of the comprehensive GOCR exercise. The Mission should review the National Conservation Strategy for guidance on GOCR policy and priorities once it is available.

A third document consulted for the present work was the action plan 1986-90 for the Ministry of Natural Resources, Energy and Mines (Ministerio 1987). The fact that the authors had been instrumental in the preparation of this action plan, helped them to understand GOCR policy and thinking on this subject.

2. RELATIONSHIP OF NATURAL RESOURCES TO DEVELOPMENT

In the last few years USAID/CR has concentrated its efforts and financial resources on the issues of democracy, equity and economic stabilization. However, if all these social and economic programs are to meet with long-term success and bring enduring development to Costa Rica, development assistance also must focus on the renewable natural resources upon which most economic development in the country depends. In the current context these resources are the nation's assets of soil, water, vegetation and wild animals which if wisely utilized can continue to sustain economic development indefinitely. A concerted effort must be made to insure that these natural resources are managed rather than destroyed, as they are exploited in coming years.

Depletion and degradation of the renewable resource base is becoming an increasing constraint to future economic and social development in Costa Rica. This is a theme developed throughout this document. With few mineral and petroleum resources, the country is heavily dependent upon renewable natural resources for generation of income in productive sectors such as agriculture, forestry, fisheries, energy generation, and tourism, as well as to supply the raw materials for most manufacturing and processing industries. Moreover, protection of watersheds to preserve clean water and ensure adequate sanitation is fundamental to socio-economic growth.

The overwhelming evidence is that pressures from a growing population, inadequate distribution of wealth and an expanding economy are causing the people of Costa Rica to overexploit the natural resources at their disposal in order to satisfy short-term needs: employment opportunities, current revenues, and avoidance of difficult political decisions such as the redistribution of productive lands (see Sec. 3). As a consequence, depletion rates of forests, soils, wildlife, fisheries, and other crucial resources exceed renewal rates, and secondary problems such as soil erosion, floods, sedimentation of hydroelectric dams and coastal harbors, pesticide misuse and water pollution and shortages have reached critical levels in many parts of the country. Although this "mining" of the environment facilitates the short-term subsistence efforts of both the people and government of Costa Rica, it has contributed to the long-term decreases in food production, per capita income and physical well-being that are occurring in the country during the 1980s (for a discussion of these relationships see the Regional Environmental Profile, Leonard 1987). Evidence reviewed suggests that Costa Rica is experiencing direct financial losses and has already sacrificed substantial future economic opportunities as a result of previous careless management of vital natural resources. Continued deterioration of these natural resource systems in the future is likely to result in decreased productivity and incomes, which in turn could further exacerbate problems of pervasive rural poverty, political and social instability, and economic stagnation.

The organization of the present document is as follows: Rather than focus on the details of each resource, which are available in the literature cited, the major problems are outlined (Chapter 3). Analyzing the problems within the framework of AID policy and USAID/CR's action plan (Chapter 5), a strategy for intervention is proposed (Chapter 6), options are identified (Chapter 7), and recommendations for priority actions are formulated for various cost levels (Chapter 8).

The outlines of the two case studies that follow demonstrate how the prospects for economic development in Costa Rica are linked to improved management of the country's natural resource base. The first (2.1) deals with the uncontrolled use of uplands and the consequent downstream coastal zone impacts; the second (2.2) with the long-term impact of deforestation. These cases vividly illustrate the serious socio-economic impact of improper natural resource and environmental management.

2.1 The destruction of Costa Rica's Atlantic coral reef

In 1987 the IIED/ANAI/CIDESA project carried out a field survey of the available living marine resources of Costa Rica's Caribbean coast to suggest areas where unexploited fishing potential could be developed on a sustainable basis for local community benefit (IIED 1987).

The collection and export of ornamental tropical marine fishes, suggested by previous research, could take fishing pressure off of the lobster population and provide diversification of livelihood for fishermen.

Since 1977 and increasingly since 1982, the two coral reef systems at Limon and Cahuita have been dying. As of March 1987, approximately 75% of the reef building corals throughout the region were dead. Similarly about 90% of the gorgonians and sea fans were dead. The decline in living reef habitat has been predictably accompanied by an equally dramatic decline in sea life and seafood generation. Many fishermen are now out of business and others are struggling. Lobster production is declining due to overexploitation and degradation of their reef habitat. Tropical fish are scarce and low in diversity. Sustainance fishing has suffered and the commercial food fish that previously provided saleable surplus are disappearing. The beauty and biological diversity of Gandoca-Manzanillo National Wildlife Refuge and Cahuita National Park have been compromised. Young fishermen have been migrating to the cities. Cultural and familial patterns of the villages of Puerto Viejo and especially Manzanillo are disintegrating.

Preliminary evidence suggests that the region may be significant as a nursery and rearing area for baby tarpon, the basis of sport fishing in the vicinity of Tortuguero, an activity which generates more than a million dollars worth of gross foreign exchange income per year (see 3.6.1). The unwitting disruption of the tarpon life cycle as with other important sea life cycles may have grave and far reaching negative impacts.

The preponderance of circumstantial, observational and empirical evidence, points to the huge sediment load emanating from the Rio Estrella as the primary cause of coral deaths at Cahuita. Pesticide contamination of the coral reef may be another factor. The interference of photosynthetic activity on coral reef biota from greatly increased water turbidity has caused general metabolic sabotage. Most of the sediment appears to be coming from the banana fields and other clean cultivated areas along the Rio Estrella. Recommendations are offered as to how to reform cultural practices in order to reduce sediment load, how to help rebuild coral reef productivity and how to assist the fishermen. Proper agricultural practices could have avoided the negative impacts on the coastal zone. Now more expensive mitigative measures are urgently needed if the reefs are to be restored.

2.2 The depletion of forests

Forestry in Costa Rica presents an alarming example of the effect of mismanagement of a natural resource on development (see 3.2). Although in 1961 45% of the country was still covered with forest, today most of the sawmills are not able to obtain sufficient logs and many are closing down. It has been estimated that by 1995 Costa Rica will have to begin import of wood, a substantial new drain on scarce foreign exchange. Annual production of logs has decreased from 2.1 million m³ in 1977 to 1.3 million m³ in 1983 (Costa Rica. Dirección General Forestal 1985, p. 215). Table 2.2-1 reports the dramatic decline in the forest sector share of GNP. In 1985 the contribution of this sector in constant colones was half of what it had been ten years before. At the same time the real price of wood (deflated by the price index for construction materials) has almost doubled. In 1983 the weighted local constant price paid for lumber was US\$225 per cubic meter (Flores 1984). It is very likely that both the declining importance of the forest sector as well as the rise in the price of wood are caused by destruction of the country's forests.

Since wood is basic to many sectors of the economy, this price increase is an added burden on the consumer. Since wood has always been an important component of housing, this price increase is increasing the cost of construction and forcing the use of costly substitute materials at a time when the GOCR is making a special effort to alleviate the housing deficit.

With the decline of forest industry many employees will lose their jobs by 1995 (almost 6000 employees work in the primary industry alone which includes sawmills, board plants and paper industry, Table 3.2-3). Since forest industry has an unusually large employment multiplier effect, this decline will also have negative impact on a large number of jobs in secondary forest industry (which manufactures finished products based on lumber and boards) and numerous economic activities that depend on wood. Because almost half of Cost Rica's energy needs are derived from fuelwood, forest depletion could also require the import of more petroleum based fuels, causing an added drain on scarce foreign exchange. In addition, the destruction of forests has numerous environmental repercussions that increase such costs as those of water supply, hydroelectric generation and protection from floods (see Sec. 3 for more detail).

Table 2.2-1 Trends of the economic importance of the forestry sector and the price of wood in Costa Rica.

Year	Contribution of the forest sector to GNP (1)	Deflated price index of wood (2)
	(millions of constant 1966 colones)	Percent
1976	111	
1977	100	
1978	90	100
1979	90	112
1980	95	115
1981	91	105
1982	72	127
1983	53	166
1984	56	178
1985	56	

(1) Source: Central Bank of Costa Rica

(2) Source: Central Bank of Costa Rica as cited in Costa Rica, Dirección General Forestal, 1985. Table 3.11.

Note: The price index of wood has been deflated in proportion to the price index of construction materials.

3. THE STATE OF THE NATURAL RESOURCES AND THEIR MANAGEMENT

3.1 Soils and land use

3.1.1 Soil resources and their use

Land use capability is defined as the most intensive use that a piece of land is able to sustain on a continuous basis without suffering degradation. This capability can then be compared with actual land use to determine whether a particular piece of land is being degraded through overuse, or could be utilized in a more intensive manner. Based on a very generalized soils map of Costa Rica, the soils have been classified into five categories of use-capability and eight classes of erosion risk (Table 3.1-1) (Costa Rica Country Environmental Profile 1982). This table indicates that only 9,437 km² (19%) are of a quality suitable for production of clean-tilled crops, amounting to only 0.36 ha/person of the country's 1987 population. Only 4,656 km² (9%) are capable of sustained grazing without being degraded. In 1980, the actual use of land for clean-tilled crops was 2,250 km² (4%) and for pasture 19,000 km² (37%). The Environmental Profile concludes: "Apparently large areas suitable for clean-tillage are currently under-utilized as pasture for livestock. This area may amount to as much as 7,187 km², equivalent to 76% of the best land. The opportunity exists for major increases in crop production simply by converting the pastures on class A lands to crops."

The total land area suitable for all agricultural uses (clean-tilled crops or pasture or permanent crops) is 22,251 km² (44%). About 85% of this area is already occupied by the 19,000 km² of pastures.

The evolution of actual land use is illustrated in Fig. 3.1-1. It is striking to see that the area under both annual and permanent crops has remained almost constant since 1950. However, the area dedicated to pasture has exploded since 1963. In the 20 years following 1963, 18% of the land area of Costa Rica was converted to pasture, practically all of it from forest. Many of these pastures occupy land that is not capable of sustaining permanent grazing without being degraded, as illustrated by the fact that 19,000 km² are under pasture although only 4,656 km² are classified for this purpose (Table 3.1-1).

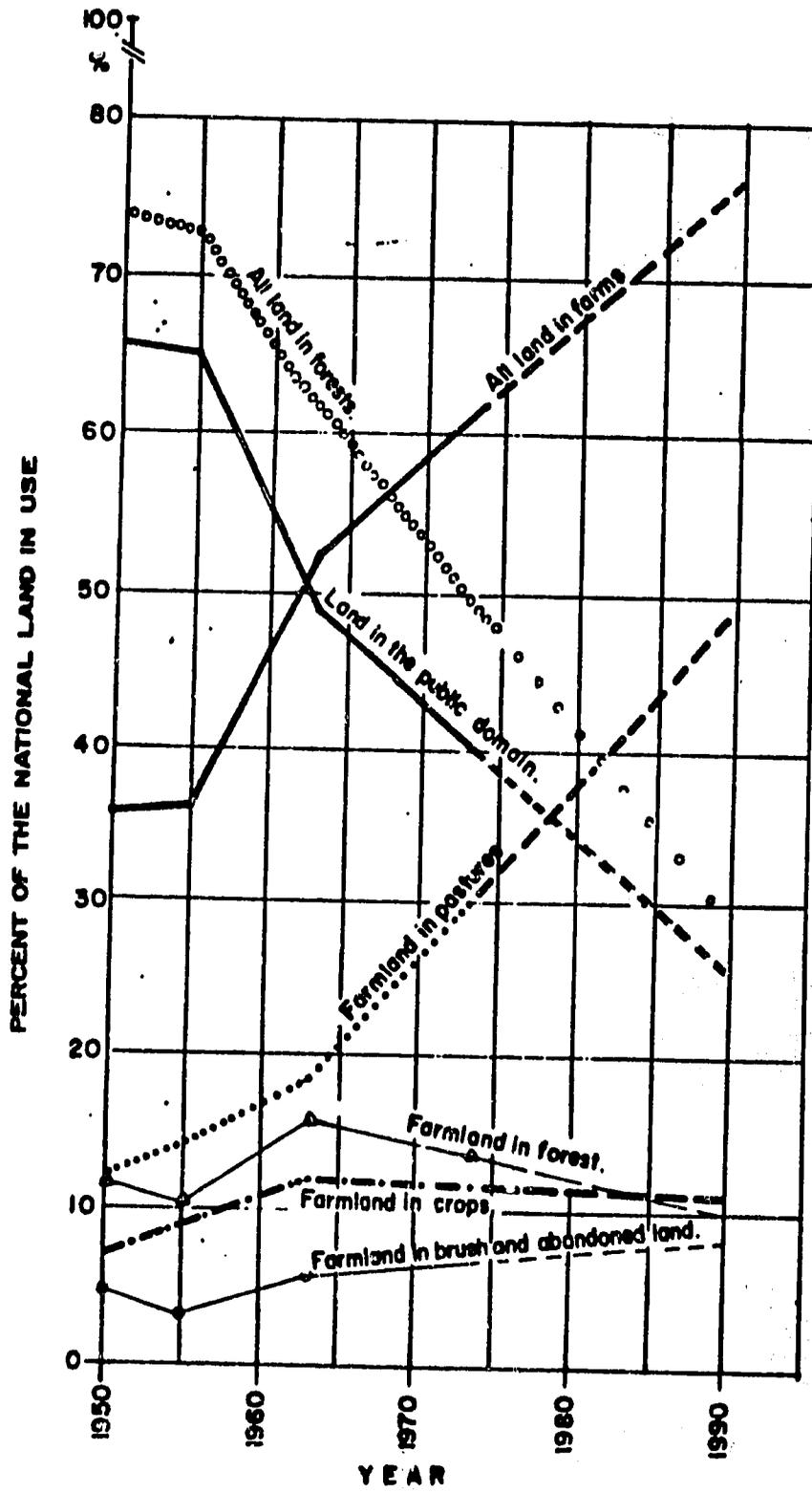
In summary, there is a need to bring land use in line with the capability of the land to sustain that use. The two most critical, but related, land use problems faced by Costa Rica are the conversion of forest to pasture on steep and excessively humid land not capable of sustaining this use without becoming degraded, and large areas of potentially highly productive crop land underutilized for extensive pasture. Complex causes underlie this paradox, the most important ones related to land tenure, the laws governing land acquisition through usage, the economic incentives supporting the production of beef for export linked to the political constituency formed by the ranchers, and the rapid expansion of the population with few employment alternatives. The GOCR is increasingly aware of these problems as evidenced by the new forest law, the 1987 presidential decree of a state of emergency for the forests, the recent creation of an interinstitutional group for watershed management, the creation of a Ministry of Natural Resources, the preparation of a national conservation strategy and other recent actions, many of which are discussed below.

3.1.2 The degradation and loss of the soil resource

The use of the land above its capacity to sustain that use has caused serious degradation of the soil, primarily due to erosion. The Country Environmental Profile presents an estimate of the location, extent and severity of erosion. It concludes that the most serious and widespread erosion is found in the Pacific drainage system where 30% of the area is either severely or extremely eroded. In contrast on the Caribbean side only 5% of the area falls into this category. Lands with undulating to hilly relief are most affected. The greater erosion on the Pacific side is caused primarily by the seasonal wet-dry climatic regime, the prevalence of cattle ranching on steep slopes and the greater erosivity of the soils.

Another serious loss of the soil resource is due to urbanization and road construction. The uncontrolled expansion of the metropolitan area between Paraiso on the east and Atenas on the west is removing some of the country's prime agricultural land from crop production. Many of the food crops such as the temperate zone vegetables and fruits can only be grown on these highland soils for which there are virtually no qualitative equivalent substitutes in Costa Rica.

The construction of roads not only removes soil resources from other uses, but improper construction frequently cause direct environmental damage to the surroundings. An even more serious negative impact of road construction is the creation of access to ecologically fragile areas, exposing them to improper land use through uncontrolled colonization, a process which has caused a veritable ecological catastrophe in various parts of the country. Currently this threat as a result of new roads is particularly critical in the northeast where USAID is financing road construction and in the Osa Peninsula.



by Joseph A. TomD.

Figure 3.1-1. National Land Use for the years 1950-1990

Table 3.1-1 Estimated use-capability and hydric erosion risk for Costa Rican soils based upon general site factors, including bioclimate, after Vasquez (1979) and Tosi (1969-1972).

Hydric Erosion Risk	MAJOR LAND USE CAPABILITY CLASS (Area in km ²)					All Land
	Clean-tilled Crops	Pasture	Permanent Crops	Forestry Protection		
Very Low or Nil	7,290	1,021	110	2,955	700	12,076
Moderate	2,147	430	429	3,829	0	6,835
High to very high	0	3,205	7,619	6,015	0	16,839
Extremely high	0	0	0	3,209	11,791	15,000
Land Use Total	9,437	4,656	8,158	16,008	12,491	50,830

Source: Costa Rica Country Environmental Profile, 1983.

3.2 Forests

3.2.1 Status of the forest

The fate of the forests of Costa Rica is one of the saddest cases of natural resource mismanagement in Central America. The yearly rate of forest loss as a percent of the remaining forests in Costa Rica has been the highest of Central America (3.9%) and perhaps for all of Latin America. It is estimated that about 60,000 ha of forest are lost each year (Leonard 1987, p. 119). From an area of 26,000 km² covering more than half of the country in 1970, the forests had been reduced to only 16,000 km², covering 31% of Costa Rica in 1987 (Fig 3.2-1). As explained in 3.1, most good agricultural land was cleared long ago, so that in recent years almost all clearing occurred on land unsuited for agricultural purposes. Of the land whose most intensive appropriate use is classified as forest and should therefore remain under forest cover, 60% has already been cleared.

All of the natural forests of Costa Rica are broadleaf forests, but their composition and ecology varies enormously from the mixed tropical wet forests of the Atlantic plain, to the cloud forests that cover the slopes of the volcanoes and down to the dry deciduous forests and the mangroves of Guanacaste. The different forest types, their composition and ecology are described in the Costa Rica Country Environmental Profile (1983) and by Janzen (1983).

Of the remaining dense, mature forest, about 70% is located in national parks or other wildland units where no commercial exploitation is permitted (see Section 3.3). According to calculations of 1981, there are less than 500,000 ha of commercial forest left in the country, i.e. forest suitable for sustained timber production. Most of it is located in the northeastern part of the country and on the Osa peninsula. Of this commercial forest only about one third, 146,500 ha are virgin, i.e. primary forest and of this only 90,000 ha is forest with a high productive potential, in blocks larger than 3000 ha. Table 3.2-1 shows the distribution of these commercial virgin forests, that is, those forests with a high potential for management (Flores 1985). However, deforestation has been advancing at such a rapid pace that these figures are optimistic.

The DGF and IGN have begun preparation of an actual land use map and a national forest inventory using 1986/87 Landsat imagery. By early 1988 a map at a scale of 1:200,000 showing nine classes of actual land use will be available for the whole country. Areas of special interest, such as some forest reserves will be mapped at 1:50,000 scale. These maps will be valuable planning tools and for the first time will allow precise estimates of areas and locations of remaining forests.

A large part of the remaining forest is located in so called "Forest Reserves" which cannot legally be alienated from the public domain, but where harvest of timber is permitted when authorized by the DGF. In reality however, the DGF has not been able to control these reserves (see 3.3) A sizeable proportion has been invaded by squatters who have cleared the forest rather than even harvest it. In many cases, only remnants of the original natural forest reserves remain as islands in vast expanses of degraded secondary forests and agricultural lands. Table 3.2-2 shows that overall about one fourth of the area of the reserves has already been deforested, and that in some of the large reserves half of the forest is already gone.

3.2.2 The process of deforestation

Complex causes underlie this seemingly irrational destruction of the forest. Both traditionally and legally an individual can gain tenure to public domain land outside of the wildland reserves, by clearing and agricultural use, and squatters can obtain users rights by working land not used by the owner. The purchase of farms by IDA for distribution and subsequent clearing has caused the destruction of large areas of forest on land not capable of sustaining agriculture -- an example of government institutions working at cross purposes. Given this historical and legal constellation; the growth of population, land speculation and the rapid expansion of cattle ranching since the late 1960's have been irresistible economic incentives to clearing of the forests (Fig. 3.1-1).

The 1969 Forest Law prohibited spontaneous settlement on public land. However, because of the inadequate cadastral registry which does not permit identification of public land and the inability of the DGF to enforce the law due to budgetary and administrative constraints, the clearing and alienation of public land has continued. The 1986 Forest Law is more severe in its protection of forest, making it easier to have squatters evicted and increases the penalties for illegal clearing of forest. It is yet too early to see how effective enforcement of this new law will be.

3.2.3 Forest industry

In 1983 the primary forest industry of Costa Rica was made up of about 222 sawmills, two plywood plants, one veneer plant, one chipboard plant, and one pulp & paper plant. Table 3.2-3 summarizes the production and economic indicators of this industry.

Sawmills: By all measures, the sawmill industry is the most important of the Costa Rican forest industries. With few exceptions it is also the most rudimentary. Almost all of the sawmills are small, traditional operations with deficient equipment, with very low efficiency

and excessive waste. Table 3.2-5 shows that in 1980 about one fourth of the mills had a production capacity below 5 m³ of lumber per day, and less than 10% of the mills had the capacity to produce more than 25 m³ per day. Partly because of the diminishing wood supply and the decrease in construction, this industry is in a serious crisis and many mills are closing. In 1983 it operated at only 58% of its capacity. Table 3.2.-4 shows that in 1983 the sawmills consumed 646,200 m³ of logs to produce 303,300 m³ of lumber, an efficiency of only 46%. About 91% of the logs come from the provinces of northern Alajuela, Limon and southern Puntarenas. For complex reasons most of the sawmills are located in the Central Valley or in San Carlos, far from the forest resource. Consequently an excessive proportion of the cost of lumber manufacture is attributed to transportation to the sawmill (28%). On the other hand, only 4.3% of the cost of lumber manufacture is due to the cost of the standing tree (Flores 1985). This fact that the tree is practically a "free" resource means there is no little economic incentive for conservation. Therefore Costa Ricans will economize on labor and capital, but logically do not see it necessary to economize on wood. Ideally a reduction of this waste would be one of the means to stretch out the diminishing forest resource. One of the objectives of the National Development Plan is to reduce waste in logging and in forest industry.

Board plants. In 1983, the plywood industry which has a production capacity of 49,000 m³, produced 23,700 m³ of boards from 60,600 m³ of logs. Although the conversion rate of logs to product was fairly good, this industry operated at only 48.4 % of its installed capacity. One relatively modern operation (Plywood Costarricense S.A.) dominates this industry with 95% of the production capacity of the country. The veneer plant (Cosas de Madera) is located near Puerto Limon with a production capacity of 18,000 m³ but produced only 13,000 m³ in 1983. The chipboard plant is an integral part of the Plywood Costarricense operation. Its raw material is the residue from the plywood operation. It has a production capacity of 60,000 m³ but produced only 15,000 m³ in 1983, working at only 25% of its capacity. (Flores 1985).

Pulp and paper. Scott Paper operates the only pulp and paper plant in Costa Rica, with a production capacity of 14,000 tons/year. In 1983 it operated at 60% of this capacity. Only 15% of the fiber needed by this plant comes from roundwood, all from the industry's own plantations near Turrialba and Guapiles. The rest of the fiber is derived from recycled paper and imported chemical long-fiber pulp. (Flores 1985).

3.2.4 Forest management and its potential

Most of the wood that supplies industry comes from the liquidation of the natural forest and its conversion to agricultural or grazing use. Management of the natural forest for timber is almost non-existent in Costa Rica. One of the strongest constraints to forest management is that, with few exceptions, the wood using industry does not own its forest resource but buys logs wherever it can. It is cheaper to exhaust the timber supply with depreciated logging equipment and old sawmills, than to invest in new equipment and long-term forest management. The industry is thus not directly concerned with managing the source of its raw material. On the other hand, the forest owner who is most interested in ranching or farming, has no concept of the true value and potential that his timber has to industry and liquidates his timber at low prices so as to develop his farm, rather than manage the forest for sustained income. He deals with only the logger and trucker. The prospects of forest management will remain bleak unless the needs of the industry and the forest owners are linked for mutual benefit, such as in an integrated operation. It is up to forest industry to take the initiative in this respect. The DGF could encourage the process.

3.2.5 Reforestation

When compared to the rate of deforestation, the rate of plantation establishment has been miniscule. Cumulatively through 1984, there existed about 10,779 ha of plantations in Costa Rica (Flores 1984), most of them still too young for harvest. The rate of reforestation has increased slightly over the last few years, reaching 2300 ha planted during 1986.

The Government gives generous income tax credits to encourage plantations. Unfortunately, this program has been of very limited success. One reason is that it is limited to wealthy individuals or enterprises who pay income taxes. Another reason is that business interests have subjugated reforestation to real estate schemes, whereby individuals can purchase reforested lots for speculation, future housing development and recreational use and credit the reforestation costs to their income tax. Because location of these plantations are therefore often decided on non-forestry reasons, they frequently have very little wood producing value. A new arrangement of more flexible fiscal incentives also accesible to small investors (Certificado de Abono Forestal) is threatened with a similar type of abuse. However, it is unlikely to become operational before 1989. A fundamental problem with both types of incentives is that their amounts are too high, currently fixed at US\$1461 per hectare, one of the highest in Latin America (Sedjo 1982). They tend to exceed real planting costs, resulting in a small area planted, completely subsidized by the public treasury, for the benefit of a few large investors.

Increasing interest has been demonstrated by small farmers in establishment of trees in various agroforestry systems and in woodlots, for fuel and rustic construction wood. Various donor financed projects, including USAID's Natural Resource Conservation Project, the ROCAP/CATIE Tree Crop Production Project, the German GTZ project near Puriscal and the European Economic Community in the same area have been important catalysts in this process. Although this type of tree planting integrated with agriculture is scattered over thousands of farms and hard to quantify, collectively it is already very important as a source of wood products and has great potential, especially for small producers.

Flores (1985) has made projections of the forest plantations required in order to reduce the potential gap of wood supply once the natural forests are depleted. He estimates that between 1985 and 1995 a total of 267,800 ha need to be planted, if massive import of industrial wood is to be reduced. According to Flores, without plantations, imports would gradually rise from 0.8 million cubic meters per year in 1996 (at a cost of \$217 million) to more than one million cubic meters in the year 2000 (at an annual cost of \$289 million). Although these projections might be overly simplistic since possible substitution effects and wood derived from sources other than the dense, mature forest is not adequately taken into account, they do give an idea of the enormous magnitude of the wood supply problem. Even if the ambitious plantation program recommended by Flores were to be followed (little progress so far) import of wood would still be required during several years before the first plantations reach maturity.

The model presented in Table 3.2-6 attempts to project wood supply, based on the land area likely to be producing trees suitable for sawtimber or plywood. These results also clearly demonstrate that for the medium term, plantations cannot offer a solution because most will not have reached harvestable age, but that it is feasible for the country's timber supply to be met by the remaining natural forests -- if reasonable improvements in management are achieved in the next few years. With the data and assumptions used, if the current trends continue so that only minimal improvements are achieved, by the year 1999 the country will be able to produce only 352,212 m³ lumber per year. Since lumber consumption in 1984 was already larger than this (423,530 m³) and demand is likely to continue to increase, serious shortfalls are likely. However, with conservative improvements in management of natural forests and in industrial efficiency, Costa Rica could produce 1,103,299 m³ annually at the end of the century, probably enough to meet the demand. Since many of the figures used in the model, especially those concerning land areas, are rough estimates, at present the use of this model is more for conceptual rather than predictive purposes. Once the updated land use data, based on the Landsat images, is available in early 1988, the model should be able to give fairly accurate predictions for different scenarios.

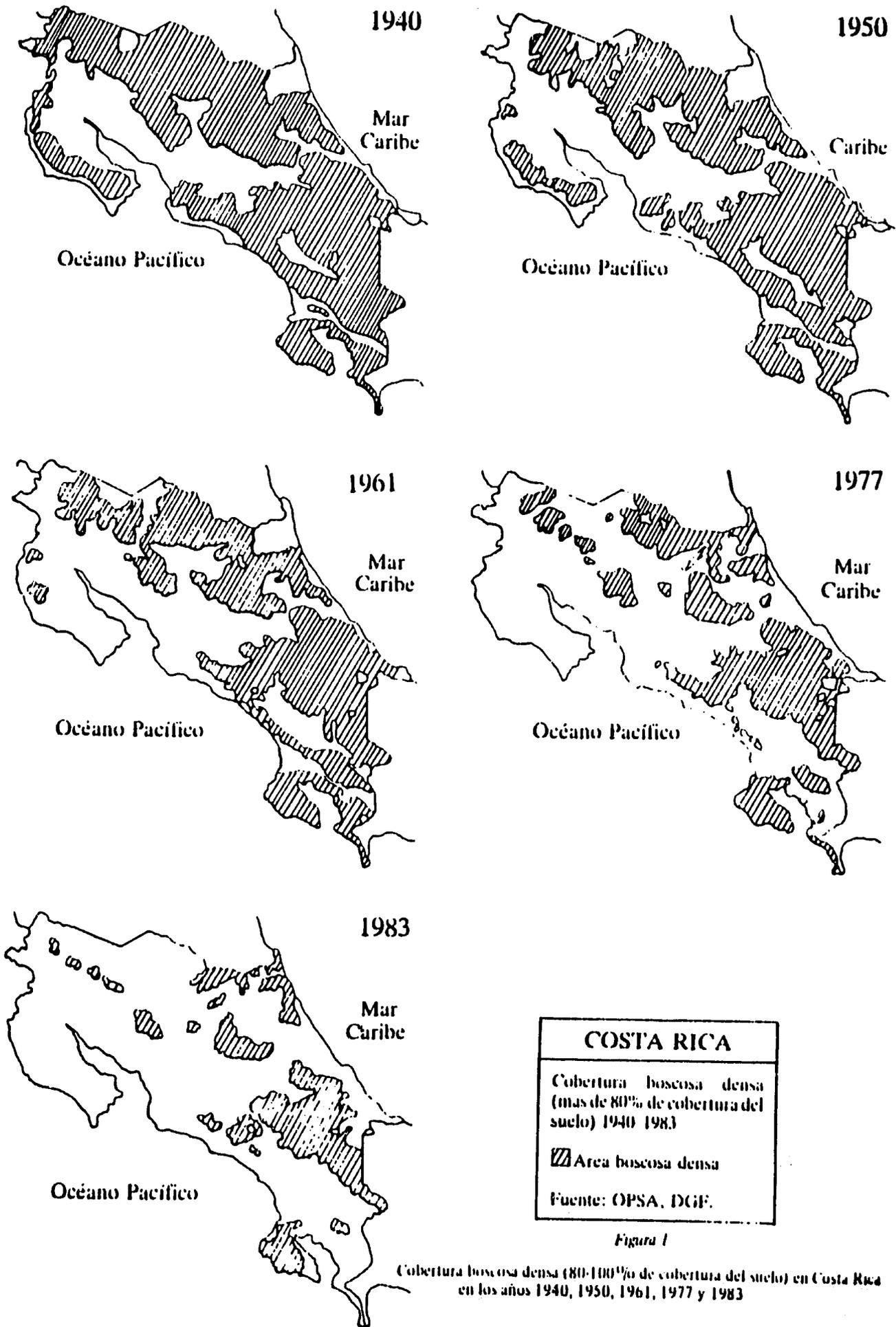


Figure 3.2-1. Dense Forest Cover of Costa Rica

Table 3.2-1 Forest area of Costa Rica, by type of forest in early 1983
(area in hectares)

Forest region	Total area of dense forest	Forest area legally protected	Forest area available for potential production	Commercial forest area	Virgin commercial forest
Atlantic	464,688	194,788	269,988	122,458	45,888
Northern	262,878	28,988	241,978	182,271	55,888
Central Pacific	247,888	52,988	194,188	87,526	13,588
North Pacific	79,388	31,788	47,688	32,895	3,888
South Pacific	285,788	93,488	192,388	92,335	38,888
COUNTRY TOTAL	1,339,718	393,688	946,118	516,677	146,588

Source: Flores 1984

Table 3.2-2: Areas of forest reserves in Costa Rica

FOREST RESERVE	AREA (3) ha	PERCENT OF COUNTRY AREA	PERCENT OF RESERVE COVERED BY FOREST (2)	AREA OF RESERVE COVERED BY FOREST 1985 ha
Arenal	18,325		80	14,660
Cordillera Volcanica Central	69,900		50	34,950
Cordillera de Guanacaste	32,337		70	22,636
Golfo Dulce	76,803		70	53,762
Grecia	2,000		75	1,500
Juan Castro Blanco	13,700		90	12,330
Los Santos	6,200		50	3,100
Mangroves (1)	35,000		100	35,000
Matina	400		0	0
Rio Macho	99,205		95	94,245
San Ramon	7,800		100	7,800
Taboga	297		100	297
TOTAL FOREST RESERVES	361,967	7.12%		280,280

(1) Limits undefined.

(2) Estimates. Personal communication Damaris Garita, DGF, based on Matamoros (1985).

(3) Source: Estado del medio ambiente. Fundacion Neotropica. 1987 (Draft)

Table 3.2-3. ECONOMIC ASPECTS OF PRIMARY FOREST INDUSTRY IN COSTA RICA IN 1983

Type of primary industry	Log consumption (m3)	Production	Apparent consumption per capita	Value of production (millions of colones)	No. of permanent employees	Income paid to employees & soc. security (millions of colones)
Sawmills	646200	303300 m3	0.122 m3	2703.7	4362	323.5
Plywood & panels	73600	46400 m3	0.012 m3	660.7	1040	75.0
Paper (1)	5040	8400 tons	0.01 tons	525.0	550	41.0
TOTAL	724840	354740 m3(2)	0.134 m3(3)	3889.4	5952	439.5

(1) Only 15% of paper production is derived from roundwood (5040 m3 all from plantations), the rest from recycled paper and imported pulp.

(2) Includes 5040 m3 of wood as chips for mechanical pulp.

(3) Does not include paper consumption

Table 3.2-4 SAWMILL CONSUMPTION AND PRODUCTION FOR 1983

PROVINCE	ROUND WOOD CONSUMPTION (m3)	AVERAGE RECOVERY %	VOLUME OF PRODUCTION (m3)	PERCENT OF NATIONAL PRODUCTION
San Jose	138,700	47.5	65,900	21.7
Cartago	91,400	47.5	43,400	14.3
Alajuela	219,700	45.6	100,200	33.0
Heredia	60,800	46.8	28,500	9.4
Limon	57,900	45.9	26,600	8.8
Puntarenas	47,800	45.9	22,000	7.3
Guanacaste	29,900	45.9	13,700	4.5
NATIONAL TOTAL	646,200	46.4	300,300	99.0

Source: Flores, 1985.

Table 3.2-5 SAWMILL PRODUCTION CAPACITY IN CUBIC METERS OF LUMBER/DAY

PROVINCE	1 - 5	5.1 - 10	10.1 - 15	15.1 - 20	20.1 - 25	> 25.1	TOTAL
San Jose	6	2	20	6	0	1	35
Cartago	0	4	4	6	6	0	20
Alajuela	13	6	16	9	4	8	56
Heredia	2	1	4	1	2	0	10
Limon	13	13	9	2	0	5	42
Puntarenas	12	8	6	2	2	0	30
Guanacaste	6	1	4	1	0	4	16
National Total	52	35	63	27	14	18	209

Source: Costa Rica. Direccion General Forestal, Mapa distribucion de la industria forestal en el pais. 1980.

Table 3.2-6 Projected sources of sawtimber for Costa Rica for the year 1999.

Land use	Area in use 1984	-----WITH MINIMUM IMPROVEMENTS-----							-----WITH FAVORABLE DEVELOPMENTS-----						
		--Change in use--		Area in use 1999		Area producing timber in 1999		Harvestable timber yield	Allowable annual harvest	--Change in use--		Area in use 1999		Area producing timber in 1999	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	000 ha	000 ha	%	000 ha	%	000 ha	m3/ha/yr	m3 (r)	000 ha	%	000 ha	%	000 ha	m3/ha/yr	m3 (r)
FAPMS COVERED BY 1984 AG CENSUS															
Annual crops	386	0	0	386	0	0	0	0	0	0	386	0	0	0	0
Permanent crops	236	0	0	236	10	24	1	23,600	0	0	236	20	47	1	47,200
Pasture	1652	180	11	1832	10	103	1	183,200	129	8	1781	20	356	1	356,200
Young secondary forest + brush	226	305	135	531	10	53	0	0	102	45	320	20	64	0	0
Mature forest	492	-192	-39	300	10	30	5	150,000	-92	-19	400	20	80	7	560,000
Forest plantations															
Planted before 1980	0.2	0	0	0.2	100	0.2	15	12,300	0	0	0.2	100	0	15	12,300
Planted 1980 - 1984	6	0	0	6	100	6	15	346,000	0	0	6	100	6	15	346,000
Planted 1985 - 1989	16	0	0	16	100	16	0	0	20	0	20	100	20	0	0
Planted 1990 - 1994	20	0	0	20	100	20	0	0	40	0	40	100	40	0	0
Planted 1995 - 1999	30	0	0	30	100	30	0	0	60	0	60	100	60	0	0
Other uses on farms	70	0	0	70	0	0	0	0	0	0	70	0	0	0	0
SUBTOTAL AG CENSUS 1984	3060			3427		362		715,100			3327		675		1,321,700
LAND NOT COVERED BY AG CENSUS															
Forest reserves	359	-359	-100	0	100	0	0	0	-259	-72	100	100	100	7	699,769
Midland system (exclusive forest reserves)	678	0	0	678	0	0	0	0	0	0	678	0	0	0	0
Indian reserves	279	0	0	279	0	0	0	0	0	0	279	0	0	0	0
Urban, water, etc.	29	0	0	29	0	0	0	0	0	0	29	0	0	0	0
Farms not covered by census + public domain outside midland system (=residual)	597	0	0	597	0	0	0	0	0	0	597	0	0	0	0
SUBTOTAL: NOT COVERED BY CENSUS	1942			1583		(0)		0	(259)		1683		100		699,769
TOTAL	5010	0		5010		723		1,430,360	0		5010		1450		3,343,329
Lumber yield								352,212							1,103,299
(Conversion factor tree to log)								0.54							0.60
(Conversion factor log to lumber)								0.46							0.55

Note: Seemingly multiplication discrepancies are due to rounding off on printout.

Table 3.2-6 Continued

SOURCES AND ASSUMPTIONS:

Column

All calculations are limited to sizes and species of trees that can be sawn into lumber or made into plywood, i.e. fuelwood, posts, poles, etc. are not included here.

2 Censo Agropecuario 1984

2 Legal boundaries of Forest Reserves, but only part of area is still under forest cover

2 Wildland areas, Indian Res, Urban & Water: Estado Medio Ambiente, Fund. Neotropica

2 Farms not covered & public domain is the residual area that is unaccounted for

3 Assumes Forest Reserves are converted half to pasture and half to young secondary forest

3 Assumes all future plantations are established on land occupied by young secondary forest

3 Assumes part of mature forest on farms is cut over to form young secondary forest

4 $(Col.3/Col.2)*100$

5 $Col.2+Col.3$

6 Reasonable assumptions, open to discussion. The percentage refers to the area under intensive management to produce sawtimber, some of it in conjunction with coffee, cocoa and pastures

7 $(Col.5*Col.6)/100$

8 Reasonable assumptions based on technical literature, with low level of management. Plantations produce no sawtimber before age 15; 10 m³/ha/yr at ages 16 to 20; 15 m³/ha/yr when older than 20 years.

9 $(Col.7*Col.8)*1000$. For plantations the calculation is: $(Col.7*Col.8*1000*20 \text{ year rotation})/5 \text{ year cutting period}$

10 Assumes 100,000 ha of Forest Reserves can be saved and managed

Assumes increasing rate of forest plantation

Assumes part of mature forest on farms is cut over to form young secondary forest

11 $(Col.10/Col.2)*100$

12 $Col.2+Col.10$

13 Reasonable assumptions, open to discussion. The percentage refers to the area under intensive management to produce sawtimber, some of it in conjunction with coffee, cocoa and pastures

14 $(Col.12*Col.13)/100$

15 Reasonable assumptions based on technical literature, with intermediate level of management. Plantations produce no sawtimber before age 15; 10 m³/ha/yr at ages 16 to 20; 15 m³/ha/yr when older than 20 years.

16 $(Col.7*Col.8)*1000$. For plantations the calculation is: $(Col.7*Col.8*1000*20 \text{ year rotation})/5 \text{ year cutting period}$

Current lumber yield conversion factors from Flores 1985, future factors estimated on experience in other countries

COMMENTS:

1 By January 1988 more reliable figures on current land use (column 2) should be available when DGF staff finish a vegetation type map (scale 1:200,000) for the whole country, based on Landsat images. At that time this model should be recalculated using the new data.

2 Although plantations can be producing timber, very little of it will be mature enough for sawtimber in 1999

3 Current lumber consumption for Costa Rica estimated at 423,530 m³ by Flores 1985.

3.3 Wildlands

Wildlands are defined as natural land and water areas little modified by modern society, where wild species predominate. Wildlands thus include the full range of ecosystems (natural areas), whether land-based (e.g., forest, woodlands, bushlands, grasslands, deserts), natural inland bodies of water, or coastal and marine areas. Wildland management is defined as the direct maintenance, protection or enhancement of relatively unmodified natural ecosystems and their characteristic plant and animal species.

3.3.1 Wildland resources and their use

As outlined in the Country Environmental Profile (1983), Costa Rica is one of the most advanced Latin American countries regarding the development of national conservation objectives and a national system of wildlands. Although deficiencies are apparent in the administrative and management capabilities of the National Park Service (SPN), strong support has been provided by both national and international private organizations, and Costa Rica today offers an ambitious and impressive wildland system that, without including Indian reserves, occupies approximately 20% of the national territory (1,327,916 ha). The system includes national parks, biological reserves, forest reserves, wildlife refuges, and other natural areas, of which the national parks cover the largest area (Table 3.3-1.).

Most of the wildland units were established during the 1970's and early 1980's, after scientific study of their natural and cultural resources, and an analysis of the local socio-economic situation. Detailed evaluations of the entire system of wildlands and forest reserves was done with the purpose of improving management and protection (Tropical Science Center 1982, Godoy 1984, Matamoros 1985). According to these studies, some units should not be included in the system of wildlands, the classification of many units should be changed, some new units should be added and others should have their boundaries modified. Although implementing some of these recommendations is contemplated in the work plan of the Ministry of Natural Resources, so far little progress has been made.

3.3.2 Resource quality

The diversity of natural environments and richness of associated biological resources in Costa Rica is one of the highest in the world on a per unit surface basis. Some of the wildland areas, however, are not adequately protected and little or no management is carried out, partly because of inadequate funds to cover operating costs. As a consequence, a few of the parks (managed by the SPN) and most of the forest reserves (managed by the DGF) are being degraded from deforestation, colonization and uncontrolled hunting and fishing.

3.3.3 Problems associated with the management of wildlands

The numerous problems associated with the consolidation and management of wildland areas are discussed in the Costa Rica Environmental Profile (1983). They are briefly summarized below:

Operational and management planning:

Management plans exist only for a few of the wildland units and there is a great variability in the quality and utility of those that do exist. For example the La Amistad master plan was recently completed and is very detailed, while the management plan for the Santa Rosa National Park dates from 1968 and essentially has only historic value. Many of the plans do not include detailed budgets or strategies for procuring financing.

The boundaries of each wildland unit are marked on 1:50,000 topographic maps, but generally not on the ground. Government personnel have difficulty protecting poorly-defined units, while neighbors and squatters can not respect unknown boundaries. Most wildland units contain private property within its boundaries, most with legal title although some have only possessionary rights. The complexity of land tenure contributes to a gradual deterioration in these wildlands. With GOGR funds and donations about 85% of the area within the boundaries of the national parks has been acquired. Information on the area within the parks that still needs to be acquired is available and its total cost is estimated at \$10,000,000.

The information base is particularly weak for forest reserves and protection zones, where control of boundaries is frightfully deficient. There are diagnostic timber inventories for several reserves but they are superficial and inadequate as a basis for management and exploitation. In one case (Arenal) where detailed ecological studies were done (TSC 1980), the management recommendations have not been implemented because ICE has not allocated funds.

Inadequate protection and management:

Protection of most of the parks and other wildlands managed by the SPN is acceptable at present, although pressures are increasing. However, management tends to be rudimentary. Adequate management is not carried out in any of the forest reserves, which are managed by the DGF. Modest protection is provided by one to four forest guards per unit; however, unit administrators who are not professional foresters are usually responsible for more than one unit and, with few exceptions, are not based in a unit. The SPN suffers the inefficiencies and rigidities of so many government agencies, with an excessive proportion of its budget tied up in personnel costs. The scarcity of funds to cover operating costs, exacerbated by

the economic crisis of the 1980's, is one of the primary causes of this unfortunate situation in all of the wildlands.

Resource degradation: In most of the forest reserves, protection zones and even in some of the national parks, there is illicit exploitation of timber, firewood, charcoal, wildlife and soil. Small landholders wastefully exploit the land, often with the DGF and the SPN helpless to prevent the process. Particularly disheartening is the destruction of timber in the opening of new agricultural lands, i.e., the Golfo Dulce, Río Macho, and Cordillera Volcánica Forest Reserves, often with the assistance of IDA. The DGF is unable to effectively manage 12 forest reserves and 22 protection zones covering 9% of the country.

Deficiencies in wildlands legislation and policy: Serious defects in legislation and its regulations that concern wildlands deter effective management, although the new forest law is an improvement over the old. Policy regarding use and management of specific wildlands is sometimes poorly defined and other times too restrictive to allow for the development and use of wildlands.

Institutional role -- public vs. private: Until recently all regulation and management of wildland areas has been handled by the public sector, principally by the DGF and SPN. Although there is a legitimate role for it, inadequate use has been made of the private sector especially regarding resource management and development. The National Parks and Neotrópica Foundations are recent exceptions to this rule and have been very active and effective. Continued support for private sector participation both in forestry and wildlands is viewed as an important need by many observers, who believe that the public institutions should concentrate their scarce resources on the regulation and protection side of resource management. The Ministry of Natural Resources, Energy and Mines is creating a task force to reform the administrative apparatus of the entire wildland system. One of its main objectives is to privatize many of the functions currently carried out by the SPN. Because the two foundations provide a sizeable proportion of the budget of the SPN, this privatization has already made considerable progress in recent years. For instance, the Neotrópica Foundation has contracted numerous employees and has loaned them to the SPN for specific tasks. By contributing funding, these private groups have of course had increasing influence in decision making concerning the wildlands. For example, management decisions concerning the proposed Guanacaste National Park are being made by a board composed of representatives from the public agencies and the private sector, an experimental arrangement that might be expanded to other parks (Janzen 1986). By law the SPN is the agency responsible for park management, however there is much scope for contracting many of its functions. Of course, resistance is to be expected from those public officials who would lose power.

In Costa Rica, numerous donors have worked for over a decade with the Park Service and a number of local private groups to establish the national parks/wildlands system. They have provided funds for acquisition and management of lands, training and education. Most recently, President Reagan awarded the World Wildlife Fund's J. Paul Getty Wildlife Conservation Prize to two Costa Ricans for their 15 year effort to build this system from its modest beginnings. As described above, the Costa Rica parks program is now seeking to become less dependent on government funding and rely more on private sources such as the National Parks Foundation, which WWF/US and the Nature Conservancy helped found. This Foundation as well as the Neotropica Foundation have started permanent fund raising campaigns. The U.S. donors will probably continue to work with the National Park Service and the private National Parks and Neotrópica Foundations in the future to build a stronger constituency through increased local use and to explore concessions and other means by which the system can respond better to the needs of the country.

Through a program in Wildlands and Human Needs WWF/US has been able to expand their projects in Costa Rica to include the sustainable management of lands outside the park system, and to natural resource/environmental education. Their recent initiatives aim at integrating development uses with protection of natural resources. They have provided funds to explore the sustainable use at a local community level of several wildlife species, most notably crocodilians, sea turtles, and white-tailed deer. The WWF/US habitat conservation programs are increasingly focused on areas where development uses such as forestry can be integrated with the conservation of biological diversity.

Other private organizations such as ANAI and the Organization for Tropical Studies are also expanding to foment management of wildlands. The National Plan for Environmental Education being prepared by the Fundación de Educación Ambiental hopes to improve coordination and efforts in this field. Local conservation actions in Sarapiquí are being encouraged through a pilot operation of the Fundación Neotrópica, together with INCAE and the Ford Foundation.

The WWF/US education affiliate, RARE, has developed a curriculum with the Costa Rican Ministry of Education for use by primary schools, to enhance understanding of the environment and natural resources. RARE is now developing a general education program on natural resources with the Universidad Estatal a Distancia (UNED).

Table 3.3-1: Areas of legally protected wildland units in Costa Rica and institutions responsible for their management

	-----AREA-----		PERCENT OF COUNTRY AREA
	ha	ha	
NATIONAL PARKS (SPN)	432,290		8.50%
Barra Honda		2,296	
Braulio Carrillo		44,099	
Cahuita		1,068	
Corcovado		41,789	
Cordillera de Talamanca		193,929	
Chirripo		50,150	
Isla del Coco		2,400	
Manuel Antonio		683	
Palo Verde		5,704	
Rincon de la Vieja		14,084	
Santa Rosa (1)		49,515	
Tortuguero		18,947	
Volcan Irazu		2,309	
Volcan Poas		5,317	
BIOLOGICAL RESERVES (SPN)	16,481		0.32%
Carara		4,700	
Hitoy Cerere		9,155	
Isla del Cano		200	
Islas de Guayabo y Negritos		143	
Lomas Barbudal		2279	
Islas de los Pajaros		4	
ABSOLUTE BIOLOGICAL RESERVE (SPN)	1,172		0.02%
Cabo Blanco		1,172	
NATIONAL MONUMENT (SPN)	218		.00%
Guayabo		218	
PRIVATE PROTECTED WILDLANDS	9,234		0.18%
La Selva (OTS)		1,403	
Wilson Botanical Garden (OTS)		127	
Monteverde (TSC)		5,000	
Los Espaveles (CATIE)		200	
Marenco (Miranda Family)		422	
3 de Junio (UCR)		750	
Hacienda La Pacifica (Asoc.Ecol.)		1,332	

Table 3.3-1: Continued

	-----AREA-----		PERCENT OF COUNTRY AREA
	ha	ha	
WILDLIFE REFUGES (DGF)	127,867		2.52%
Cano Negro		9,969	
Curu		84	
Dr. Rafael Lucas Rodriguez C.		7,354	
Isla Bolanos		5	
Tamarindo		420	
Tapanti		4,715	
Ostional		162	
Golfito		1,309	
Gandoca y Manzanillo		9,449	
Barra del Colorado		92,000	
Penas Blancas		2,400	
PROTECTION ZONES (DGF)	99,848		1.96%
Barbilla		12,830	
Cabecar (2)		0	
Caraigres		4,000	
Cerro La Carpintera		2,000	
Cerros de Atenas		700	
Cerros de Escazu		3,600	
Guacimo y Pococi (3)		0	
Guanacaste (4)		24,428	
La Selva		2,000	
Las Tablas		19,602	
Quitirrisi		40	
Rio Grande		1,500	
Rio Tiribi		650	
El Rodeo		1,785	
Turrubares		2,947	
Cerros Nara (2)		0	
El Chayote (2)		0	
La Cangreja		1,937	
Pacuare		13,060	
Cuenca del Rio Tuis (2)		0	
Tivives		2,369	
Rio Sombrero		6,400	
TOTAL WILDLANDS (excluding forest reserves)	687,110		13.52%
FOREST RESERVES (See Table 3.2-2)	361,967		7.12%
INDIAN RESERVES	278,839		5.49%
TOTAL OF ALL LEGALLY RESERVED LAND	1,327,916		26.13%

Table 3.3-1: Continued

Notes:

- (1) Includes 33,513 ha of the Santa Rosa and Murcielago sections and 16,000 ha of the area recently annexed between them.
- (2) Limits undefined.
- (3) Doubtful area
- (4) The Guanacaste Protection Zone has an area of 34,870 ha, which includes 10,442 ha of the Cordillera Guanacaste Forest Reserve, Orosi section.

Source: Estado del medio ambiente. Fundacion Neotropica. 1987.
(Draft)

3.4. Wildlife

A necessary starting point for an effective program in wildlife conservation and utilization is a solid working knowledge of the local fauna. In this respect, Costa Rica is fortunate among Latin American countries: due to the work of a long succession of local and visiting naturalists, its fauna is probably one of the best known in the neotropics (Janzen 1983). Although details of taxonomic status, local distribution and abundance are still debated for many species, and new species are still being added, the basic faunal inventory is relatively complete, at least for most vertebrate groups. For many invertebrate groups, far less is known but at least some groups have received concentrated study in recent years (e.g., arachnids, butterflies and moths, some beetle groups).

3.4.1. Wildlife resources

Costa Rica has a herpetofauna of about 360 species (ca. 210 reptiles, 150 amphibians); an avi-fauna of some 850 species (ca. 625 breeding birds, 225 nonbreeding migrants and visitors); and a mammal fauna of some 205 species, divided nearly equally between bats and nonflying mammals. Largely because of the country's small size, rather few species, mostly herps, are endemic to Costa Rica per se. However, a much more sizeable portion of the fauna consists of species with a very limited distribution; most are found only in Costa Rica and western Panama, such that events in Costa Rica could have a significant effect on total species populations. Most such species are found in the highlands; a few, in the humid forests of the Golfo Dulce lowlands.

Wildlife is one of the greatest attractions for the ecotourism industry that is rapidly developing in Costa Rica. The potential contribution of wildlife as a food source in rural areas could also be increased with proper management, especially for white-tailed deer, iguanas, ducks and marine turtles.

3.4.2. Problems in wildlife conservation

The wildlife of Costa Rica can be classified into four groups with respect to perspectives for management and exploitation: 1) Endangered species; 2) Species used by man; 3) Pest species; and 4) Species without known direct economic importance to man. In general, management practices should be directed toward the protection and preservation of endangered species; for usable species, the main objective should be to regulate exploitation practices to assure sustained yields. For both of these groups the principal problem is habitat destruction; in second place poaching and illicit trade. Control measures for pest species should ideally be specific to the species in question, without

jeopardizing other components of the ecosystem. The vast majority of wildlife species will fall in group 4. These species are functional parts of natural ecosystems, and they may represent or affect essential resources for species in the first three groups. However, they are not subject to intensive management practices, and their preservation will follow upon the maintenance of intact natural ecosystems. The ideal practice would be to preserve adequate representatives of as many kinds of ecosystems as possible, to maintain total biotic diversity. For highly mobile animals, such as many birds and insects, and perhaps some large mammals, this may include protecting corridors connecting ecosystems containing essential but highly seasonal resources. Protection of such ecosystems is an automatic consequence of adequate management of the forests (see 3.2) and the wildlands (see 3.3). However, except for La Amistad, most protected wildlands are of inadequate size, even with good management, to maintain genetically viable populations of certain species.

The Costa Rica Country Environmental Profile examines current wildlife policies and practices in relation to the above objectives. Effectiveness could be improved and duplication reduced if the wildlife management functions of the DGF and the SPN were fused into one unit, as the Ministry of Natural Resources intends to do. In addition to Costa Rican conservation groups, several U.S. and international groups are active in wildlife conservation in Costa Rica. These include the International Union for the Conservation of Nature (IUCN), World Wildlife Fund (US and International), The Nature Conservancy, the Conservation Foundation, U.S. Fish and Wildlife Service (USFWS) and the U.S. National Park Service. The National Autonomous University, with financial support of the USFWS and WWF/US, hosts a regional program in wildlife management that provides training and carries out limited research and technical assistance. This is the only substantial wildlife program in all of Central America.

In general, most of the threats to wildlife are adequately countered by habitat protection/management and the control of the negative impact of illegal hunting, animal trade and the misuse of biocides. Thus, the actions taken to protect and manage wildlands (3.3) and other natural areas of forest (3.2) are essential to the conservation of wildlife.

3.5 Water resources

3.5.1 The status of water resources

Costa Rica is unusually rich in water resources, due to the combination of its rugged topography and high rainfall. The country has excellent dam sites and rivers with abundant, year-round flow. It is conservatively estimated that Costa Rica has 9,000 MW of hydroelectric potential and 350 m³/second of sustained groundwater flow. Although rainfall, which is the ultimate origin of the water resource, is probably not influenced by human intervention, the flow of the water after it arrives at the land surface depends on the condition of the watershed. Thus changes in land use can have a large effect on the quantity, quality and timing of flow in rivers and below ground.

One of the most fundamental water resource management problems of Costa Rica is that construction and management of infrastructures which depend on water, such as hydroelectric installations, irrigation schemes and aqueducts, are traditionally divorced from management of the watersheds above these structures. Thus, although ICE, SENARA and ICAA do acceptable jobs of dealing with the above infrastructures, the complex endeavour of managing the watersheds is diffusely spread between them, MAG, the Ministry of Natural Resources, Energy and Mines, the municipalities and others. Fortunately this situation is improving due to an initiative in greater coordination through the "Interinstitutional Agreement for Integrated Watershed Management" (see 7.5.1).

ICE has divided the country into 34 watersheds or groups of watersheds. Recently the interagency National Advisory Council of the ROCAP/CATIE Watershed Management Project has selected four large watersheds that have top priority for management (Annex 2). One of these, the upper Rio Virilla, was chosen as the pilot watershed for the project and a management plan is being prepared.

Because their problems, beneficiaries and the institutions that deal with them are radically different, for the sake of this document, watersheds are divided into two categories: those that supply potable water to municipalities and those that supply large infrastructures. The former (see 7.4) tend to be relatively small, with an area usually measured in the hundreds of hectares, where intensive management practises are often feasible and where one can expect great support from the local population which suffers the consequences of mismanagement at the faucet. The latter watersheds (see 7.5) might cover thousands of hectares and require major, systematic efforts involving several institutions to improve management, the consequences of which often accrue to downstream users or to society in general.

3.5.2 Potable water

Costa Rica has been exceptionally successful in supplying water to its citizens. In 1980, 82% of the total population was served by aqueduct, broken down to 98% in the urban centers and 62% in the rural areas. ICAA (popularly known as AyA) is responsible for supplying water to the metropolitan area of San José (3.3 m³/second), some of the other urban centers (2.1 m³/second), and some rural areas (0.5 m³/second). The completion of the Orosi aqueduct with a capacity of 1.8 m³/second will increase the supply to the metropolitan area. However, of the 87 municipalities in Costa Rica, 47 are responsible for their own water supply independently of ICAA, supplying a total of 675,000 inhabitants (Fundación Neotrópica 1987).

ICAA has plans to improve 27 urban and 22 rural aqueducts with the help of an IDB loan. Through IFAM, USAID (Project 515-0192) is financing improvements in eight of those aqueducts managed directly by the municipalities. USAID, IFAM and other agencies have identified limited water supply as one of the major constraints to construction of new housing. Many municipalities are turning down house construction permits because of inadequate water.

Traditionally there has been more concern with water quantity than quality, especially outside of the metropolitan area. The recent survey of the priority watersheds of 13 municipalities paints a shocking picture of contamination and of watershed degradation (Arias and Portilla 1987).

3.5.3 Hydroelectric and irrigation development

A progressive development strategy by ICE has led to the construction of numerous hydroelectric projects with a total capacity of 627 MW, that now generate 98 per cent of the nation's electricity. Rural electrification programs have reached over 70 per cent of the population.

SENARA is the principal institution responsible for irrigation. Although irrigation could substantially increase agricultural productivity, the lack of national policy, experience and expertise, especially related to integrated water resources management, must be overcome before this irrigation potential can be realized. The Itiquís Irrigation District is already under management and SENARA currently has 53 small scale irrigation projects (of up to 5,000 ha) identified for future development totaling 52,603 ha. Together with the 66,675 ha of irrigation being developed under the Arenal-Tempisque Project, by the year 2000 Costa Rica will have more than 120,778 ha under irrigation.

3.5.4 Floods

The problems caused by flooding have been increasing recently, due primarily to the increasing use of natural flood plains for economic activities and human settlement. The absence of flood-risk zoning and of the political decisions to prohibit flood plain construction have exacerbated the damage caused by floods. The threat of disastrous floods is greatest in the Caribbean lowlands, especially in the towns located at the base of the mountains, many of which are situated on outwash cones of the large rivers. Of course, increasing deforestation and watershed degradation will continue to aggravate the flood problem.

3.6. Coastal and marine resources¹

Costa Rica has an exceptional geographic position with coasts on two oceans and considerable diversity and abundance of coastal and marine resources. The very irregular Pacific coast extends for 1,016 km with numerous bays, peninsulas, promontories and estuaries. In contrast, the 212 km long Atlantic coast of is quite uniform and lacks the morphological complexity of its western counterpart. With Cocos Island, Costa Rica has a exclusive economic zone and jurisdictional waters covering about 520,000 square kilometers, equivalent to ten times its terrestrial surface area.

The Pacific continental shelf is more extensive than the Caribbean and with much less slope; the more abrupt Caribbean shelf is partly responsible for the straightness of the country's eastern coast. The Pacific coast has a tide cycle with two highs and two lows of differing magnitude. High tides can exceed three meters. The Caribbean daily tidal cycle has one high and one low tide differing only by centimeters. The tidal fluctuations strongly affects the composition of floristic and faunal communities on both coasts. The litoral flora is richer on the Caribbean side, and the litoral fauna is richer and more abundant on the Pacific side.

Beaches, mangroves, coral reefs and lagoons are the principal coastal habitats. Many of the sandy beaches are the nesting ground of the threatened, commercially important marine turtles. In addition, the beaches whose form and color have regional differences, constitute an important national and international tourist attraction.

Mangroves are an especially important feature of the Pacific coast; some 15% of the shore area is in mangroves and associated estuaries. These nutrient-rich waters are the breeding and nursery areas for the majority of commercial fish harvested by Costa Rica, for shrimp and for many marine species important for subsistence fisheries. Mangroves are much less extensive and important on the Caribbean coast. The mangroves is the coastal ecosystem most severely affected by human exploitation for saltworks, charcoal, firewood, tannin and shrimp ponds. Cutting of mangrove forests is common, especially in the Nicoya Gulf area where 54% of the stands have been degraded or deforested. If properly managed, their potential for wood production is very high. For the country as a whole by 1979, 40% of the country's mangrove forests had been destroyed (Madrigal et al. 1979), causing negative impacts on reproduction of fish and other marine life.

Coral reefs are limited to the Caribbean coast, particularly around Cahuita Point and south to the Panama border. Coral reefs are known to be the most productive ecosystem in the world in terms of biomass produced per unit area. The Cahuita reef is a typical fringing reef, some 2.5 km

1. The Costa Rica Country Environmental Profile (1983) is the main source of this chapter.

long and 1 km wide, covering about 600 ha. Despite declaration as a national park in 1970, considerable reef mortality is occurring apparently due to sedimentation from rivers and possibly contaminants from banana lands and the Limón port (for economic implications see 2.1).

Coastal lagoons are restricted to the northern Caribbean coast, extending some 120 Km north of Limón. They are usually parallel to and just behind the coast and are predominantly fresh water. Narrow bands of mangroves occur near the mouth of canals and rivers; these areas support an important sport fishery for tarpon and other fish.

3.6.1 Marine fisheries

Fishing is a complementary activity of coastal inhabitants that has inhibited significant development of commercial fisheries. Commercial extraction of marine resources is characterized by intensive exploitation of a very few species from well defined geographic areas. The concept of integrated exploitation is completely lacking. Thus there is considerable underutilization of associated species, such as the shrimp by-catch. Utilization of marine resources is constrained by the lack of scientific information on exploitable resources. The Directorate of Fisheries in MAG is the government institution responsible for policy, coordination and control of the fisheries sector. Institutional, policy and legal aspects of fishing in Costa Rica are presented in the Country Environmental Profile (pages 48-50).

Fishing is conveniently classified on four levels: artisanal, semi-industrial, industrial and sport. Artisanal fishing is done in small boats (less than 10 m long) and near shore, although some may stay at sea for up to five days. Though artisan fishing occurs on both coasts, it has much greater socio-economic importance on the Pacific, particularly in the Nicoya Gulf. On the Caribbean coast it is primarily concentrated on seasonal catching of lobster and green turtles. Semi-industrial fishing by the shrimp boats and sardine fleets is done in the 20 km zone of the Pacific in depths less than 100 m. Industrial fishing of tuna in Pacific off-shore waters is done by a very few vessels; the majority of tuna is exported frozen, rather than canned. The number of fishing camps has greatly increased in recent years and sport fishing is a major component of nature tourism. Daily expenditures of sport fishermen are among the highest of all tourists. For instance, in reference to tarpon sports fishing, concentrated on the north Atlantic coast, conservative estimates based on the business of only the three main fishing lodges, indicate that over 3,000 sports fisherman-days are generated annually at a daily cost of \$300. Thus this industry brings in a gross income of over \$900,000 per year. In addition, the economic benefits derived from employment generation, charter aircraft, the use of hotels, restaurants and other facilities in San José, makes tarpon fishing an industry of significant economic impact.

Beginning in 1966 the annual catch in the Pacific littoral increased significantly, reaching maximum captures in the mid-70's. Since then, total captures have tended to decrease in spite of continued increase in the fleet. Despite the size of the maritime territory of Costa Rica, fisheries exploitation plays an insignificant role in the national economy, although there has been a slight relative increase in the past few years. Fish exports have quintupled, yet fish remain a tiny percentage of total exports. Fish imports are only about 20% as large as the national production.

Other industries associated with fishing include mariculture and freshwater fishculture. Both of these are recent developments limited in extent and economic importance.

3.6.2 Terrestrial Coastal Zone

In the past few years the coastal zone has received considerable attention due to recent recognition that the coastal environment is intimately related to the nearby terrestrial ecosystems. The effects of abusive utilization of coastal resources are now seen as immediate problems with serious consequences for artisan fisheries. Utilization of coastal zones seems to be characterized by uncontrolled development that pays little attention to resource limitations or environmental fragility. The location of tourist complexes, industrial areas, port facilities, etc., have been in response to special interests and pressures. Increased coastal pollution and demands for coastal recreation have resulted in political concern for the conservation and rational development of coastal resources.

The Costa Rican Institute for Tourism (ICT) shares authority over the coastal zones with the respective municipalities; however, centralized plans and programs for zoning and use of coastal zones do not exist. A 1961 modification to the Maritime Law extends the maritime zone 200m inland from mean high tide. The Terrestrial Maritime Zone Law (No. 6043, 1977) divides the 200 m strip into equal public and restricted zones. ICT has naturally concentrated on tourism development, while the municipalities control use of terrestrial maritime zone through leases in the public section and construction permits in the restricted section. Only the Culebra Bay project has integrated development plans. The limited development of tourism centers on the coasts has not led to a significant influx of national or foreign tourists; at least in one sense this has contributed to the attractiveness for scientific tourism in Costa Rica.

The municipalities are also legally responsible for controlling use of mangroves, but they have consistently ignored this section of the law. Primarily because of municipal disinterest in mangrove protection, MAG promulgated an executive decree (No. 7210-A, 1977) declaring all mangroves as National Forest Reserve. Use permits are granted jointly by the DGF and the Dirección de Recursos Pesqueros (DRP) of MAG, but control in the field is inadequate because of insufficient staff and operating budgets.

Increases in coastal and marine traffic during the past decade prompted the development of modern expanded port facilities at Caldera (near Puntarenas) and Moin (near Limon). Other minor ports exist on the Pacific coast (Quepos, Golfito) due to export of bananas and vegetable oil. Port facilities for receiving fish catches are inadequate.

3.7 Energy resources

The national energy plan for 1986-2005 presents a detailed account of the current energy situation as well as projections for the future (Costa Rica. Min. de Industrias, Energía y Minas, 1986). However, it is our understanding that USAID has a policy of not financing activities in hydropower, petroleum, coal or hydrothermal. Consequently, these energy sources will not be considered in the present document. Discussion of potential USAID involvement will be limited to biomass energy.

3.7.1 Energy consumption

Fig 3.7-1 shows the evolution of energy consumption in Costa Rica and projections until the year 2005. At present biomass, principally fuelwood, is the largest energy source: almost half (48%) of all energy consumed in Costa Rica is derived from biomass. It is followed by petroleum derivatives (38%). Hydroelectric energy accounts only for 14% of total energy consumed. Almost all electricity used in Costa Rica is derived from hydropower (98%). The two domestic sources of largest potential, hydroelectricity and fuelwood have only been developed to 7.1% and 13.6% of their potential respectively (Table 3.7-1). It is clear that in spite of a continued development of hydroelectric energy sources, the country will depend increasingly and at great cost on imported petroleum derivatives.

3.7.2 The status and prospects of biomass energy

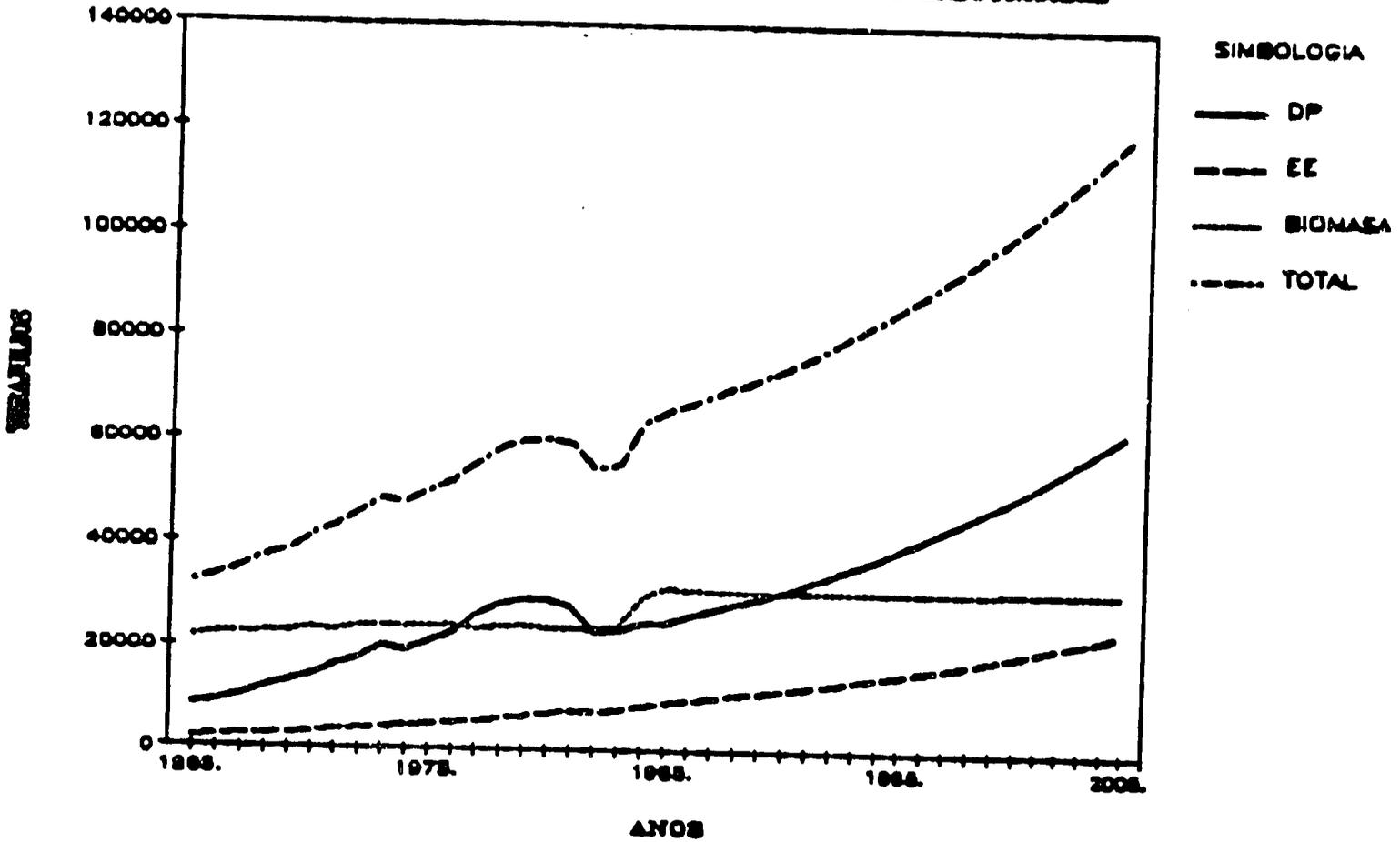
Industrial and agricultural sector: This sector consumes about 160,000 tons of fuelwood annually, of which 100,000 tons are burned to dry coffee. Because of the rise in oil prices, almost all coffee processing plants have recently converted back to fuelwood for this purpose. Most of this fuelwood is derived from trees on farms (Reiche and Campos 1986, Canet 1986).

USAID has supported efforts to substitute biomass energy for imported petroleum derivatives in Costa Rican industry. After studies (Costa Rica, Dir.Gen.Energía 1984) identified the cement industry as one of those where substitution could have the greatest impact, USAID helped finance the retrofit of the Industria Nacional de Cementos, S.A. in Cartago, so that it can now substitute up to 40% of its bunker fuel with biomass. At present oil palm shells are the biomass that is burned, but this is a limited resource and the cement plant could potentially burn up to 100,000 tons of wood chips per year if available at an acceptable price per calorie. This is a new situation which could have considerable positive impact on forestry because it could create a market for wood from early thinnings of plantations. Market mechanisms now need to be given a chance to develop the supply, although the government must maintain control to avoid indiscriminate cutting of natural forest.

USAID has helped to identify opportunities for additional substitution of biomass fuels for petroleum derivatives in industry, however until now the subsidized price of fuel oil and diesel have been one of the major obstacles to progress in this direction, a situation that has recently changed with the reduction of subsidies.

Residential and commercial sector: Fuelwood accounts for 76% of the energy consumed by this sector, equivalent to one million tons annually (Canet 1986). Most of this fuelwood is obtained directly by the user and does not pass through the market. Because it must be available near the point of consumption, efforts are being made to encourage tree planting on farms, especially in the dry, western parts of the country where supply is critical. The ROCAP/CATIE Tree Crop Production Project and its predecessor have been doing research, training and small scale planting since 1981, with considerable success. There is increasing interest among farmers in planting trees, especially in their integration with agriculture through numerous types of agroforestry practices. So far there are no massive efforts to accelerate this process, but much could be done through the existing agricultural extension network. Currently Dutch development assistance is negotiating a project to assist IDA cooperatives in Guanacaste in establishing multi-purpose forest plantations.

FIGURA # 32
CONSUMO TOTAL DE ENERGIA
DERIVADOS DEL PETRÓLEO, BIOMASA Y ELECTRICIDAD



FUENTE: DIRECCION SECTORIAL DE ENERGIA

Figure 3.7-1. Energy Consumption in Costa Rica

Table 3.7-1 ENERGY RESOURCES OF COSTA RICA (December 1985)

RESOURCE	IDENTIFIED POTENTIAL (TERA JOULES/YEAR)	DEGREE OF UTILIZATION
Hydroelectric (1) (Projects >20 MW)	132 566	7,1
Wood (2)	109 634	13,6
Plant Residues (3)	1 853	N.D.
Bagasse (4)	702	81,8
Biogas (5)	9 981	minimal
Geothermic (6)	2 523	0
Coal (7)	519 520 (8)	0
Alcohol	6 637 (9)	0

- Notes:
- (1) The identified potential corresponds to hydro power.
 - (2) The calculation considers a humidity of 30%.
 - (3) Includes rice husks, coffee processing residues, palm nut shells and corn cobs.
 - (4) Data from: Recursos Bioenergeticos y posibilidades de sustitucion en el Sector Industrial de Costa Rica. Meta Systems Inc. April 1984.
 - (5) The potential can be diminished depending on the concentration of the residues, temperature and water content.
 - (6) An exploitation period of 25 years is assumed.
 - (7) Only the Volio reserves are included.
 - (8) Corresponds to total potential and not annual.
 - (9) Assumes 74.000 ha. of sugar cane cultivated for this purpose

Source: Direccion Sectorial de Energia, Diagnostico del Sector Energia de Costa Rica, 1985, p.98

3.8 Environmental contamination

Because of economic development, urbanization, industrialization and increased per capita consumption, Costa Rica generates more wastes than ever before. Environmental protection and natural resource management measures and institutional capacities have lagged far behind technological advances. Potable water quality is quite good except for rural systems outside the control of ICAA jurisdiction. Nevertheless, organic matter, industrial and domestic effluents and sediments still contaminate the country's rivers -- the most serious national contamination problem. The Central Valley rivers are highly polluted with detergent effluents and contaminated river water is often used to irrigate vegetable crops in the Central Valley and to wash vegetables before sale.

Aquifers for the metropolitan area are being contaminated by garbage dumps, careless use of pesticides and fertilizers, and lack of sewer systems. Coastal aquifers are particularly susceptible to salt water intrusion and contamination by organic matter and agro-chemicals.

The increasingly widespread use of agricultural pesticides in Costa Rica, all of which are imported, is resulting in an increased hazard to human health, aquatic and terrestrial nontarget organisms, and the general environment (Hilje et al. 1987). In 1982, 11.2 million kg of pesticides were imported, at a cost of U.S.\$35.3 million, compared to 6.8 million kg imported ten years earlier, at a cost of U.S.\$6.8 million. There are currently 185 pesticide active ingredients and over 800 formulations registered for use in the country.

Some pesticides banned, restricted, or undergoing special review (RPAR) by the Environmental Protection Agency in the U.S., such as Aldrin, Mirex, Temik, Parathion, Methomyl, Methamidophos, Parquat, Benomyl, and others, are widely used in agricultural areas, where 31% of the Costa Rican population live.

Among the crops more intensely treated with pesticides are bananas, rice, cotton, vegetables in general, and ornamentals. The increasing reliance on pesticides not only leads to health and environmental problems, but also increases significantly the costs of production. For instance, in 1984 U.S. \$17.5 million were spent just on chemical control of black sigatoka on bananas.

Most of the pesticide-derived problems are caused by a general poor understanding of the nature, functions and hazards of pesticides among users and by inadequate enforcement of existing pesticide regulations. For example, serious and even lethal errors such as entering fields right after spraying, applying pesticides without protective equipment, mixing

pesticides and cleaning tanks with bare hands, spraying vegetable crops right before harvest and sale, etc., are common practices. Documented incidents of fish and shrimp mortality have been associated with pesticide mixing areas and landing fields for crop dusters. Integrated pest management in Costa Rica is limited to the ROCAP/CATIE Integrated Pest Management Project focussed on tomatoes and potatoes.

Quality control and inspection of commercial food stuffs for chemical residues has been largely ignored in Costa Rica. Although MAG is responsible, it does not have the facilities or budget for adequate control. Contaminated export products are commonly consumed locally. As late as 1981, organochlorine (DDT - related pesticides) residues were being found in food products. Even today, significant levels of DDT are found in human milk in some rural areas (Umaña and Constenla 1984). Occasionally agricultural products from Costa Rica have been rejected by U.S. customs because of pesticide contamination.

Solid wastes are probably the most inadequately managed, yet widespread contaminants in the country. Central Valley urban centers have large problems with solid waste management and many Costa Ricans still indiscriminately dump garbage.

Air pollution comes principally from automotive exhausts, burning cane fields, and slash and burn agriculture. Industrial contamination of air is minor. San Jose has abnormally high levels of acid rain and high levels of particulate matter in the air.

3.9 Assessing environmental impacts

The economic dependence that Costa Rica now has on continuing flows of financial assistance from foreign donors places the major donors in a position of being involved in almost all aspects of development planning and economic policy. Naturally, this degree of involvement gives these external agencies a great deal of leverage in influencing GOCR development policies at the same time that it significantly increases the degree of responsibility that these agencies must exercise in implementing their programs. It also means that decisions made by development assistance agencies have enormous implications for the status of natural resource management efforts in the region.

Although a large amount of the direct development assistance in Costa Rica goes to projects that depend upon or may disrupt the basic natural resource systems -- soil, forests, watersheds, coastal environments -- only a very minute portion of this assistance is currently directed to improve the management or ensure the protection of these systems. The three major international donors in the Costa Rica are USAID, the World Bank, and the Inter-American Development Bank. In the private sector, the Overseas Private Investment Corporation provides substantial amounts of financial resources for private development projects (See Leonard, 1987, pages 183-186).

Only a very small number of all development projects in the country are actually designed specifically to improve the management of natural resources, and most of these are small specialized projects run by AID, UNDP, or FAO. One exception is the effort to consolidate the Guanacaste National Park. The overwhelming majority of development projects in the country aim to alter the natural environment and, to a greater or lesser extent, build in some safeguards to minimize adverse environmental consequences.

On a project-by-project basis, development assistance agencies are making increased efforts to assess the direct environmental impacts of their particular projects. Nevertheless, assessing and mitigating environmental impacts (such as the effects of road building on remote fragile areas, or upstream watershed management as part of hydroelectric investments) have not been widespread or of critical concern for the major providers of development capital to the region.

The GOCR has modest capability in the field of environmental assessment and impact mitigation, particularly in the Ministry of Natural Resources, Energy and Mines which has trained personnel, working in this area. Further support is needed. This is especially critical to ensure that major donor projects will be sustainable in the future, and to prevent some projects from undermining others as well as the overall economic development efforts of the country.

Impact assessment and mitigation are particularly important for projects in water resources, energy development, industrial forestry, commercial agriculture, coastal development, marine resource exploitation and road building.

4. CONSTRAINTS TO THE WISE USE OF NATURAL RESOURCES

Numerous obstacles stand in the way of better management of the natural resources of Costa Rica. This document limits itself to brief comments on the most serious ones. A more detailed analysis is found in many of the references mentioned in the text, especially the Costa Rica Environmental Profile (1983) and the planning documents mentioned in 1.3.

4.1 Structural constraints

4.1.1 Land tenure

In Costa Rica 61% of the land area in farms is concentrated in 6% of the largest farms, while 44% of the smallest farms contain only 2% of the land. In general, the large holdings occupy the best agricultural lands. The consolidation of large holdings has been closely linked with extensive cattle ranching. Ranching is notoriously low in employment generation. It is estimated that this practice annually requires the equivalent of 6 workdays per hectare, compared to 37 for beans, 60 for rice and 130 for coffee. Consequently, with large holdings on the best land but giving employment to few people, many small farmers are forced to grow crops on steep slopes and areas ecologically not suited for such land use.

Land speculation frequently has detrimental effects because it results in clearing of forests to demonstrate ownership, but subsequently the land is not used to its maximum capacity nor protected from degradation because the owner has no long-term interest in farming or forestry.

4.1.2 Population growth and distribution

In spite of a sharp drop in population growth rate in the 1970's, since then the rate has remained almost constant at the alarmingly high level of 2.7% per year. Greater population density implies more pressure on all natural resources. One of the traditional escape valves for the growing rural population which cannot find employment, has been the settlement of new lands, usually forested. With the closing of the agricultural frontier in recent years, the public lands, most of which are parks and reserves, are under increasing pressure of invasion.

4.2 Policy constraints

4.2.1 Economic crisis

The economic crisis which began around 1980 continues to have detrimental effects on the management of natural resources. One of the reasons is the budgetary cuts suffered by the public natural resource agencies which have hampered their capacity for field activities even more. The conservation impetus of the 1970's when many of the national parks were created, slowed down considerably when the crisis hit. The fundamental problem is that at a time of crisis, short-term production goals displace long-term goals such as environmental quality and sustained management of resources. Only gradually are decision makers beginning to realize that even in the short run, correct management of natural resources can bring significant economic benefits (i.e. nature tourism, forest management).

4.2.2 Legal framework

Laws affecting natural resources are extremely diffuse and often contradictory. About 1500 laws deal with the subject of the natural environment. A "Codigo Ambiental" has been proposed to unify legislation. Perhaps the legislation with the greatest impact on natural resources and land use is that which stipulates that public domain can be acquired as private property by simply clearing the forest. This has been one of the most serious incentives to forest destruction with disastrous consequences. Fortunately, the new forest law passed in 1986 diminishes the force of this legislation (Lepiz 1987). However, the main problem is probably not quality of the legislation, but rather enforcement. Because actions affecting natural resources are geographically diffuse and often occur in remote areas, enforcement of this legislation is an unusually difficult problem.

4.3 Operating constraints

4.3.1 Low efficiency of public sector institutions

As a rule, the government agencies dealing with natural resources are notoriously inefficient. The litany of deficiencies is universally familiar. Much of the inefficiency is caused by the obsolete, rigid structures of the agencies, especially those mechanisms dealing with the disbursement and control of funds. Low salaries force many of the most qualified individuals to find jobs elsewhere. This is probably one reason that most of the natural resource agencies are dominated by very young, inexperienced staff. Another reason is that the expansion of these agencies has been relatively recent. The allocation of more than 90% of the budget to personnel means that funds are inadequate to cover operating costs. The result is staff stuck in the office unable to carry out the needed field work. Work attitudes suffer under such conditions.

The low effectiveness of enforcement of regulations affecting natural resources is especially alarming. Not only are inspectors and guards often unable to find the transportation needed to patrol the immense areas for which they are responsible, but also political pressure and corruption make enforcement even more difficult.

4.3.2 Inadequate coordination between organizations

Not infrequently agencies work at cross purposes. A well known conflict is that between IDA which distributes land for clearing and settlement often without adequate consideration of land use capability, and the DGF which is trying to assure that land not suited for agriculture be kept under forest. Another conflict faced by the natural resource agencies has been with the banks which give credit for development of agriculture and ranching without taking into account whether the land is capable of such uses. The diffusion of responsibilities for watershed management has already been mentioned.

4.3.3 Information and qualified personnel

Although the techniques required to improve management of natural resources are generally well tried in Costa Rica, for some work such as secondary forest management the technological underpinnings are weak. Costa Rica has more than 200 university graduate foresters and many cannot find work in their profession, but qualified personnel in some specialties are scarce, others are poorly utilized.

5. A FRAMEWORK FOR USAID INTERVENTION

5.1 Global AID policy on natural resources

AID's concern for the linkage between conservation and development is reflected in several policy and strategy documents. These include: Policy Determination 74, A.I.D. Forestry Programs and Policies, April 15, 1981; Policy Determination 6, Environmental and Natural Resource Aspects of Development Assistance, April 26, 1983; Agency Environmental Sector Strategy Paper, December 18, 1982; and the recent LAC Regional Action Plan. In each case an emphasis is placed on institution building, training, policy reform and the transfer of information and technologies for improved natural resources management. The present strategy was designed to closely conform to this policy and strategy guidance, and to serve as a basis for USAID/CR's action plan taking into account the conservation of tropical forests and biological diversity (see STATE 037076 and 118324).

The various components of this strategy support the more recent AID Policy and Program Guidance on Humid Tropical Forests (see: 84 STATE 328482 and AID Action Plan on Conserving Biological Diversity; Action Plan and International Environmental Protection Act of 1983, PL98-164 which adds Sec. 119 to the Foreign Assistance Act). Sec.119 of the FAA specifically directs AID, in consultation with the heads of other U.S. Government agencies, to develop a U.S. strategy including specific policies and programs, to protect and conserve biological diversity in developing countries.

In a wider framework, the global concern about tropical forests is reflected in the Tropical Forest Action Plan being developed by the World Bank, FAO and the World Resources Institute, and also in the Bellagio Strategy Meeting on Tropical Forests (July 1987) attended by national leaders, including Costa Rican Vice President Jorge M. Dengo, and donor agencies. Results of this meeting have been endorsed by AID Senior Assistant Administrator, Nyle C. Brady (see Annex 4).

5.2 Current and previous USAID involvement

The only major recent involvement by USAID in natural resources is the Natural Resource Conservation Project (515-T-032)(CORENA). It included components in watershed planning for the Rio Puriscal, a pilot watershed in the Rio Nosara, reforestation and range management on the Nicoya Peninsula, management of the natural forests of Sarapiquí and environmental education in the Braulio Carillo National Park. Although it did leave several concrete achievements, the project terminated in 1985 without reaching all of its objectives. No doubt defective design, diverse implementation sites, problems of internal management and start-up during the worst part of the economic crisis were some of the reasons for its poor performance.

The Mission has two local currency funded projects of modest size administered through PL480, Title I. These include upgrading of infrastructure in the Caño Negro Wildlife Refuge in northern Alajuela Province and preservation of mangroves in Garabito Park at Esparza.

Based on experience in land settlement projects, the Mission has now fixed certain criteria for land purchase which take into account the potential deforestation which settlement encourages. Road construction has accelerated deforestation in newly settled areas. In the Northern Zone Infrastructure Project (515-T-041), deforestation has accompanied improved access to the area. The Mission will conduct a complete environmental assessment as part of the design of the Northern Zone Consolidation Project (515-T-0235).

In a joint effort with the Fundación Neotrópica, the Conservation Foundation is beginning work in the buffer zone around the Corcovado National Park. The purpose is to manage the forests and intensify agriculture in the vicinity of the park (see 8.1.1 for details). This modest effort uses central funds designated for biodiversity, matched by a grant from the Conservation Foundation and supplemented by local currency from the Mission.

Central funding also gives support to the World Wildlife Fund for biodiversity studies in Talamanca and to the Organization for Tropical Studies for environmental education. Additional central funds are being considered for the Conservation Foundation to promote agroforestry in Nicoya and Carillo, for expansion of the World Wildlife project in Talamanca and for biodiversity studies in the Santa Rosa National Park.

6. A PROPOSED USAID STRATEGY FOR NATURAL RESOURCE MANAGEMENT

From the above coverage of the problems confronting the soil, water, biologic and energy resources of Costa Rica, it becomes clear that the common threat to all of these resources is improper land use. Spontaneous, often chaotic exploitation of resources has resulted in numerous unstable land use systems which threaten to degrade further the resource base upon which development depends. The encouragement of sustainable land use patterns is a vast, long-term undertaking. Without its successful resolution the very stability of Costa Rica's economy and society will be in jeopardy. If Costa Rica is to continue as a model of democratic, equitable development in Central America it must resolve its major land abuse problems. Costa Rica could become a model of sustainable, environmentally sound land use, enhancing its role as a model in other areas: democracy, public health, education, civic mindedness and peace. USAID can assist the country in achieving this goal.

Which are the specific areas where USAID support could have the most impact? Many of the land abuse problems identified have their origin in the indiscriminate clearing of forests (problems of hydropower, water supply, flooding, loss of wildlife and wildlands, wood supply, erosion, etc.). Consequently the proper management of the forest cover is one of the actions requiring the highest priority. Because a large proportion of the remaining forest is found in the national parks, management must involve both these reserved lands which are being threatened, as well as the lands with forestry potential that surround them but which are being exploited beyond their capacity. Management of the latter must harmoniously integrate with agricultural practices in these buffer zones. USAID/Costa Rica should embark on a strategy of assisting both the management of commercial forest as well as wildlands. The time is appropriate for action because of increasing public concern about the consequences of deforestation. The new forest law of 1986 and the forest emergency decree of September 1987 are concrete illustrations of this concern. The decree places serious restrictions on logging and land clearing, but at the same time gives incentives for industries to assure their own sustainable wood supplies through plantations and natural forest management. Costa Rica needs to act urgently in order not to lose its productive and protective forest cover and the rich biological resources contained therein.

A second, related broad area of suggested USAID support is in the improvement of land use in the country's major watersheds. Inadequate quality, quantity and timing of water will increasingly constrain development. Priority needs to be given to those upper watersheds that have important downstream impacts on development, such as those that supply urban areas, hydroelectric installations and irrigation schemes. In these

watersheds land use must be such that on-site and downstream benefits be increased and kept in balance. The destruction of the forest cover, grazing and farming of excessively steep slopes, and inadequate soil conservation are the causes of many of Costa Rica's most serious watershed problems.

The following section outlines specific promising options for USAID support within the broad areas of natural forest and watershed management. These options might be considered the appropriate "building blocks" of a USAID program. In Section 8 some of these "blocks" have been selected and combined into the framework of a USAID plan of action for various levels of funding available.

7. OPTIONS FOR SUPPORT BY USAID

7.1. Management of natural commercial forests

7.1.1 Rationale

As discussed in 3.2 above, the commercial forests which are the main sources of wood for the economy will be approaching depletion around 1995 if present trends continue. Thereafter Costa Rica will have to import increasing amounts of wood and its substitutes, burdening itself with a possibly unsustainable cost which could cancel out many of the gains in exports achieved with USAID help. Even if forest plantations were to be established at an adequate rate immediately (which is impossible), the time it takes for these trees to reach a size sufficient for them to produce lumber would still leave a 10 to 20 year gap without an adequate domestic lumber supply. To narrow this gap, it is imperative to stretch out the existing natural forest resource through improved forest management as well as more efficient utilization in the woods and the sawmills.

Improved management is needed both for the relatively small area of commercial primary forest that is left, as well as for the large areas of degraded and secondary forests. Financially the primary forest with its standing capital in the form of commercial timber ready for harvest is the most attractive. The degraded and secondary forests will require modest investments to improve growing conditions for the immature trees with commercial potential.

In contrast, the alternative of forest plantations require investments up to US\$1000 per hectare, with the first benefits not accruing until about 10 years after establishment. The limited availability of capital for these purposes is a major constraint. Initial investments to achieve sustained productivity of the natural forest are much lower than for plantations, although yields of useable wood also tend to be lower in the natural forest.

Forest management will respond to AID guidelines on tropical deforestation and the preservation of bio-diversity. Proper utilization will help sustain the most efficient segment of the private sector forest industry and alleviate future balance of payments problems which will occur when wood is imported.

7.1.2 Objectives of USAID assistance

-- Support the management of natural commercial primary and secondary forest in Costa Rica, for the sustained production of timber and other forest products.

-- Encourage progressive wood using industries to assure their own sustained wood supply through management of the natural forest.

7.1.3 Proposed actions

Three or four sizeable remaining blocks of natural forests with commercial potential, totalling at least 100,000 ha, need to be delineated on the map and in the field (Osa, Northern Zone, Northeast Atlantic, Sarapiquí). It is suspected that little primary forest remains and that a large proportion will be degraded and secondary forest, most in private ownership. Delineation will be facilitated once the vegetation type map is completed as part of the current national forest inventory (Jan/Feb 1988). Several of these areas will coincide with the buffer zones around the national parks, discussed in 8.1. Inside these commercial forest boundaries all clearing of forest for non-forestry uses should then be prohibited by the DGF and enforced. Forestry personnel from lower priority regions of the country will be transferred to these forests and control intensified. The legal and institutional framework for control and management exists. The infrastructure for inspection and control of logging and management need to be constructed, and staff deployed. Guidelines for logging and management need to be developed. Logging permits should be allocated in an orderly fashion upon presentation of a realistic management plan, and should require compliance with the guidelines, so as to assure the sustained productivity of the forest. Standing timber needs to be inventoried before sale to assure fair pricing and the collection of revenues. In the secondary and degraded forests, owners will be encouraged to carry out timber stand improvement practices. Demonstrations, permanent measurement plots and applied research will be needed to refine techniques and to convince land owners. Extension is important to enlist interest of the forest owners. As experience is gained, similar techniques can be expanded to other commercial native forests. The low level of expertise in natural forest management will be a constraint, so that training in this field will have to be intensified, probably utilizing facilities of CATIE, ITCR, UNA, OTS and EARTH.

The most progressive wood using industries need to be encouraged to improve their efficiency and to integrate vertically, that is to assure themselves of a sustained wood supply through direct acquisition of forest properties and the formation of joint ventures or other types of associations with forest owners. It is to be expected that progressive secondary industries (furniture, doors and other specialty products for exports) which have large investments will be the most receptive. Many of these will need long-term credit in order to purchase forest properties. Financial instruments need to be developed to encourage this type of long-term investment. (BANCOOP is moving into the forestry sector and trying to develop new financial mechanisms). Diverse incentives are foreseen in the new forest law for the purpose of making industry responsible for its wood supply. Through skillful application of these incentives, technical

assistance to industries and AID financial resources for credit, those industries demonstrating concern for their long-term wood supply will be rewarded. One possible mechanism, for example, might be to allocate long-term logging permits on a preferential basis for those forest tracts covered by forest owner/industry joint ventures or other agreements for sustained management. Incentives could be combined with coercive measures such as charging a high tax on logs processed by sawmills that have not demonstrated an assured wood supply. The newly approved IDB loan for forestry (see 7.3) includes substantial financial support to forest industries for improving utilization and would be a major complement to the efforts described here. The emergency decree is a reflection of increasing political will to take more drastic measures and to couple them with incentives.

7.1.4 Potential gains

If this effort is successful, within five to ten years Costa Rica will have three or four sizeable blocks of natural commercial forest under sustained yield management by numerous private owners. These will be the main providers of quality hardwoods needed for furniture, interior construction and other high value products, many of them for export. Up to 20 progressive forest industries will have acquired forest properties or formed some kind of association with owners so as to assure the sustained supply of wood to their industries. Most of today's primary forest in these blocks will have been harvested, but in such a way as to encourage the regeneration of commercial species. Conversion of forest to non-forest uses inside these blocks will have ceased, and forest harvesting will be done according to simple management plans adequately controlled. It is likely that by that time all commercial primary forests outside these blocks will have been destroyed or severely degraded, making these remaining managed forests increasingly valuable as a sole source of quality tropical hardwoods which will command premium prices. Gradually in various parts of Costa Rica, forest owners and industry, encouraged by rising wood prices, will start to manage the small remaining patches of secondary forests using the experience gained inside these blocks. The pressure of encroachment on the national parks adjoining these commercial forest areas will have been reduced.

7.1.5 Issues

-- By the time AID would get involved, would there be enough primary commercial forest left to make it worthwhile? The DGF forest inventory in progress should give some answers by end December 1987.

-- Is it politically and administratively possible to control forest destruction, given Costa Rican realities, i.e. pressure from vested interests, institutional capacity, GOCR budget priorities?

-- How to link forest management to wood using industries through incentive programs? What other mechanisms besides those mentioned could be used? How can the forest owner be guaranteed a fair price for his standing timber? Which AID financial resources already exist which are accessible to forest industry? Can and should USAID credits be made available for purchase of forest to supply industry, considering that this might be the most realistic solution?

-- Increasing recovery from the forest and the log in the mill is one of the keys to extending wood supply. To what extent should maximization of utilization, especially species and sizes not currently used be included in eventual USAID assistance?

-- The development of appropriate practices and markets will be a major challenge, given the isolation of some of these areas.

-- Why should USAID get involved in natural forest management again after the Project 032 experience? What has changed since then, what has been learned? New Ministry, new forest law, forest emergency decree, relative economic stability, more accumulated experience by foresters. A decision to proceed would be encouraged by a strong reaction of the DGF to implement the natural forest components of the new forest law and the forest emergency decree.

-- What are the political implications of working along the Nicaraguan border (La Cureña and the Barro Colorado areas where land clearing is progressing rapidly)?

-- How can the forest management be tied to the Zona Norte Project? Road construction has probably accelerated deforestation, so support of forestry in this region is a logical sequence.

-- How can natural forests outside these three blocks gradually be included in management?

-- Will AID environmental regulations hamper attempts to manage the primary tropical forest? Although well intended, some of the regulations require so many safeguards that AID support for the harvesting of trees, which is a necessary part of commercial forest management, could become bogged down in the bureaucratic approval process.

7.2 Management of wildlands

7.2.1 Rationale

Many of the rivers which supply water for cities, hydropower and irrigation have their origin in the wildlands. The wildlands are responsible for attracting an increasing number of foreign tourists, who have helped make tourism into the second or third industry in terms of foreign exchange. Evidence is accumulating that nature tourism is responsible for a large fraction of tourist expenditures (Laarman and Durst 1987, Laarman and Perdue 1987), although nation wide estimates are not available. The wildlands are the habitat of one of the most diverse floras and faunas on the globe. Most of the wildlands do not have the capability to sustain other uses, yet they are under increasing pressure of encroachment and degradation. Their destruction would have catastrophic consequences for the development of Costa Rica, a fact increasingly understood at the policy level. Although legal establishment of the wildlands has been an admirable achievement, much remains to be done during the next few years to assure that these critical areas remain intact and are properly managed. Some of the most urgent needs are to "lock up" small areas of additional critical lands through purchase so as to form cohesive, more easily managed and ecologically viable units. Even though current capability might not be adequate to manage additional lands, if they are not acquired soon it will be too late because they are threatened with degradation and rising prices. Other needs are to develop infrastructures for management, such as roads; guard stations and visitors centers; to assure sufficient personnel for patrol and management; and to encourage use of the parks for educational purposes.

7.2.2 Objective of USAID assistance

Help consolidate and manage Costa Rica's wildland system, through institutional strengthening of private conservation groups and GOCR policy reform.

7.2.3 Proposed actions

USAID could assist the Fundación de Parques and other private groups with the acquisition of land to consolidate the national park system. Innovative financing arrangements need to be explored for this purpose, such as the use of matching grants from U.S. private conservation groups, land swaps through IDA, the "purchase" of part of the national debt and use of these funds for conservation purposes (see Annex 3 for examples and mechanism).

USAID could also help accelerate the process of privatization of many of the wildland management activities and the related administrative reforms of the SPN (see 3.3.3). Examples of activities that are needed and which could be

contracted to private entities are the elaboration of practical management plans for some of the parks and subsequently some of the roads, trails, guard stations and other infrastructure needed to implement these plans. Some of the environmental education, staff training, patrolling and habitat management might also be contracted. There is increasing interest among local, private groups (Asociaciones de Desarrollo, municipalities) in conserving the parks and other wildlands. Their involvement needs to be systematically encouraged and part of the burden of managing the wildlands can gradually be transferred to them, since they are often the most direct beneficiaries. (However, law enforcement must continue to be a national responsibility.) USAID could finance a program so that young Costa Rican volunteers could do conservation work in the national parks, an arrangement that has already been tried on a modest scale (See Annex 3). The educational and international touristic value of the parks could be enhanced if appropriate guidebooks, audio-visuals, signs, nature trails, visitors centers and other educational facilities could be made available.

In order to help solve the chronic problem of inadequate funds to cover continuing operational costs of managing the wildlands, an endowment could be established for this purpose (similar to arrangements made for the oil palm cooperative project). Beneficiary of the endowment might be the Fundación Neotrópica or another private entity, which could contract out certain management activities. In addition, mechanisms need to be developed so that the costs of conservation are covered by those who benefit directly. Such mechanisms might include users fees for visitors, a tourism tax and the diversion of part of the consumer fees for water and electricity to conservation purposes. Increased use of private concessions to provide certain services such as food, lodging, guides, transportation might generate income for management and encourage greater use (and consequently support) of those wildlands judged to be ready for it. These financial arrangements need to be linked to the general reforms of the national wildlands system currently being contemplated.

7.2.4 Potential gains

If successfully implemented, within about five years the above activities will result in a national wildland system with clearly defined boundaries, protected against encroachment, with adequate and continuous income to cover the operational costs. The wildlands will be managed for multiple benefits such as water, wildlife, recreation and scientific purposes, thereby increasing their value to the country and their probability of being maintained intact in the future.

7.2.5 Issues

-- How could the economic value of wildlands be estimated without an expensive study? Are any previous attempts or data available in Costa Rica? An estimate of the foreign currency brought in by tourism attributed to these wildlands would be a partial approach.

-- Could a matching grant mechanism with US private conservation groups be used to create an endowment to cover the continuing operational costs of managing wildlands? If so, the matching grants should have low minimal amounts so as to open it to a larger number of small organizations.

7.3 Reforestation and reduction of waste in forest industry

7.3.1 Rationale

Even with proper management the existing natural forests are inadequate to meet Costa Rica's future wood needs. Commercial scale reforestation is urgently needed. For several years the DGF has been preparing a major forestry project for IDB financing (Costa Rica. Dirección General Forestal 1985). Project design and negotiation have been an exceedingly long, arduous process. During its first phase, one of the main objectives of this project as stated in the project document is to provide credit to private land owners to create 10,000 ha of forest plantations. Another component of the project aims to extend the life of the native commercial forests by reducing waste in forest industry. About three fourth of the funds are to be channeled to private reforestation and industry via the banks. Already at an early stage the use of ESF or PL480 funds to provide the GOCR counterpart contribution was discussed with USAID. However, in accordance with official agreements, USAID is not allowed to make a commitment before the project has been approved by the Legislature. In October 1987, the project proposal was approved by the IDB. The next step is for the GOCR to sign the project after which it will be submitted to the Legislature for approval. If USAID and the GOCR were to agree to utilize ESF or PL480 funds to provide all or part of the needed US\$6.6 million in local currency, this would mobilize US\$12.2 million in IDB credits for the project (total \$13.8 million). It is doubtful that the project would ever become operational if USAID decides not to provide the counterpart contribution.

7.3.2 Objectives of USAID assistance

Cause the establishment of 10,000 ha of private reforestation and improve efficiency of forest industry, by providing the counterpart funds to an IDB loan for a major forestry project.

7.3.3 Proposed actions

USAID's intervention would be primarily financial, by designating ESF or PL480 funds to be used by the GOCR as counterpart contribution for the IDB loan. The project would first have to be signed by the GOCR, who would then almost certainly approach USAID for the use of the mutually programmed local currency. However, USAID's manifestation of interest is likely to influence progress of the project within the Legislature.

Because the project has already been approved by IDB, it is almost impossible that USAID will have any influence on the content of the project. The situation will be one of "take it or leave it" (although USAID might

choose to finance only certain components of the project). USAID will want to make its own analysis of the project document, before reaching a decision.

7.3.4 Potential gains

According to the IDB project document, successful implementation would result in almost doubling the area of forest plantations in Costa Rica, it would increase wood recovery at the sawmills by 10% and it would increase the wood utilized from a unit area of natural forest by 38%. Both of the latter effects would help stretch out the natural forest as a wood source. Through relatively modest cofinancing USAID could help mobilize almost three times the amount in external financial resources.

7.3.5 Issues

-- Because the original proposal has been severely scaled down and the numerous modifications that have been made since 1983, by this time the IDB project design might be a patchwork whose coherence might be questionable. Allegedly the original objectives and strategy have been maintained. The quality of the current design needs to be confirmed.

-- The IDB credits were to be used in conjunction with GOCR fiscal incentives (Certificado de Abono Forestal) for commercial scale reforestation. This incentive scheme is an improvement over the current tax credits, but remains a controversial arrangement which has been criticized as giving excessively generous tax breaks to investors. It is debatable whether the economy will really benefit from expenditure of such high amounts per hectare for reforestation. It can be questioned whether more modest, but more easily accessible incentives would not result in a larger area being planted and would force greater efficiency in reforestation.

-- It is doubtful whether the Ministry of the Treasury has the will and the capacity to absorb the sacrifice in fiscal revenues that this expensive incentive scheme would require in order for an adequate area to be planted. This limited capacity is the justification of setting the planting goal at 10,000 ha, although the National Development Plan has a goal equal to double this area. Reduction of the amount of the tax break or creation of a suitable source of credit might be more cost effective solutions. Creation of viable, long-term financing is one of the objectives of the project, and an area where USAID might contribute.

-- Even though because of the above issues USAID might decide against using local currency as a counterpart to reforestation under this project, it might nevertheless be advisable to use local currency to provide the counterpart for some of the other project components, especially for forest industry, a natural complement to the natural forest management described in 7.1 and 8.1.2.

7.4. Management of municipal watersheds

7.4.1. Rationale

An adequate supply of water is a prerequisite to the economic progress of the towns of Costa Rica. Increasingly lack of clean water is limiting the installation and expansion of industry, such as the case of the coffee processing plants above Heredia and some of the dairies north of San José which compete with water for residential areas. Parasite epidemics attributed to contaminated water, such as recent ones in Junta de Abangares, Ciudad Cortes, and San Rafael de Heredia cause suffering and economic setbacks.

ICAA and municipalities supply potable water to 98% of the population in urban areas and 62% in rural areas. Even as new projects are being completed, demand is exceeding supply in several critical areas (Arias and Portilla 1987), a situation which acts as a drag on development. ICAA has in the past ignored protection of water supplies due to the lack of clarity as to which institutions are responsible for watershed protection and pollution control, and because of inadequate financial resources. The municipal watersheds to be dealt with are generally small land units requiring modest amounts of financing to correct specific problems. Inadequate water supply makes a great impression on anyone. For this reason local entities tend to be strongly motivated to undertake management of the watersheds upon which they depend, once they are given the proper guidance and financial resources. Seeing the positive effects of watershed management near home will facilitate intervention in other areas.

7.4.2. Objectives of USAID assistance

-- Mobilize and support the municipalities in managing the watersheds upon which they depend.

7.4.3 Proposed actions

The DGF signed an agreement with IFAM to carry out diagnostic studies of the watersheds for the 47 municipalities which manage their own water supplies. Thirteen of these municipalities have been given priority and management actions have been identified for their watersheds (See Annex 1 Table A1-1; Arias and Portilla 1987). Eventually technical assistance being provided thru the ROCAP funded CATIE Regional Tropical Watershed Management Project could be expanded so that it will lead to the development of management plans for some of these watersheds. Subsequently, USAID funds could support the municipalities in carrying out the required management actions. The watershed management plans should include a detailed financial plan linked to the budgetary process of the municipality, which would be the basis for financing the activities. Although most of the preparation of the watershed management plans should be contracted, the municipalities need

to be actively involved in this process, probably through the municipal engineer, to assure their continued participation in implementation.

Two types of actions are needed: First, are those that can be implemented by the municipalities directly or contracted by them with the help of IFAM, such as the construction of water storage and distribution structures, land purchase, fencing of critical areas, construction of infrastructure for guards, fire control, monitoring of water quality and quantity, etc. USAID funding would be channeled through IFAM, preferably using existing mechanisms through which USAID already supports this organization for other purposes.

Second, are a group of land management activities which farmers should be encouraged to use more widely because they have positive effects on runoff, such as soil conservation practices, use of land according to its capacity, reforestation, gully control, better cropping practices, environmental education and training of municipal employees. However, the municipalities do not have the means to foment these activities, nor should they try to create this capacity. Rather, other government agencies whose mandate covers this type of extension work should be encouraged to concentrate efforts in the selected municipal watersheds, especially MAG through its Centro Agrícolas and the DGF. The newly created Executive Group for Integrated Watershed Management which includes representatives from the major public institutions involved (MIRENEM, MAG, ICAA, SENARA, ICE, SNE and DGF) will facilitate the task of recruiting this kind of assistance. The municipalities and IFAM can exert pressure to obtain such of assistance and, even more important, could use USAID generated local currency to supply the counterpart contributions to the MAG and DGF assistance. Examples of counterpart contributions by the municipalities include vehicles and their operation, office space for technicians, and various equipment and supplies needed for extension. These contributions would help remove some of the obstacles which currently constrain the effectiveness of extensionists.

7.4.4 Potential gains

Successful implementation would result in up to 47 municipalities with adequately managed watersheds, many of these contiguous so that they form large blocks, which would serve as examples for the management of other watersheds. The institutional mechanisms for grass roots action and auto-financing would have evolved so that management would continue without USAID intervention. Many of these watersheds would supply water to housing partly financed by USAID and GOCR. Water quality would be improved, thus reducing the incidence of disease attributed to biological and chemical contamination. Through better water supply, economic activity and the quality of life would be enhanced in the small towns, thus counteracting the emigration to the capital city.

7.4.5 Issues

-- IFAM would need to add watershed specialists to its staff. Does it have the institutional capacity to handle this new effort? Could it contract these services from private sources?

-- Could the ROCAP/CATIE Regional Watershed Management Project be expanded so as to prepare the watershed plans? Could USAID/Costa Rica purchase these services from the project? Or should the plans be contracted to private consultants?

-- What mechanisms could be created so that water users will pay for watershed management costs in the long run? How could part of the tariffs paid by users be channeled to the managing agencies?

7.5 Management of watersheds above large infrastructures

7.5.1 Rationale

Unfortunately, ICE and other public entities which manage infrastructures that depend on water, are not complying with their legal mandate to conserve, and manage the country's watersheds. Unless critical watersheds above both existing and potential hydroelectric projects are protected, the efficiency and even the viability of the hydroprojects will be jeopardized by accelerated siltation of reservoirs (Cachí, Arenal) and other structures will be endangered through flooding.

For example, the current and projected capital investment alone in the Arenal-Tempisque hydropower and irrigation scheme amounts to \$730 million. This entire operation depends on the water supplied by a 413 km² watershed. The sunk cost corresponding to each hectare of the watershed is therefore about \$17,676 -- far above the purchase price of the land. The alternative use of this land for agriculture and the resulting annual stream of benefits, gives this land an economic value of a few hundred dollars per hectare -- far less than the capital investment dependent on it. Future economic activity much greater than this \$730 million investment will depend on the continuous functioning of the infrastructure. Watershed management practices which can protect this economic production are obviously a good investment. As a matter of fact, it is difficult to understand how the country and the financing institutions can be as negligent about watershed management as they are, given the high stakes involved.

ICE, SENARA and the financing institutions have concentrated on structures and their operation. The responsibility for management of the watersheds that supply these multimillion dollar investments is diffuse. Currently, systematic efforts are being made to coordinate (i.e. creation in August 1987 of an executive secretariat under the "Interinstitutional Agreement for Integrated Watershed Management" which was promoted by the CATIE Regional Watershed Management Project) and to link financing for watershed management to financing of the structures. Among international donors, AID is at the forefront in insisting on this linkage. It is expected that with relatively modest funding, USAID can leverage financing from IDB and other donors.

7.5.2 Objectives of USAID assistance

-- Support the management of watersheds that supply large hydroelectric and irrigation schemes.

-- Encourage policy reforms that facilitate watershed management, including improved interinstitutional cooperation and fiscal mechanisms through which the water user pays for management of the watershed.

7.5.3 Proposed actions

In association with wildland management, integrated watershed management will help to protect these infrastructure investments while promoting sustainable and productive land use. Integrated watershed planning and management technologies are well-known and were refined for pilot areas under the USAID Natural Resource Conservation Project (032). Substantial work is being carried out by the CATIE Regional Tropical Watershed Management Project to strengthen watershed management efforts and GOCR institutions. The watershed planning and management approach is effective in integrating a number of natural resource management actions (forestry, agroforestry, soil and water conservation, environmental planning, etc.).

One of the first actions would probably be the elaboration of detailed management plans for the selected watersheds, structured as modules in such a way that parts could be funded by various financial institutions and executed independently. Land use capability mapping would identify land used inappropriately, beyond its capacity, where project interventions would concentrate. It is to be expected that maintenance of forest cover and its expansion would be important activities which would require educating the local communities on environmental concerns and getting them involved, deployment of guards, fencing and eventually land acquisition. Probably extension and credit or other incentives would have to be employed to encourage farmers to change land use from inappropriate annual crops and grazing on steep slopes, to establishment of forest plantations, permanent crops and well managed pastures. Vegetative soil conservation practices would have to be demonstrated and disseminated. It would probably be most appropriate to implement these activities through decentralized local entities such as the respective Centro Agrícola Regional or the Centro Agrícola Cantonal. Another possibility might be to contract some of these services through private companies or NGO's. Strengthening and enforcement of environmental regulations, especially those governing land use and road construction, would be important actions.

Priority watersheds include the Virilla, the Bebedero and Arenal, the upper Reventazón and the Barranca Rivers. Priority sub-watersheds within these major basins are the Arenal reservoir catchment, the Río Chiquito, Río Reventado, Río Purires and Río Tiribí (See Annex 2, Table A1-2). The ROCAP/CATIE Regional Watershed Management Project in coordination with its National Advisory Committee (CAN) is currently developing a bankable watershed management plan for the upper Río Virilla. It is expected that other priority watersheds will receive attention in the future as financial and human resources permit.

Since most of the infrastructure has been partially financed by other donors, their financial cooperation in some cost sharing arrangement might be possible in this regard. Financing could be channeled via the new Executive Group for Integrated Watershed Management which includes representatives from the major public institutions involved. The technical secretariat of this Group would serve in a planning and coordination function. Technical assistance for planning could be provided by the ROCAP/CATIE Regional Watershed Management Project. Policy reforms, management plans and contributions from the national institutions implementing these projects would be established as conditions precedent to the provision of USAID generated local currency.

7.5.4. Potential Gains

Implementation of this alternative would result in management plans for two to four large watersheds mentioned above (see Annex 2) in such a format that they can be submitted to financial institutions for funding. At least one or two of these plans will be in execution through cost sharing arrangements between the multilateral development bank and USAID. The work in the watersheds will be assisting farmers in bringing actual land use in line with land use capability by giving incentives and technical assistance for soil conservation, reforestation, range management, and other practices which favor watershed conditions. Additional benefits would be improved welfare of the rural inhabitants of these watersheds. Policy reforms would lead to a financial mechanism that would support watershed management on a sustainable basis. If this effort is successful, the watersheds above selected infrastructures would be under management assuring the longevity of costly structures.

7.5.5. Issues

-- Would a multi-donor approach to the management of watersheds above major infrastructures be appropriate? Most of these projects have been constructed with funds from IDB, World Bank or CABEI, and they might be interested in protecting their investment through cost-sharing. This issue could be pursued through a series of donor meetings, perhaps starting with exploratory informal discussions which could later be expanded to more formal meetings under the auspices of the Executive Group for Integrated Watershed Management.

-- The approach to be used for watershed management would involve interinstitutional cooperation and the channeling of resources to executing entities (ICAA, ICE, SENARA, municipalities, Centros Agrícolas, contractors, etc.) with technical assistance and planning provided by a specialized institution such a CATIE. Is there the need to strengthen a specific institution for project implementation?.

7.6 Privatization of forest development

7.6.1 Rationale

The Dirección General Forestal (DGF) has frequently been deplored as a weak, ineffective institution incapable of operating large forest development schemes. In this sense it shares many of the well known constraints of other GOCR ministerial dependencies. It has been suggested that a nation-wide private forestry "institute" be created whose objective would be to encourage the development of forestry as an enterprise, including both the growing and the utilization of forests. The functions and structure of this institute would be similar to the successful "Instituto del Cafe", "Liga de la Caña" or similar entities. The Instituto Forestal of Chile might serve as another model. It would be operated as a private entity, except that the GOCR would have representatives on the board of directors. The primary advantage would be avoidance of the chronic bureaucratic, financial and political constraints of the DGF. The development functions of the DGF (such as extension, nursery production, the implementation of the incentive scheme) would be transferred to this institute leaving the DGF with the control functions (such as inspection of harvest operations and sawmills, permits, infractions), a task it could handle with a much reduced staff. Several local "corporaciones forestales" as well as the "Camara Nacional de Empresarios Forestales" illustrate the increasing interest of the private sector in forestry and they would probably support this initiative. The political constellation is very favorable to the creation of such a corporation at this time, all the way up to the highest levels of government.

7.6.2 Objective of USAID assistance

Support creation of a private forestry institute as a vehicle to accelerate the development of forest management, the establishment of plantations and the improved efficiency of forest industry.

7.6.3 Proposed actions

Creation of the forestry institute is a political decision of the GOCR. USAID could encourage this decision by offering support to the fledgling organization. The primary functions of the corporation could be:

- Encourage forest management, tree planting and improvements of industrial efficiency through the diffusion of information and the provision of technical assistance;
- Represent forest owners and forest industry in negotiations with the DGF, financial institutions and other government agencies;
- Serve as a conduit for forestry development incentive schemes;
- Establish guidelines and set quality standards for forest management and industry

- Develop markets for forest products, especially underutilized species and residues;
- License foresters entitled to prepare and administer execution of forest management plans for private owners;
- Implement forest development projects based on sound land use.

The institute would derive its income from taxes on stumpage and forest products, dues paid by its beneficiaries and the existing "Fondo Forestal". This fund has been continued under the new forest law (Ch. 3) and is currently fed primarily by forest fees. It is to be used for projects in forest development either on public or private land.

Creating the institute is not particularly complicated. The challenge, of course, is to assure its income, and effective and socially responsive operation. However, it could start very modestly and, as it demonstrates its capacity, grow gradually by taking over functions now inadequately handled by the DGF. This institute should not be confused with a JAPDEVA or CODESA type of corporation, rather it should be a federation of private individuals and groups concerned about services needed to stimulate forestry development. Government participation would be limited to one or two representatives on the board of directors, the others would be elected by the members of the institute. The board would appoint a professional manager, who would direct a small staff.

USAID could support this new entity financially by providing an initial infusion of funds for start-up of operations, infrastructure and equipment. It could provide technical assistance for planning the corporation and for specific development operations. Once operational, the corporation could become the executing agency for USAID financed projects such as those to encourage forest management (see 7.1) and reforestation (see 7.3).

7.6.4 Potential gains

Within a couple of years a dynamic private entity dedicated to forest development could be functioning in Costa Rica, finally giving the impetus that the sector has lacked and cutting through many of the administrative constraints. Starting modestly with emphasis on management of natural forests and establishment of plantations, the institute could grow in breadth to gradually give support to the more progressive forest industries. Because its own tasks would be more limited, the DGF would probably carry them out more effectively. The GOCCR payroll would be reduced by several hundred employees, many of whom would be absorbed by the new private institute which could be very selective in the individuals it hires.

7.6.5 Issues

-- It could be argued that rather than move forest development functions to the private sector, an effort be made to make the DGF more effective. This approach has been attempted for more than 15 years through numerous assistance efforts of FAO, USAID and other donors. Unfortunately results have not been encouraging. Is a radically different approach appropriate at this time? The implications are complex and need to be evaluated carefully. Certainly a gradual transfer of functions would avoid some of the risks.

-- Who should take the initiative to make such a proposal and what could USAID do to encourage a positive outcome? A first step might be to contract a consultant to work out a detailed proposal as a basis of discussion.

-- How can long-term financing for annual operating expenses be structured?

-- How can balance be maintained between the institute and the DGF? If the latter is restricted only to control functions, there is a danger that it could be cowed by the politically and financially powerful institute.

-- How could the needs of the small producer be adequately represented? What safeguards could be created to avoid dominance of the institute by the large landowners and investors?

7.7 Environmental contamination by pesticides

7.7.1 Rationale

As pointed out in a recent diagnostic study of the consequences of pesticide misuse in Costa Rica (Hilje et al. 1987), environmental and human health impacts are serious and getting worse. A total of 502 acute pesticide intoxications followed by hospitalization were reported in 1983 by that C.C.S.S. with a 10.4% mortality and experts believe that this is only a small percentage of the actual poisonings that occur, as subacute, chronic cases normally go unreported. Outpatient and emergency treatments have not even been measured. The most critical agricultural areas seem to be the banana zones and ornamental plant and flower operations and to a lesser degree coffee production areas. Fruit and vegetable growing seems to be responsible for fewer intoxications, although this may be more a reflection of the types of pesticides used and the occurrence of long-term chronic versus short-term acute intoxications.

Environmental consequences that have been documented include: 1) soil contamination; 2) pesticide residues in foodstuffs leading to the rejection of beef and other agricultural exports; 3) pesticide residues detection in human milk and adipose tissue; 4) ecosystem impacts such as fishkills and the reduction of eggshell thickness or marine bird populations and development of pesticide resistance in nontarget organisms, such as on malaria-transmitting mosquitos. In Costa Rica over 1500 cases of malaria were reported in 1986, thru October; a dramatic increase over previous years where an average of 100-150 cases occurred.

Few ecosystem or human health studies have been performed. The accumulation of pesticides in humans, their occurrence in domestic foodstuffs, and discharge of agrochemical contaminants in rivers, estuaries and near shore coastal environments are all priority topics worthy of attention.

7.7.2 Objectives of USAID assistance

Strengthen GOCR capabilities to provide technical assistance, carry out research and training, and monitor and control the use of pesticides to avoid significant environmental and human health impacts.

7.7.3 Proposed Actions

-- Assist national institutions in the analysis of environmental and human health consequences of pesticide use in Costa Rica. Also study and disseminate information regarding the economic costs and benefits of pesticide use.

-- Provide technical assistance and promote and develop integrated pest management techniques for priority, high pesticide use crops (banana, coffee, rice, and ornamentals, cotton, and vegetables).

-- Strengthen institutional capabilities to deal with the regulation and control of pesticide importation procurement and use.

-- Assist in training and public awareness to avoid the environmental and public health, problems of pesticides. Assist with in-service training of professional in this field.

-- Assist in developing an institutional capability to monitor and control the contamination of foodstuffs.

-- Compare traditional production systems using low levels of pesticides with more "modern" systems, and evaluate the economic and social costs of pesticide use, as a basis for proposing modifications.

7.7.4 Potential gains

Both the short and long-term potential gains of these actions are substantial. From an environmental point of view the productivity of natural ecosystems will be maintained or increased. The stability of agroecosystems will be increased with more rational and reduced use of pesticides. From an economic and social point of view, environmental contamination and resultant human health impacts will be reduced. A more rational use of pesticides will reduce the costs of agricultural productivity and improve opportunities of exports of traditional and non-traditional agricultural products.

7.7.5 Issues

-- Numerous institutions are involved in the regulation, control, technical assistance training and research functions required. What would be the most effective institutional mechanism(s) to accomplish the objectives?. Would an EPA type of agency be appropriate?

-- Environmental analysis and mitigation techniques are an important mechanism to control the impacts of pesticides. Should this be included in an environmental contamination program?.

8. RECOMMENDATIONS FOR USAID ACTIVITIES

Several operational principles have guided the development of a plan of action for USAID:

It is the opinion of the authors that USAID would have the greatest impact by concentrating its support on the integrated management of discrete geographic areas, in which several of the options outlined in Section 7 can be combined. In these relatively small areas, techniques and institutional arrangements can be developed, which can later be expanded to other parts of the country. Work in small, manageable areas has several advantages over diffuse national approaches: it forces concentration of effort so that progress is more visible, it facilitates experimentation and learning, most natural resource problems are site specific, etc. The proper choice of the area is one of the most important decisions and needs to be agreed on by the major entities involved, using objective criteria .

Secondly, preference is given to activities that build on on-going efforts, especially those where USAID is already involved.

Third, activities are chosen for which local or other external funding and interest are available in a large proportion, thus giving a multiplier effect to USAID funds and increasing the chances of continuity.

Finally, activities that require excessively complex institutional arrangements are avoided. Under the principle of "keep it simple", it is proposed to do a few things well, rather than to try to solve all problems through one complex effort.

Some of the options of Section 7 above have been combined as "building blocks" to construct a proposed plan of action described in Section 8 below. Not all options have been utilized, and some were judged to be of higher priority or more feasible. Particular importance for immediate action was attached to the management of natural commercial forests, wildland management and management of municipal watersheds, primarily because of their profound implications and the existence of a good base to build on. It is suggested that primarily these, and secondarily some of the other options be combined in specific geographic areas.

After taking into account the operational principles listed above, the status of the resources, the constraints and the different options for USAID support the priority plan of action recommended is the following:

USAID support of the integration of forestry, agriculture and wildland management in the buffer zones around one or two of the national parks of Costa Rica.

An additional secondary plan is:

USAID support of the management of selected watersheds.

Both plans can be implemented simultaneously if sufficient funding can be made available. There is considerable complementarity between them. To what extent they can be combined organizationally depends on the geographic areas that are selected, a choice which determines whether the buffer zones and watersheds overlap, at least partially. Also the institutions, techniques and beneficiaries are different, a fact which argues against administrative combination. Both approaches are discussed below, for various cost alternatives.

8.1 Integrated natural resource management of the national parks and their buffer zones

The objectives of management of these buffer zones are to:

-- Conserve national parks by helping to stabilize sustainable land use in the buffer zones surrounding them.

-- Raise the living standards of the population in the buffer zones through the introduction of improved agricultural and forestry practices.

-- Create nuclei of appropriate integrated natural resource management which could serve as a model for expanding this type of activity.

The justification for this strategy is the following: The GOCR, with the help of private Costa Rican and U.S. conservation groups has made a good beginning of protecting the wildlands and initiating management of some of them. However, the wildlands are under increasing pressure of encroachment. Much of the threat comes from unplanned, chaotic development of the lands contiguous to the parks. Here valuable forests with commercial potential are cleared for low yielding pastures. With time the parks will stand like islands in a sea of degraded pastures. Such a situation will cause even greater pressure on illicit exploitation of the wildlands for wood and other resources. It will also have negative effects on the biological diversity within and around the parks. Consequently, the lands surrounding the parks, need to be managed as "buffer zones" in order to protect and enhance the parks themselves.

This approach is the concept of the "biosphere reserve" which has evolved over the last two decades with the help of UNESCO's Man and the Biosphere Program (MAB). Any biosphere reserve must address itself to three concerns: It must have one or several core areas to ensure its "conservation role"; it must participate in an international network of biosphere reserves for "research and monitoring" purposes; and it must fulfill a "development role" through local participation, demonstration and education. The relative importance of the three roles will vary from one biosphere reserve to the other, but it is their combined presence which is essential. Schematically the biosphere reserve may be visualized as concentric areas with a protected core (i.e. national park) and increasing intensity of controlled development approaching the periphery (i.e. managed forests, forest plantations, agroforestry, intensive grazing) (Batisse 1986). Part of the Central Cordillera has already been proposed as a biosphere reserve under the MAB Program.

The areas surrounding some of the national parks of Costa Rica offer unusual opportunities for demonstrating the complementarity of conservation and development, and creating models for expansion. The proper management of these buffer areas has the double payoff of increased, sustained productivity of the land itself, as well as the numerous benefits generated by the parks which these zones protect. At this time most of these buffer zones are at an incipient stage of development, not yet excessively degraded, so that the encouragement of proper land use would require only modest investments. Because they are areas of spontaneous colonization, if nothing were done, within a few years these lands will have been degraded through improper use. During the last two decades, national and international support has been mobilized for the wildlands of Costa Rica. This growing interest will facilitate management of the buffer zones by creating a favorable policy climate and making private resources available to compliment USAID financing.

For the solution of land use problems involving farmers, it has often been demonstrated that an integrated approach combining agriculture, forestry and certain support activities in a concentrated geographic area is more effective than a strategy dedicated exclusively to one or the other. Costa Rica has had some encouraging experience in this respect, some of it supported through USAID projects (Rio Parrita, Nosara).

Implementation of these activities would be consistent with AID guidelines on environmental management and tropical forests (see 5.1). It would fulfill USAID obligations with respect to biological diversity as dictated in the Foreign Assistance Act of 1986.

The new AID financed work of the Conservation Foundation/Fundación Neotrópica around the Corcovado Park (Donovan 1967) is a base upon which to build additional activities according to the strategy recommended here. These funds are made available only on a yearly basis. Depending on the progress of this pilot effort, more substantial long-term USAID funding could be allocated to the management of the buffer zone around the Corcovado Park and other parks as well.

Although specific geographic areas are mentioned in this proposal, some of them should only be considered indicative and the best choices with the information currently available. Objective selection of the working area is a very important decision which will require additional study during the design phase.

8.1.1 Minimum cost alternative

Description of activities: USAID supported planning and demonstration activities are about to begin in the buffer zone of the Corcovado Park. However, funding is assured only for one year. As a minimum, USAID could continue to finance this operation gradually increasing the yearly budget.

The mix of activities is currently being designed by the Conservation Foundation/Fundación Neotrópica team (Donovan 1987). Through rapid appraisal techniques and meetings the local population will participate in the design. In general terms, three groups of management practices can be foreseen:

- Management and utilization of commercial forests with various restrictions according to local conditions (described in 7.1).
- Stabilization and intensification of agriculture, with emphasis on tree crops, agroforestry and soil conservation.
- Complete protection of critical forest areas in the buffer zone, for habitat conservation, wildlife and watershed cover.

Through technical and financial support at the community level, farmers would be encouraged to implement these improved practices. This will probably take the form of agricultural and forestry extension, demonstration plots, pilot forest harvesting and processing operations, establishment of nurseries for tree crops (cacao, fruit trees) and other activities which respond to the needs of the local people and serve to foment appropriate land use.

Because the nature of forest harvesting and processing requires considerable investment and has large economies of scale, it would be advantageous to organize farmers in the working area into a forest cooperative or other type of association. USAID could assist this cooperative in getting started and making it self sufficient, by contributing credit and technical assistance as described above. An example of this approach was started on an ITCO cooperative in Coto Sur (La Vaca) in the late 1970's (Rodriguez 1977). Organizationally, technically and financially it worked. The cooperative was formed with ITCO support. It was made up of several hundred members, each with about 20 ha of forest. The cooperative bought and operated a sawmill, logging tractors and trucks for four years. Administrative and management weaknesses within the cooperative finally caused the operation to fail when ITCO withdrew its support prematurely. (It is an ironic illustration of mismanagement of forests in Costa Rica, that although the cooperative originally had over 8000 ha of virgin forest, now only 10 years later many of the members have to walk several kilometers just to obtain firewood.)^{1/}

^{1/} Personal communication Jorge Rodriguez Q., Oficial Mayor, Ministry of Natural Resources, Energy and Mines.

Implementation arrangements: Organization and operation of this alternative would simply be a continuation, for a period of five to ten years, of the Conservation Foundation/Fundación Neotrópica BOSCOA Project currently being initiated with USAID financing. These contractors will make special efforts to involve other private and public entities and to obtain funding for increasing the size of this pilot effort. The fact that IDA owns a large area of land in the buffer zone might facilitate operations.

Potential gains: Through stabilization of rational land use around the Corcovado Park, the chances of protecting the park from encroachment would be increased. New schemes would be developed whereby the local population can make a living from the natural forest, models which will have application elsewhere. The new settlers would be organized in cooperatives and their welfare improved through agricultural and forestry practices appropriate to the site. At least part of the Golfo Dulce Forest Reserve will be under management providing Costa Rica with lumber which it might otherwise have to import.

Cost: For the first year of operations the funding level is the following: AID/W funds for bio-diversity \$75,000; Conservation Foundation matching grant \$75,000; USAID ESF generated Colones 60 million; plus an undetermined amount of Costa Rican in-kind collaboration. A minimum effort would require continuation of this level of assistance for at least five additional years, perhaps as beneficiary of a trust of some kind or as part of a development project.

8.1.2 Medium cost alternative

Description of activities: With respect to management of buffer zones, on 4 November 1987, a committee made up of representatives from MIRENEM, DGF, SNP and the Sub-Directorate of Wildlife analyzed and selected the areas around the three national parks of the Central Volcanic Cordillera and around the Corcovado National Parks as the two zones of highest priority, and those around La Amistad and Tortuguero Parks as second priority. For a more ambitious program, in addition to the experience being acquired at Corcovado, USAID could finance the management of the priority buffer zone around the Poas, Braulio Carillo and Irazú National Parks of the Central Cordillera. In addition, management of these parks themselves could be included as described in 7.2.

Although the general approach would be similar, the work in the Central Cordillera could advance more rapidly than that around Corcovado because with respect to natural resources the former is one of the best know areas in Central America and its development is much further advanced. Some experience was obtained here through the Mission's Natural Resource Conservation Project (515-T-032). The Central Cordillera-Sarapiquí area presents unusual opportunities for

management because of its new good road link to San José, the existing interest of community groups in conservation, the sources of community water supplies, the existing forest industries, the Horquetas gasifier, the new possibility of selling wood residues to the cement plant in Cartago for fuel, the prospects for environmental education and scientific tourism, the presence of government institutions, and other favorable factors.

In order to foment forest management of the buffer zones, USAID could support the types of activities described for Corcovado (see 8.1.1) but on a more ambitious scale. In addition, USAID financial resources could be used as incentives for the formation of joint ventures between forest industries and forest owners as indicated in 7.1.3., for the purpose of assuring a sustained wood supply to industry. Also funds could be made available to create and start up a Forestry Institute as described in 7.6.

Activities could include support to management of the parks themselves. First, the management plans for these three parks would require updating and revision. USAID could then finance some of the infrastructure and activities foreseen in the plans, such as guard stations, training for staff, visitors centers and facilities for environmental education. To patrol the wildlands more effectively communication equipment, motorcycles and vehicles are needed. Continuing operational costs could be covered through creation of an endowment for this purpose, using USAID funds to leverage private matching grants. Most of these actions should be contracted to private entities in accordance with current tendencies described in 3.3.3. USAID could also encourage the reforms being initiated by the Ministry of Natural Resources Energy and Mines to decentralize wildland management and turn more functions over to the private sector.

Implementation arrangements: The principal host country government agency responsible for implementation could be the Ministry of Natural Resources, Energy and Mines, recently created through restructuring of other ministries. Two units within this ministry will play important roles : the Directorate General of Forests (DGF) and the National Park Service (SPN). The former will be responsible for intensification of forest protection, the allocation of utilization permits, the approval of management plans, the administration of incentives foreseen by the new forest law and general control functions. The SPN, by law, has final responsibility for management of all of the country's national parks. The SPN will directly carry out the planning of park management and protection of the parks.

One of the fundamental operating principles should be to carry out as much of the work as possible through private institutions and local government entities. Continued support for private sector participation both in forestry and

wildlands is viewed as an important need by many observers, who believe that the national public institutions should concentrate their scarce resources on the regulation and protection side of resource management. Special efforts should be made to involve the private and local institutions from the beginning and to be responsive to their needs. For forestry and agroforestry the most promising institutions are probably the "corporaciones forestales" that are already operating in the project area. These are associations of forest and sawmill owners whose main activities until now have been in reforestation. Because of their concern with potable water supply much support can be expected from the county and municipal governments. Some of the "centros agrícolas cantonales" have been unusually successful in bringing about land use changes in other parts of the country (with AID support in Hojanca and Turrialba).

The National Parks and the Neotrópica Foundations have been very active and effective in support of conservation, mostly with the use of private funding. Because the two foundations provide a sizeable proportion of the budget of the SPN, privatization has already made considerable progress in recent years. The matching grant mechanism and ties with U.S. NGO's should be amplified, taking advantage of their experience in conservation (see Hoose 1981 for description of different approaches to land protection).

Gradually, the "Instituto Forestal" that would be created could take over more of the responsibility for fomenting forest management. There are indications that financing for management of commercial forests would be forthcoming from private banks. BANCOOP, for example, is currently exploring investment possibilities in forestry and has a forester on its staff. With the development of appropriate financial incentives (i.e. credit adapted to the long-term nature of forestry), USAID might be able to encourage this tendency.

One of the most promising financing arrangements, which combines support of both forest development with wildland management, is the following: USAID could donate a substantial sum to a private Costa Rican conservation entity such as the Fundación Neotrópica, on the condition that this donation would be used to create a trust fund to be used for forest development. This donation could be used to leverage additional gifts from private U.S. conservation groups on a matching grant basis. The funds from the trust could be loaned to a forest cooperative, to be created in the Central Cordillera buffer zone, for example. The cooperative would use the loan to initiate forest harvesting, management and processing. Possible uses would be for road construction, purchase of oxen and trucks for log transport, purchase of portable sawmills or working capital. The interest from the trust fund could flow to the Fundación Neotrópica (or other

entity, eventually even the Instituto Forestal) to be used to cover part of the annual operating expenses of some of the wildland units, thus permanently alleviating the chronic problem of inadequate funds for protection and management. This scheme is similar to the arrangements through which USAID supported the oil palm cooperative.

By including an additional arrangement for "swap" of Costa Rica's foreign debt, the above matching grants of the private U.S. conservation groups could be leveraged to more than double their original amounts (see Annex 3). A recent precedent is the donation of \$100,000 by the World Wildlife Fund which was increased to \$216,000 worth of local currency through this kind of debt swap arrangement with the Central Bank. In this case, the local currency is designated to be used for the purchase of 15,188 ha of forest land for the proposed Guanacaste National Park. The Ministry of Natural Resources, Energy and Mines has created a "conservation trust fund" managed by BANCOOP to encourage donations using this scheme. In summary, through a combination of matching grant and debt swap, each colon USAID deposits into the trust fund could leverage as much as three colones to be used for forest development, with interests going to wildland management.

Potential gains:

The same gains described in 8.1.1 would be achieved over a wider geographic area. If the Central Cordillera Biosphere Reserve is chosen, the impact on environmental education and water supplies would be considerable. The protection and management of the three parks would be intensified and a financial mechanism would be in place to assure a continuous income to cover their annual operating costs. In addition, one or more self sustaining forest cooperatives will be using environmentally sound practices for deriving a sustainable income from the forest. A private Forestry Institute would be fomenting forest plantations and management, having taken over many of the functions and some of the personnel of the DGF. The most progressive wood industries would have made arrangements to assure their own wood supplies.

Cost: Table 8.1-1 presents a break down of estimated cost of this this alternative. To have a significant impact a commitment of at least seven years should be considered.

Table 8.1-1 Indicative budget for medium-cost alternative of park and buffer zone management. Assumes 7 year effort.

	Foreign Exchange US\$000	Local currency US\$000	Total US\$000
Forest management			
Continuation of BOSCOA Project on-Dsa "	1400	700	2100
Trust fund for forest mgt. & park operation		10000	10000
Research & demo on regeneration & mgt.	500	200	700
Training short-term	300	300	600
Training long-term	100		100
Technical assistance	200		200
Vehicles for extension	180		180
Support to "Forestry Institute"	300	300	600
National park management			
Revision of management plans		200	200
Park infrastructure		2000	2000
Communications equipment	200		200
Environmental education		500	500
Technical assistance	140		140
Agroforestry and farm forestry			
Extension agents		200	200
Vehicles for extension	120		120
Vehicle O & M		168	168
Extension materials		200	200
Nursery materials		500	500
Technical assistance	140		140
Training short-term	150	150	300
Long-term advisor	360		360
SUBTOTAL	4170	15498	19668
Inflation (15%)	626	2325	2950
TOTAL	4796	15348	20144

8.1.3 High cost alternative

Description of activities: For a more ambitious effort, in addition to the minimum (8.1.1) and medium (8.1.2) alternative USAID could finance increases in the intensity and the range of activities carried out in the two working areas (Corcovado and the Central Cordillera). It is felt that this intensification of activities and addition of new activities is preferable to expanding to a third working area, primarily for logistic and organizational reasons. A promising new area of emphasis could be the modernization of selected forest industries near the two working areas so as to increase the recovery of useable wood from the forest and from the log so as to stretch out the forest resource. Support to industry would require primarily credit and technical assistance. A second new area of emphasis might be the financial support to commercial scale reforestation in the buffer zone of the Cordillera Central. However, any support to commercial scale reforestation should be contingent upon a successful resolution of the many issues listed in 7.3.5. A third area of intensification could simply be an increased level of funding for consolidation and management of the national parks through the private sector as described under the medium cost alternative (8.1.2), especially an increased level for the endowment.

Implementation arrangements: Both modernization of industry and reforestation are the main objectives of the IDB forestry development project described in 7.3, so that the release of ESF local currency as all or part of the counterpart contribution to this IDB loan would probably be the most realistic way to expand activities. However, it should be noted that the IDB project is not restricted only to the Corcovado and Cordillera Central areas.

Potential gains: In addition to the gains described under the minimum and medium alternatives, this high cost alternative would achieve the benefits described under 7.3.4, that is, the establishment of 10,000 ha of plantations, the increase of wood recovery at the sawmill by 10%, and an increase in the wood utilized from a unit area of natural forest by 38%.

Cost: In addition to the finances needed for the medium cost option (8.1.2), this high cost alternative requires \$6.6 million worth of local currency as GOCR counterpart contribution to the IDB loan, of which \$2.3 million are foreseen as credits for reforestation and \$1.6 million for industry.

8.2 Management of selected watersheds

The objectives of management of selected watersheds are to:

-- Mobilize and support the municipalities in managing the watersheds upon which they depend.

-- Support the management of watersheds that supply large hydroelectric and irrigation schemes.

-- Encourage policy reforms that facilitate watershed management, including improved interinstitutional cooperation and fiscal mechanisms through which the water user pays for management of the watershed.

The justification for this strategy is the following: The flow of water in the stream reflects the effect of land use in the watershed. For this reason the watershed is a natural management unit. The water user, residential, industrial, irrigation, hydropower or other, is very sensitive to the amount, timing and quality of the water in the stream. Therefore, when water problems arise there is a strong incentive for affected users to mobilize in order to solve them. As water problems increasingly constrain economic development and cause distress, institutions ranging from local groups to national government agencies are motivated to improve the land use in the watersheds upon which they depend. Therefore, by supporting these initiatives with relatively modest resources, it is expected that USAID could have a large impact on alleviating the constraint of water supply on economic growth, especially in rural areas.

Solving water supply problems forces an integrated approach to land use, but one that is restricted to a discrete geographic area -- the watershed. This geographic limitation facilitates operations and makes results more visible.

USAID contributions to watershed management can build upon mounting concern and existing efforts (i.e. the Interinstitutional Agreement for Integrated Watershed Management, the initiatives of certain municipalities, the ROCAP/CATIE Regional Watershed Management Project, the forest emergency decree, etc.). With respect to municipal watersheds, the rationale and current actions are outlined in 7.4. The "delivery system" through IFAM is already used by USAID for other purposes, including potable water systems. With respect to those watersheds above large infrastructures, because of these massive investments, national, rather than local agencies are taking action as described in 7.5.

8.2.1 Minimum cost alternative

Description of activities: The activities recommended are those outlined in 7.4, intended to help the municipalities take charge of their own watersheds. Although 13 priority watersheds have already been identified and necessary actions outlined (Arias and Portilla 1987) the choice seems to have been rather arbitrary and might need revision. Geographically close watersheds with similar problems need to be grouped and a strategy for intervention developed. It might be advisable to give priority to those watersheds which supply municipalities where USAID financed housing is concentrated. The preparation of plans for management of the watersheds need to be contracted out. These plans will serve as a basis for soliciting USAID and other support.

Implementation arrangements: IFAM and many of the municipalities have experience in implementing similar projects. USAID experience with IFAM has been excellent. IFAM would be the primary executing agency, which in turn would mobilize the individual municipalities. Mechanisms already used to channel funds to the municipalities through IFAM for the construction of infrastructure can be used for those watershed interventions executed by the municipalities directly or contracted out. USAID financing (predominantly local currency) would require counterpart contributions by IFAM and the municipalities. Personnel for implementing the watershed plans would be provided by the municipalities. All operation and maintenance of installations would be the responsibility of the municipalities, a task to which they are accustomed and tend to do well. The CATIE Regional Tropical Watershed Management Project and EARTH could offer training as well as technical assistance to IFAM and the municipalities.

Potential gains

See Section 7.4.4.

Cost: Costs are estimated to be in the neighborhood of \$10,000 to \$100,000 per watershed. Funding could gradually expand to cover more watersheds as experience is gained.

8.2.2 Medium and high cost alternatives

Description of activities: An expanded program could include the minimum alternative described above plus the preparation of management plans for selected large watersheds above infrastructures. These watersheds are generally extensive hydrographic units requiring large investments for integrated management. Bankable watershed management plans such as the one currently being developed for the upper Rio Virilla by the ROCAP/CATIE Regional Watershed Management Project could be prepared for other priority watersheds, using USAID financing. Subsequently USAID funds could leverage additional finances for management, from the major donors who have interest in protecting their investments in infrastructure (i.e. principally IDB and the World Bank). (Preliminary discussions of the GOCR with IDB regarding funding for the Rio Virilla plan have been positive.) IDB is requiring protection of the Arenal watershed and has approximately \$1 million set aside for natural resource management on the Arenal/Moracea irrigation project where the GOCR will have invested \$236 million by the year 2000.

These management plans would emphasize the conservation for development and grass roots approach that is recommended for the buffer zone management. Thereby, the buffer zone and watershed activities would compliment each other. The activities would follow models being applied in the Rio Nosara and the Rio Puriscal where USAID helped finance preparation of a detailed management plan (CORENA 1985). (See 7.5.3 for more detail on activities)

Implementation arrangements: Management could be carried out via the leader national institutions responsible for water resource development in that watershed (ICE, SENARA, ICAA). The "Interinstitutional Agreement for Integrated Watershed Management" signed in August 1987 between MIEM, MAG, ICAA, SENARA, ICE, SNE and DGF will facilitate coordination, especially because it created a permanent executive secretariat made up of one full-time technician from each institution. As in the case of the municipal watersheds CATIE could provide part of the needed training and the technical assistance in watershed planning.

Potential gains: The gains would be the combination of those described in 7.4.4 and 7.5.4.

Cost: Without knowing which watersheds are chosen and what the activities will be, it is very difficult to estimate costs. This is best done as part of the watershed management plan. However, to give an idea of the order of magnitude experience can be transposed from the Rio Parrita. The watershed management plan for the Rio Parrita foresees treating 16% of the watershed area (CORENA 1985). The agricultural development treatments proposed include improvements in cropping practices, soil conservation, pasture improvement, reforestation, development of small agroindustries, farm-to-market roads. The average costs of these treatments were estimated as \$650 per hectare in the Rio Parrita watershed for that land actually receiving treatment. Assuming unit costs will be the same, the cost of treating the four priority watersheds would be as follows:

Rio Virilla	Total Watershed Area (km ²)	Percent of area assumed to require treatment	Total cost of treating watershed (\$ millions)
Rio Virilla	830	20	10.7
Upper Rio Reventazon	877	25	14.2
Rio Bebedero/Arenal	2300	35	52.0
Rio Barranca	507	25	8.0

Of course part of these costs would be met by the government and possibly part by other donors, especially the multilateral banks which are financing infrastructures. USAID could adjust its contribution by varying the proportion of total costs it finances as well as by varying the number of watersheds.

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ANNEX 1

LIST OF PERSONS INTERVIEWED

- Guillermo Arias, DGF Representative on the Secretariat of the Interinstitutional Group for Watershed Management
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- Mario Boza, Fundación Neotrópica
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- Angel Chiri, Integrated Pest Management Specialist, ROCAP
- Edwin Cyrus, Head of Cartography Section, DGF
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- Rodrigo Gamez, Advisor to Ministry of Natural Resources
- Claudio Gutierrez, Coordinator, CATIE Regional Watershed Management Project
- Gary Hartshorn, Tropical Science Center
- Federico Herrero, General Manager, Banco Cooperativo
- Ian Hutchinson, Silviculturist, CATIE
- Max Koberg, investor in forest plantations and manager of tree farm
- Marcelino Losilla, Watershed Manager, DGF
- Alonso Matamoros, Sub-Director, DGF
- Elmo Montenegro, FAO Adviser to DGF
- Pat Morton, researcher on environmental education
- Walter Picado, Country Coordinator, ROCAP/CATIE Tree Crop Production Project
- Susan Poisson, researcher on environmental education, OTS
- Ricardo Reyes, FAO Advisor, DGF
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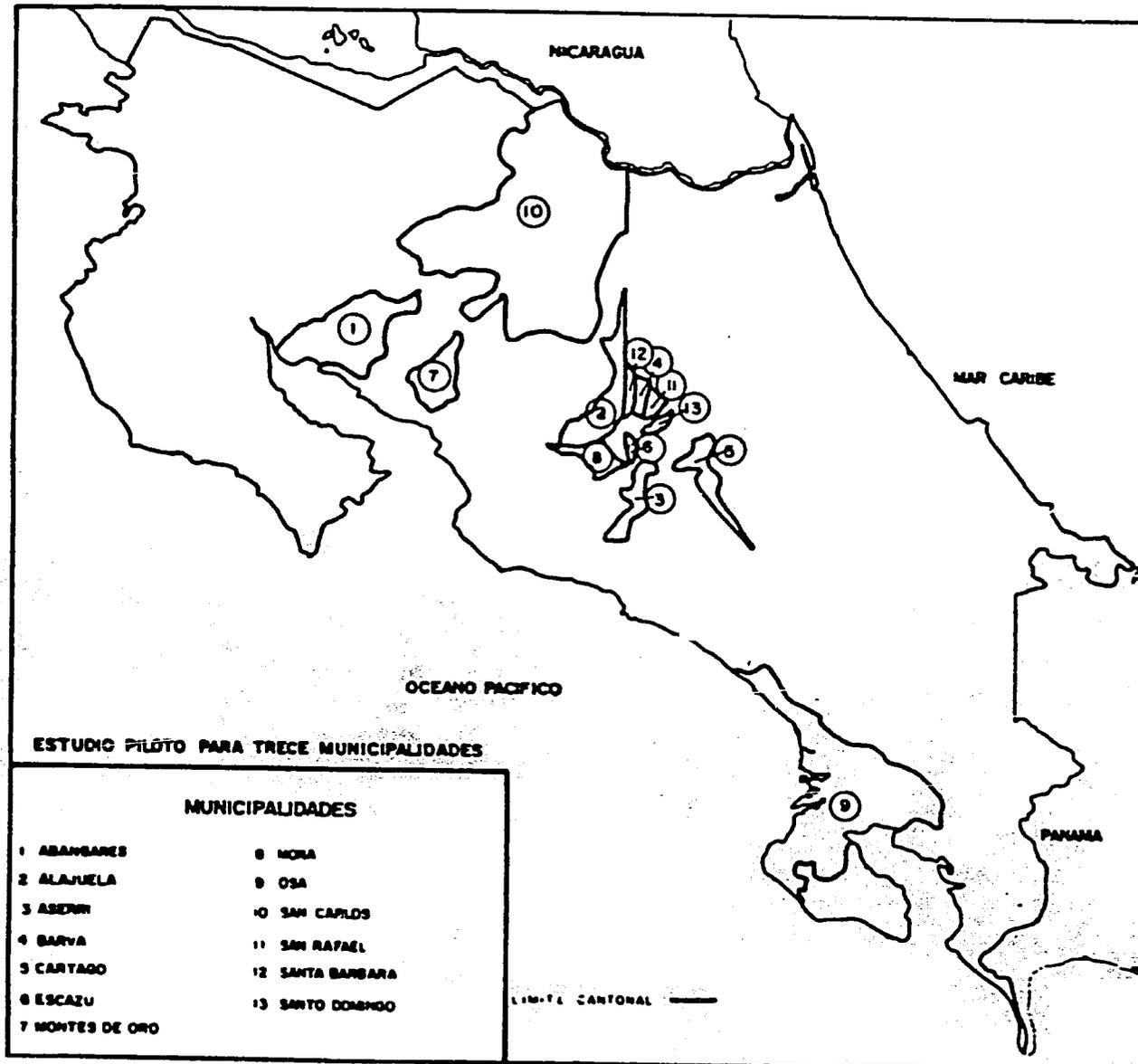
Heriberto Rodriguez

Vincenz Schmack

Lorraine Simard

Ross Wherry

PROTECCION DE CUENCAS HIDROGRAFICAS



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N°	CANTON	CUENCA	AREA (ha)	-LOCALIZACION -COORDENADAS IGN -HOJA CARTOGRAFICA -REGION	PROBLEMAS PRINCIPALES	ACCIONES SUGERIDAS
12	Santa Bárbara	1) Río Potreros	791	-229-224/521-516 -Barva -Valle Central	-Contaminación por agroquímicos -Deforestación -Viviendas establecidas en las partes altas de las cuencas. -Áreas de recarga inmediata cultivadas con café.	-Determinar el nivel de contaminación -Control de talas. -Reglamentar el establecimiento de viviendas -Proteger áreas de recarga inmediata o área de dilución.
		2) Río Porrosati	2134	-235-223/527-518 -Barva -Valle Central		
		3) Río Ciruelas	2734	-235-226/526-517 -Barva -Valle Central		
13	Santo Domingo	1) Río Pará Grande	1029	-222-225/540-536 -Barva y Carrillo -Valle Central	-Agua para uso potable contaminada -Deforestación	-Dar tratamiento al agua. -Control de talas. -Establecer programas de educación ambiental
		2) Río Agrá	347	-222-227/538-533 -Barva y Carrillo -Valle Central		

SP

Nº	CANTON	CUENCA	AREA (ha)	-LOCALIZACION -COORDENADAS IGN -HOJA CARTOGRAFICA -REGION	PROBLEMAS PRINCIPALES	ACCIONES SUGERIDAS
9	Osa	1) Quebrada Benjamín	200	-328-326/524-521 -Changuena y Terraba -Pacífico Sur	-Colonización agrícola -Falta educación ambiental. -Agua para uso potable contaminada -Deforestación -Cuenca del Balzar muy deteriorada	-Establecer área de protección absoluta (545 ha) -Dar tratamiento al agua -Control de talas -Sustituir la cuenca del Balzar por la Quebrada El Tigre.
		2) Río Balsar	2700	-327-334/517-511 -Changuena y Terraba -Pacífico Sur.		
10	San Carlos	1) Río Platanares	1600	-256-251/497-490 -Quesada -Vertiente Norte	-Colonización agrícola -Falta educación ambiental.	-Establecer área de protección absoluta (500 ha) -Control de talas. -Establecer programas de educación ambiental. -Protección de salud de tanque. -Prohibir el establecimiento de actividad con posibilidad de causar contaminación
11	San Rafael	1) Río Segundo-El Gallito	829	-234-229/532-526 -Barva -Valle Central	-Deforestación -Agua para uso potable contaminada. -Falta educación ambiental. -Raquítico caudal de las fuentes productivas.	-Control de talas -Dar tratamiento al agua. -Establecer programas de educación ambiental -Buscar nuevas fuentes de abastecimiento
		2) Río Bermúdez	240	-229-225/528-527 -Barva -Valle Central		

Nº	CANTON	CUENCA	AREA (ha)	-LOCALIZACION -COORDENADAS IGN -HOJA CARTOGRAFICA -REGION	PROBLEMAS PRINCIPALES	ACCIONES SUGERIDAS
6	Escazú	1) Quebrada La jas-Higuerón	500	210-206/522-519 Abra Valle Central	-Deforestación -Sobrepastoreo -Erosión en caminos -Agua para uso pota ble contaminada -Inadecuado aprove- chamiento del agua	-Deforestación -Establecer áreas de protección absoluta (550 ha) -Prohibir construcción de caminos y otra in- fraestructura. -Dar tratamiento al agua. -Replantear el aprove- chamiento actual del agua.
		2) Río Agres	456	208-204/523-520 Abra Valle Central		
7	Montes de Oro	1) Río Ciruelas	580	236-231/462-457 Miramar Pacífico Seco	-Erosión acelerada -Sobrepastoreo	-Establecer área de protección absoluta (600 ha) -Control de talas -Proteger áreas de re- carga inmediata.
		2) Río Rastra	360	238-235/462-458 Miramar Pacífico Seco		
8	Mora	1) Río Quebrada Honda	576	210-206/515-512 Abra Valle Central	-Erosión acelerada -Sobrepastoreo -Deforestación -Agua para uso pota ble contaminada -Captaciones mal construidas.	-Establecer área de protección absoluta (576 ha) -Dar tratamiento al agua. -Control de cárcavas -Construir captaciones que aprovechen más eficientemente el re- curso hídrico.
		2) Río Pacacua	120	210-209/514-511 Abra Valle Central		

ESTUDIO DE TRECE CUENCAS DE ACUEDUCTOS MUNICIPALES - IFAM - DGF - CATIE
RESUMEN DE PRINCIPALES PROBLEMAS Y ACCIONES SUGERIDAS

N°	CANTON	CUENCA	AREA (ha)	-LOCALIZACION -COORDENADAS IGN -HOJA CARTOGRAFICA -REGION	PROBLEMAS PRINCIPALES	ACCIONES SUGERIDAS
1	Abangares	1) Río Aguas Claras	1187	-251-256/436-441 -Abangares -Pacífico Seco	-Sobrepastoreo -Deforestación -Contaminación	-Dar tratamiento al agua -Control de talas -Abandonar caminos -Reglamentar establecimientos de viviendas. -Investigación de aguas subterráneas -Programas de educación ambiental
2	Alajuela (Central)	1) Río Itiquis	2686	-226-236/514-523 -Barva -Valle Central	-Falta protección a bosques municipales y áreas de recarga -Alto uso de agroquímicos en café. -Contaminación en fuentes (botadero de basura, cantera)	-Proteger áreas de recarga inmediata y zonas protectoras. -Reforestar -Mejorar mantenimiento de captaciones. -Educación ambiental.
		2) Río Ciruelas	2734	-226-236/516-525 -Barva -Valle Central		
3	Aserrí	1) Río Suerre	144	-203-205/525-523 -Abra -Valle Central	-Sobrepastoreo -Deforestación -Erosión severa -Contaminación de aguas potables -Construcción de caminos sin normas técnicas	-Establecer un área de protección absoluta de (288 has) -Control de talas -Dar tratamiento al agua -Prohibir construcción de caminos y otras infraestructuras.
		2) Río Suárez	288	-202-209/525-523 -Abra -Valle Central		
		3) Río Cañas	200	-201-203/527-524 -Abra -Valle Central		

ANNEX 2

Table A2-1

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N°	CANTON	CUENCA	AREA (ha)	-LOCALIZACION -COORDENADAS IGN -HOJA CARTOGRAFICA -REGION	PROBLEMAS PRINCIPALES	ACCIONES SUGERIDAS
4	Barva	1) Río Ciruelas	2734	-235-226/526-517 -Barva -Valle Central	-Construcción de viviendas en la parte alta. -Construcción de floristerías en la parte alta. -Deforestación -Aguas superficiales contaminadas. -No existe planificación en el aprovechamiento actual de los manantiales.	-Reglamentar la construcción de viviendas -Reglamentar la construcción de floristerías. -Control de talas. -Dar tratamiento al agua -Proteger las áreas de recarga inmediata de los manantiales. -Reorganizar el aprovechamiento actual de los manantiales bajo su jurisdicción.
		2) Río Porrosatí	2134	-235-223/527-518 -Barva -Valle Central		
		3) Río Mancarrón-La Hoja	522	-233-226/528-525 -Barva -Valle Central		
5	Cartago	1) Río Taras	1250	-215-207/547-543 -Istarú -Vertiente Atlántica	-Erosión en cultivos -Deforestación -Establecimiento de floristerías -Bosques municipales mal manejados. -Fuentes con posible contaminación	-Implementar acciones en conservación de suelos. -Control de talas -Regular el establecimiento de floristerías -Manejar bosques municipales. -Establecer campañas de educación ambiental en bosques municipales. -Determinar el grado de contaminación de las fuentes Arriaz, Lanaster y Paso Ancho.
		2) Río Páez	1650	-217-206/553-549 -Istarú -Vertiente Atlántica		

CUENCA PRIORITARIA DE COSTA RICA
DETERMINADAS POR EL COMITE ASESOR
NACIONAL (CAN) DEL PRMC - 1987

<u>Cuenca o Subcuenca</u>	<u>Area (Km²)</u>	<u>Usos y Actividades</u>
1) <u>Rfo Virilla</u> hasta su confluencia con el Rfo Ciruelas. (Valle Central).	830	Crecimiento urbano, agricultura, ganadería crecimiento industrial y comercial, explotación aguas subterráneas, Producción Hidroeléctrica, Parques Nacionales, Riego, otros. Instituciones con mayor interés en la cuenca: AyA ICE, SENARA, DGF, INVU, IFAM.
2) Cuenca superior del Rfo Reventazón hasta su confluencia con el Rfo Birris (Valle del Guarco).	877	Crecimiento urbano, e industrial, agricultura, ganadería, embalses, producción hidroeléctrica, Parques Nacionales Riego, otros. Instituciones con mayor interés en la cuenca: ICE, AyA, IFAM, SENARA, INVU, DGF.
3) Cuenca del Rfo Bebedero y del Embalse Arenal.	2300	Mayor generación hidroeléctrica del país, embalses mayor proyecto de riego, generación geotérmica, agricultura, ganadería, minería, modificación de uso y tenencia de la tierra, parques nacionales, silvestre, otros. Instituciones con mayor interés en la cuenca: SENARA, ICE, AyA, DGF.
4) Cuenca Rfo Barranca.	507	Agricultura, Ganadería, Acueductos urbanos, manglares, minería, crecimiento urbano, otros.

Instituciones con mayor interés
en la cuenca: AyA, MIDEPLAN,
INVU, DGF.

Algunas instituciones hicieron énfasis en varias subcuencas incluidas todas dentro de las cuencas antes mencionadas. Entre éstas subcuencas están:

Cuenca del embalse Arenal.

Subcuenca Rfo Chiquito.

Subcuenca del Rfo Reventado.

Subcuenca del Rfo Purires.

Subcuenca del Rfo Tiribí.

CAPITULO I

BREVE DESCRIPCION DEL PROYECTO DE RIEGO ARENAL - TEMPISQUE1. Características Generales del Area

El Proyecto de Riego Arenal - Tempisque contempla poner bajo riego una superficie neta de 66675 hectáreas al año 2000 y está ubicado en la Provincia de Guanacaste, República de Costa Rica, en la región norte del país. Su concepción y ejecución está a cargo del Servicio Nacional de Aguas Subterráneas, Riego y Avenamiento (SENARA), institución ejecutora y responsable del uso agrícola del agua en todo el territorio nacional.

El área del proyecto se encuentra localizada en su mayor parte en la cuenca media y baja de los ríos Tempisque (cuenca: 3405 Kms²) y Bebedero (cuenca: 2050 Kms²) de la vertiente del océano Pacífico. El río Bebedero es un tributario del río Tempisque al que se une unos cuantos kilómetros antes de la desembocadura del Tempisque en el Golfo de Nicoya. En su conjunto, la cuenca de los ríos Tempisque y Bebedero constituye la cuenca hidrográfica más extensa de Costa Rica, con una superficie de 5455 Kms². (Véase mapa de ubicación. Mapa #1).

La zona tiene una estación seca muy marcada, que limita la explotación agrícola, con una precipitación promedio anual del orden de los 1700 milímetros distribuidos en el período de mediados de mayo a mediados de noviembre, y una temperatura promedio de 28°C. Las tierras del Proyecto, en su gran mayoría, son de gran fertilidad y de topografía plana, y de conformidad con las condiciones del clima, adaptables a una gran variedad de cultivos (granos básicos, caña de azúcar, arroz, oleaginosas, frutales, hortalizas) y para la ganadería vacuna.

Las condiciones de clima exigen riego para asegurar la producción agrícola y para obtener dos cosechas en los cultivos anuales de período corto. Existe solamente otra limitante relativa que es el viento, que afecta a algunos cultivos durante la época seca, en el período de noviembre a abril, por lo que es necesario la implantación de cortinas rompevientos forestales.

Según la clasificación de tierras para riego, el 70% se ubica en las clases I, II y III, aptas para gran variedad de cultivos; el 27% en la clase IV con



INSTITUCION NACIONAL DE SERVICIOS TECNOLÓGICOS, C.A.	ZONA REGABLE ARENAL TEMPLES PROVINCIA DE GUANACASTE
PROYECTO ESTUDIO PRELIMINAR DEL SUBDISTRITO CABUTO	
CONTENIDO PLANO GENERAL DE COSTA RICA	FIGURA N.º

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con limitaciones de drenaje principalmente y solamente un 3% son de clase V. Las aguas superficiales y subterráneas no presentan limitaciones para la agricultura y en general son de muy buena calidad.

En la zona predomina la ganadería vacuna extensiva; en los últimos años se ha incrementado el cultivo de granos básicos y otros, aunque con frecuencia los agricultores sufren pérdidas por problemas de sequía. Existen en la zona características históricas de grandes latifundios, por lo que el Estado ha hecho grandes esfuerzos para modificar esta estructura de la tenencia de la tierra. A la fecha es propiedad del Estado el 30% del área regable, y existe el firme propósito de adquirir los terrenos necesarios para que las áreas propiedad del Estado sobrepasen el 50% del área irrigable y luego transferir éstas, mediante venta, a pequeños propietarios. El proyecto total se estima que beneficiará a 2040 agricultores.

La zona posee muy buena red de vías de comunicación y de energía eléctrica, y plantas arroceras; ingenios azucareros; desmotadoras de algodón; plantas empacadoras de carne; bodegas; y otra infraestructura de recepción y procesamiento de cosechas, con suficiente capacidad para la producción actual.

En la parte sur del área del Proyecto se encuentran el Refugio Nacional de Fauna Silvestre "Dr. Rafael Lucas Rodríguez" con una superficie de 7500 hectáreas y adyacente a éste el Parque Nacional Palo Verde con una extensión de 7400 hectáreas, ambos adyacentes a la margen izquierda del río Tempisque.

La población en el área del Proyecto es de 56805 habitantes, con una densidad media de 30 habitantes/Km², inferior al promedio nacional.

2. Esquema General

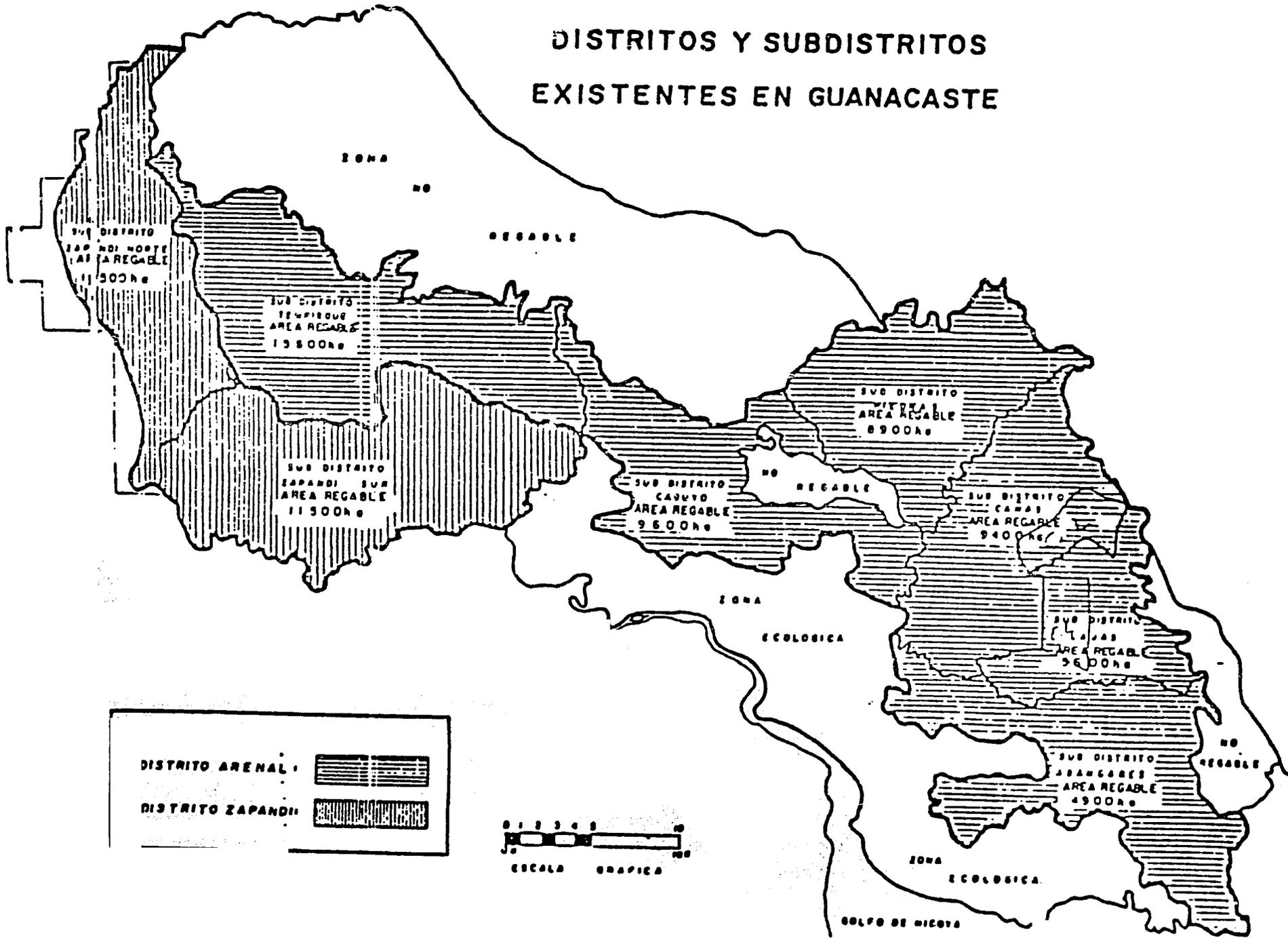
El Proyecto está dividido en dos grandes distritos (Véase mapa N°2 Distritos y Subdistritos):

- a) Distrito Arenal, localizado entre los ríos Abangares y Tempisque, con una superficie neta de riego de 46775 hectáreas y el cual se subdivide en 6 (seis) subdistritos: Abangares, Lajas, Cañas, Piedras, Cabuyo y Tempisque; y
- b) Distrito Zapandí, situado en la margen derecha del río Tempisque, con una superficie neta de riego de 19900 hectáreas, la cual podría ampliarse

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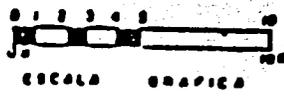


DISTRITOS Y SUBDISTRITOS EXISTENTES EN GUANACASTE



DISTRITO ARENAL: [Hatched pattern]

DISTRITO ZAPANDI: [Hatched pattern]



en un futuro a más de 50000 hectáreas dependiendo del agua de que se disponga. Comprende los subdistritos de Zapandí Norte y Zapandí Sur.

El agua para el riego proviene en su mayor parte de las aguas turbinadas del Complejo Hidroeléctrico Arenal - Corobici que suministran un caudal promedio anual de 57 mts³/seg. También se utilizarán: 5 mts³/seg de aguas subterráneas principalmente en el Distrito Zapandí; 7 mts³/seg de derivaciones del río Tempisque, y 0.8 mts³/seg de diferentes ríos pequeños que atraviezan el área del Proyecto.

Las aguas turbinadas del Complejo Hidroeléctrico Arenal - Corobici provienen del embalse artificial de Arenal, y son usadas por las plantas hidroeléctricas de Arenal (157 MW) y Corobici (174 MW), propiedad de Instituto Costarricense de Electricidad (ICE), que funcionan en cascada. El embalse tiene una superficie de 88 Kms²; un volumen total de 2416 millones de metros cúbicos; un volumen útil de 1990 millones de metros cúbicos y una área de drenaje de 413 Kms². Las aguas del río Arenal que drenaban hacia la vertiente Atlántica son trasvasadas hacia la vertiente del Pacífico por el Complejo Hidroeléctrico, el que comenzó a operar en diciembre de 1979. Las aguas turbinadas de la planta Corobici, que es la que está situada a menor elevación, descargan al río Santa Rosa, el cual a su vez se une al río Magdalena, donde se encuentra la presa derivadora Magdalena que desvía el agua hacia el Proyecto de Riego Arenal - Tempisque. El caudal máximo que descarga la planta hidroeléctrica Corobici, es de 98.5 mts³/seg, el cual actualmente llega casi en su totalidad al océano Pacífico ya que solamente se utilizan para riego unos 3.5 mts³/seg en el período de máxima demanda. La ruta que siguen las aguas del embalse de Arenal para llegar al océano Pacífico, después de pasar por la planta Corobici, es la siguiente: ríos Santa Rosa, Magdalena, Corobici, Tenorio, Bebedero, Tempisque, y Golfo de Nicoya, cruzando el área del Proyecto de Riego en dirección de norte a sur. Desde la presa Magdalena, el agua recorre unos 35 kilómetros para llegar al Golfo de Nicoya.

El Distrito Arenal será irrigado casi totalmente por las aguas provenientes del embalse de Arenal. El Distrito Zapandí utilizará aguas subterráneas, agua derivada del río Tempisque y los excedentes del Distrito Arenal.

El esquema hidráulico final quedará definido cuando se complete el estudio de factibilidad de las distintas etapas del proyecto. A la fecha, el esquema hidráulico está visualizado de la siguiente manera (Véase esquema hidráulico adjunto):

Las aguas provenientes del Complejo Hidroeléctrico Arenal- Corobicí, serán derivadas en la presa Magdalena a los grandes canales primarios: el canal del sur, de 42 kilómetros de longitud para irrigar los subdistritos Abangares, Lajas y Cañas; y el canal del oeste, de 66 kilómetros de longitud para irrigar los subdistritos Piedras, Cabuyo y Tempisque. También se considera la construcción de un embalse en el río Piedras y en otros pequeños ríos, para el riego del Distrito Arenal. Para el riego del Distrito Zapandí, se utilizarán aguas subterráneas, aguas del río Tempisque y los excedentes del canal oeste, aunque el esquema final de este último aún se encuentra bajo estudio.

El proyecto comprende la construcción de la presa Magdalena (ya construida a la fecha); obras de derivación en los ríos Piedras y Tempisque; 128 kilómetros de canales principales (42 Kms del canal del sur; 66 kms del canal del oeste; y 15 kms en el Distrito Zapandí); 1200 kilómetros de canales secundarios de distribución y drenaje; 1040 kilómetros de caminos sobre los bordes de los canales, drenajes y de servicio; y más de 2000 obras y estructuras accesorias.

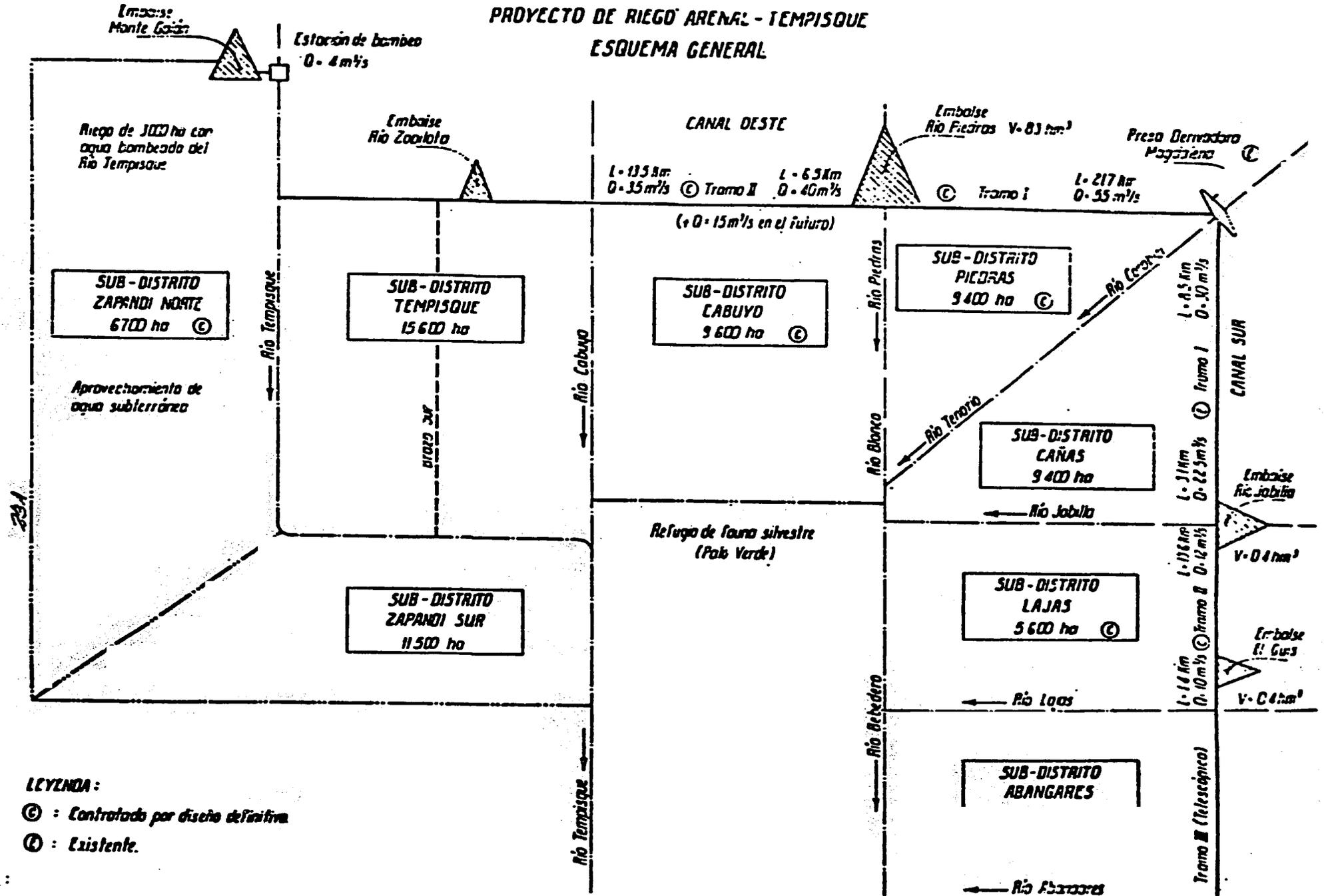
Actualmente está concluida la presa derivadora Magdalena; y el primer tramo del canal del sur (8.5 kms); prácticamente toda la red secundaria en el subdistrito Cañas y un parte en el subdistrito Cabuyo. Existe una superficie de riego de 14900 has desarrolladas por empresas privadas y se ha completado el denominado "Proyecto Piloto (etapa I) con 3922 has bajo riego.

3. Etapas de Ejecución

La planeación general del Proyecto de Riego Arenal Tempisque contempla poner 66675 hectáreas netas bajo riego al año 2000, mediante la implementación de cuatro etapas sucesivas de desarrollo.

El cuadro N°2 presenta la secuencia de construcción de las diferentes etapas y las áreas que serán irrigadas en cada subdistrito en el período 1985-

PROYECTO DE RIEGO ARENAL - TEMPISQUE ESQUEMA GENERAL



LEYENDA:

- Ⓢ : Contratado por diseño definitivo
- ⓐ : Existente.

CUADRO N°2
PLANEACION GENERAL PROYECTO ARENAL - TEMPISQUE
ETAPAS DE DESARROLLO
(hectáreas netas recibibles)

	300	300	7220			2150
Tempisque	6926			4274	2850	14050
Zapandí Norte	540		800	5860	2300	9500
Zapandí Sur	1080		200	1000	8120	10400
Lajas	126			4874		5000
Abangares					4400	4400
TOTAL	14900	3922	14175	16008	17670	66675

FUENTE: SENARA

2000. Como se puede apreciar, en el área neta total a irrigar en el año 2000 (66675 hectáreas) se incluyen las 14900 hectáreas que actualmente se encuentran bajo riego, y las 3922 hectáreas habilitadas durante el "Proyecto Piloto" en el período 1980-1985. Actualmente SENARA gestiona ante el Banco Interamericano de Desarrollo (BID) el financiamiento para la construcción de la segunda etapa (14175 hectáreas) en el período 1986-1990.

4. Uso Actual de la Tierra y Producción Actual

La producción del área bruta a ser irrigada (74020 hectáreas) ha sido calculada por SENARA en base a los resultados promedio de los últimos años. Los cultivos actuales, los rendimientos y el valor de la producción (en colones) se muestran en el cuadro N°3.

Algunos cultivos, como el arroz inundado, se siembran dos veces al año, por lo que la superficie utilizada suma más del área total.

El costo actual de producción se estima en 2011.08 millones de colones por lo que el beneficio actual neto es de 481.2 millones de colones (1.00US\$ dólar: 53 colones aproximadamente).

5. Características Futuras de la Producción

Con una cédula de cultivos de los conocidos en la zona, y con rendimientos razonables en riego, SENARA ha estimado las características futuras de producción en el área del Proyecto. Los resultados se presentan en el cuadro N°4.

Los cultivos que se presentan han sido escogidos en base a las características del suelo y al conocimiento del agricultor de la zona de la tecnología de producción. No se han considerado posibles beneficios con cultivos de mayor rentabilidad pero de tecnología más compleja y mercado más incierto. En base a las proyecciones de la demanda interna, sustitución de importaciones y metas de exportación, SENARA estima que la producción futura no planteará problemas serios de excedentes.

El costo de la producción futura se estima en 4261.03 millones de colones, por lo que el beneficio neto sería de 2039.99 millones de colones. Es decir que el Proyecto de Riego Arenal Tempisque, de acuerdo a las cifras de los cuadros N°3 y N°4 vendrá casi a quintuplicar el valor de la producción en

CUADRO N° 3

PROYECTO DE RIEGO ARENAL - TEMPISQUE
 PRODUCCION ACTUAL
 INGRESOS TOTALES

CULTIVO	SUPERFICIE (ha)	RENDIMIENTO (TM/ha)	PRECIO (C/TM.)	PRODUCCION TOTAL (miles de colones)
Arroz Secano	14710	3,0	11900	525,15
Arroz Riego	3656	9,0	11900	391,56
Caña Azúcar Secano	3950	70,0	900	248,85
Caña Azúcar Riego	10421	90,0	900	844,10
Algodón Secano	2100	2,0	29000	121,80
Maíz Secano	1780	2,0	11500	40,94
Sorgo Secano	5400	3,0	11050	179,01
Sorgo Riego	858	4,0	11050	37,92
Pastos Secano	31332	0,1	32000	100,26
Pastos Riego	120	0,7	32000	2,69
TOTAL	74327			2492,28

1 US\$ dólar: 53 colones aproximadamente

FUENTE: SENARA

CUADRO N°4

PROYECTO DE RIEGO ARENAL - TEMPISQUE
 SITUACION FUTURA
 INGRESOS TOTALES

CULTIVO	SUPERFICIE (ha)	RENDIMIENTO (TM/ha)	PRECIO (C/TM.)	PRODUCCION TOTAL (miles de colones)
Arroz Riego	40000 (2)	4,5	11900	2142,00
Caña Azúcar Riego	16000	90,0	900	1296,00
Algodón Riego	10000	3,0	29000	870,00
Maíz Riego	5000 0,5	4,0	11500	230,00
Soya Riego	9000 0,9	2,0	18750	337,50
Maní Riego	1000 0,1	2,0	26100	52,20
Sorgo Riego	15000 (1,5)	4,0	11050	663,00
Pastos Riego	9010	0,7	32000	201,82
Otros	3390	1,0	150000	508,50
TOTAL	108400			6301,02

1 US\$ dólar: 53 colones aproximadamente

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el área.

6. Costo e Indicadores Financieros

El Proyecto tendrá un costo del equivalente de US\$233.74 millones. Esta cifra incluye US\$20.60 millones del Proyecto Piloto; US\$72.44 millones de la II etapa y US\$140.70 millones para la III y IV etapas.

La rentabilidad ha sido calculada por SENARA en una tasa interna de retorno (TIR) del 16% y un valor presente neto de 1040 millones de colones al 10%.

Como beneficios sociales se consideran la creación de nuevos propietarios mediante la redistribución de la tierra y la distribución del ingreso obtenida por la creación de nuevos puestos de trabajo. Se estima que el empleo se incrementará en 9000 puestos agrícolas permanentes y 18000 empleos de servicios.

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Conservation Means \$\$ In 'Nature Tourism'

By TENSIE WHELAN

(Second of two parts)

CAN one make more money by leaving a rainforest alone, than by cutting it down? Yes, by developing nature-based tourism, claims Amos Bien, director of Rara Avis, and one of the new breed of naturalist tour operators.

Bien hopes to prove his hypothesis with the successful operation of a 525-hectare tract of rainforest on the Atlantic slope. Tourists interested in tropical ecology and natural history are the potential clients. They will hike many miles and enjoy the unique experience of a trek through Braulio Carrillo National Park's lush rainforest, in order to catch sight of a toucan, a tapir or exotic butterflies. Most come to learn, and biologists and trained guides provide them with a unique window on the tropical world of wonder.

Bien's operation is still new — the doors opened to tourists only in February. Nevertheless, he is projecting 20-40 percent bookings already for early 1988, an excellent figure considering that most well-established hotels in the Central Valley operate only at 53 percent of capacity, according to the Institute for Costa Rican Tourism (ICT).

The Marengo Biological Station, which is a few years older than Rara Avis, is a better-known private nature tourism concern. It is owned by the Miranda family — investors in real estate and half owners of the Horizontes Travel Agency in San Jose.

Marengo Director Sergio Miranda, like Bien, is bent on proving a positive relationship between conservation and profit. He explains, "Biologists have no money. Money has no environmental awareness." He wants to combine the two. "We can make an immediate profit through conservation,

though we recognize the long-term importance of conservation as well."

The Station borders the large Corcovado National Park in the southwest of Costa Rica — an area which is difficult for most tourists to reach on their own. Marengo's biologist guides take groups on voyages of discovery through the species-rich jungles of Corcovado, the nearby biological reserve on the Isla de Caño, and Marengo's own beachfront reserve.

For the Mirandas, conservation for profit is a good business. The station is operating at 90 percent of capacity. Sergio Miranda says gleefully, "I'm in a million-dollar business."

Michael Kaye, U.S. founder and owner of Costa Rica's first nature tour agency, Costa Rican Expeditions, would concur. He claims that recent years have seen exponential growth for his company. While the average tourist stay in Costa Rica is 3-4 days, for example, his clients now visit for at least 10 days, enjoying a variety of planned tours to national parks and white-water rafting.

Says Kaye, "We had been projecting 30 percent growth. That figure now seems extremely low. We had 47 percent growth in 1986 and it looks as though we'll do even better this year."

Kaye's operation nets \$800-900,000 per year, and employs 54 people. On the other end of the extreme is Sergio Vollo's Geotur, which is run by Vollo and his wife. Vollo is formerly a National Parks Service manager and self-styled naturalist. He takes groups on nature tours of Carara Biological Reserve on the west coast and the Braulio Carrillo National Park, which is located but a scant hour's drive from San Jose. His tours are spiced with amusing anecdotes about the animal kingdom. Like so many others, he



Tico Times

COSTA RICA'S wilderness is becoming a major tourist attraction.

has plans to build a lodge — in his case, near Carara and over the next two years.

Robert Chaverri, Department Head of Tourist Resources for ICT, claims that the interest in nature tourism developed in the late 1970s. Universities and scientific research centers such as the Organization for Tropical Studies (OTS) paved the way with their courses in tropical ecology attended by North Americans.

Even today, the OTS alone accounts for 1-2 percent of all tourism receipts in Costa Rica. Expenditures accrued to Costa Rica through the OTS were \$1.5 million in 1986, according to a recently released study by Dr. Jan Laarman, researcher in nature tourism in Latin America.

All the actors concerned with nature-based tourism are optimistic about the future of the industry. However, some point out that much of the industry is based on the Costa Rican national parks system, and most agree that the guardian of that system, the National Parks Service is going through some rather rough times. Marlo Boza, president of the National Parks Foundation, claims that the euphoria of the

early days at the Parks Service has given way to a bureaucracy that is mostly focused on its paycheck. He adds, however, that the limited funding makes it difficult for the Service to do its job. (The Parks Service budget for last year was approximately \$ million.)

Chaverri of ICT has another bone to pick. He says the Parks Service has a "conserve only" strategy — in other words, the policy has been not to develop services in or around the parks. Chaverri believes that this strategy is a basic mistake. He also insists that the local populations be included in the management of the parks, a sentiment with which Dr. Gerardo Budowski, Coordinator of Natural Resources and the Quality of Life Program at the University of Peace, heartily agrees. Says Budowski, "When local people see tourists using the land, they won't bother it. But they need to be included in tourism activities."

Naturalist Vollo sums up the worries most eloquently when he says, "The parks are ready for an enormous change. It's like when a butterfly bursts out of its cocoon. But if the cocoon doesn't open..."

Using Debt to Save Nature

By Spencer B. Beebe
and Peter W. Stroh

BOLIVIA's commitment to protect more than four million acres of forest and grasslands in the Amazonian lowlands of the Beni River in return for foreign-debt relief of \$650,000 signals a new and promising approach to two of Latin America's most pressing problems: the debt crisis and environmental degradation. Now, it is up to corporations, philanthropies and public agencies, notably the World Bank, to implement similar plans on a larger scale, as has already been suggested to halt widespread destruction of Brazil's Amazon Basin rain forest.

The deal with Bolivia — called a debt-for-nature swap — works like this. Armed with a \$100,000 donation, Conservation International has agreed to purchase \$650,000 of deeply discounted Bolivian debt, which will then be turned over to the Bolivians to retire.

For its part, Bolivia is putting together a public-private partnership to develop a program that combines ecosystem conservation and regional development planning in the Beni. The newly protected land will be zoned for a variety of uses: undisturbed areas for research; forest reserves in which traditional hunting and gathering by native Chimane Indians will still be allowed; and watershed forests where productive, sustainable forestry and agricultural development will be encouraged.

Economic development in the Beni will be based on ecological con-

Spencer B. Beebe is president of Conservation International, an organization that fosters biological diversity in developing nations. Peter W. Stroh, chairman of the Stroh Brewery Company, is a director.

straints. The future productivity of soils, waters, forests and grasslands will be protected, along with the full variety of native plants and animals.

But this approach should not be limited to Bolivia and a few other forward-looking nations. Many countries are, economically and ecologically, living beyond their means. Heavy foreign debt sometimes encourages countries to use their resources without regard for the future. The resulting destruction of natural resources undermines long-term economic and political health and stability. Many African nations are a long way down that road, as are Haiti and, to a lesser extent, El Salvador. The vicious cycle diminishes both the diversity of life

A new way to help third- world countries.

on earth and the social and economic choices available to the vast majority of the world's rural poor.

In the Beni, the Bolivians have demonstrated overriding principles — first, that sovereign nations must solve their own problems. Developed nations can help, but no amount of money or direction from outside will build the national capacity and the internal commitment necessary. The second is a recognition that economics and ecology have converged and that the problems and solutions are inextricably intertwined.

Mexico, Peru and Brazil all have an exceptional abundance of biological diversity and foreign debt. New policies and legislation are needed to encourage support of these and other

countries by American corporate and philanthropic interests, private organizations, international banks and the foreign assistance community.

The World Bank's plan to increase its environmental staff from 15 to 100 officers is promising. So, too, was a recent speech in which its president, Barber Conable, said "the problems of natural resource degradation are development problems" and that "we must be bold in both the scope of our enterprise and in testing untried ideas." As the holder of billions of dollars of third world debt, the bank has an important opportunity to encourage conservation programs while easing the debt burden.

Beyond that, the Agency for International Development's \$2.5 million fund for biological diversity should be greatly expanded. And Congress should clarify the tax laws to permit charitable deductions for corporations for the full face value of gifts of foreign debt notes to international conservation organizations.

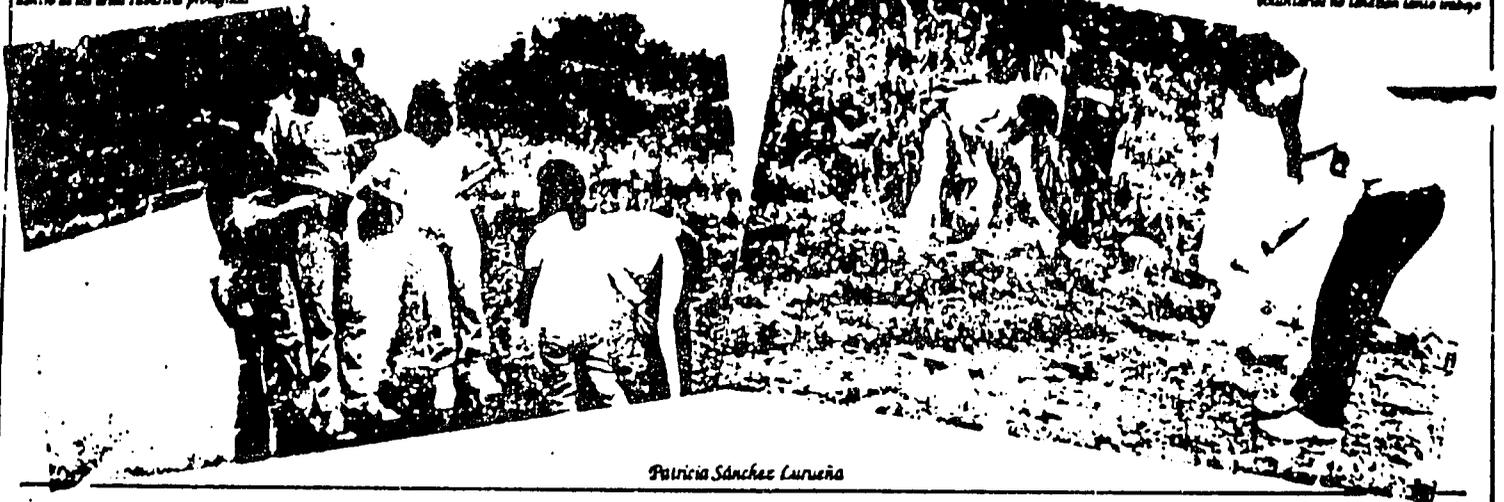
Debt-for-nature swaps and other innovative financial tools should be encouraged. The sum of Latin America's external debt plus "blocked funds" — money belonging to multinational corporations being held in foreign countries in local currencies — probably approaches \$500 billion. Obviously, not all of this money can be used for conservation. But the more that can be swapped for land or local currency to underwrite better land management, the more the twin problems of Latin debt and environmental degradation will be reduced.

In addition, debt-for-nature swaps offer the promise not only of better protection of biological diversity but also of greater hard-currency earnings from tourism for nations that preserve their natural heritage. People will travel in growing numbers to these "museums of the outdoors."

Whatever is done to help solve the world's interrelated problems of ecology and economics, it should be done in the context of helping sovereign nations determine their own future. □

Con una adecuada capacitación, los miembros de asociaciones conservacionistas pueden ser un adecuado vehículo para la educación ambiental y vigilancia dentro de las áreas silvestres protegidas.

Algunos basureros colocados a la orilla de la carretera que conduce a Guapiles no se libran de la vida. Si éstos se hubieran ubicado correctamente, quizás los voluntarios no tendrían tanto trabajo.



Patricia Sánchez Laruena

La delicadísima situación económica y la impráctica estructura administrativa de las instituciones públicas encargadas de velar por la protección de los recursos naturales dificultan las labores de vigilancia en las áreas silvestres y, en términos globales, estos dos factores constituyen las principales causas del deterioro del sector.

Sin embargo, aunque el problema es complejo, la labor que desempeñan grupos privados organizados o personas independientes colaborando con el personal de estos organismos, resulta muy provechosa y alivia la crisis. Así, el involucramiento del sector privado en faenas que el Estado por sí solo está incapacitado para enfrentar, está naciendo espontáneamente en nuestro país en los últimos años.

Algunos comités, asociaciones, grupos comunales y personas individuales se han constituido, en unites de apoyo para el Servicio de Parques Nacionales, de Vida Silvestre y de la Dirección Forestal, luego de haberse inscrito en cada uno de ellos.

Su objetivo es servir a la Nación velando por la protección de los recursos naturales, en forma altruista, a través del voluntariado.

SUS FUNCIONES

De este modo, la Asociación Preservacionista de Flora y Fauna Silvestre, Apretotas, de Moravia y su representación en Guapiles ejerce labores de vigilancia en el Parque Nacional Braulio Carrillo, ayudando así en sus funciones a los escasos guardaparques.

Sus miembros vigilan que no se produzcan extracciones

El voluntariado en apoyo de los recursos naturales

de plantas, piedras y otros recursos de esta área protegida; también enfrentan a los cazadores furtivos, principalmente pajareros, que constantemente se introducen en la zona, violando las disposiciones legales existentes.

Pero su misión la lleva más allá, cuando deben frenar a aquellas personas que transitan por la carretera San José-Guapiles y que lanzan basura a ambos lados de la misma, sin preocuparse por la contaminación que producen al parque.

Este interés por hacer respetar las leyes ambientales conduce también a los integrantes de esta asociación a funcionar como inspectores

forestales, en el control de permisos para la tala de árboles. Es posible observar a algunos de ellos a altas horas de la noche en una carretera, vigilando que los camiones madereros que la transitan lleven la autorización para cargar las tuacas.

Otros grupos privados están trabajando en otras áreas del país. Así, por ejemplo, el Comité de Defensa de los Cerros de Escazú, CODECE, ayuda a la Dirección Forestal a cuidar la zona protectora que abastece de agua a su comunidad y que está seriamente afectada por la deforestación y la disminución de este líquido.

Asimismo, la Asociación Espeleológica efectúa investigaciones sobre las

condiciones en que se encuentran las cavernas que conforman el Parque Nacional Barra Honda y aconsejan acciones para enfrentar problemas ambientales que estén afectando la zona.

La Asociación Espeleológica hace educación ambiental, para formar conciencia en la región sobre la importancia de conservar el parque y de prevenir los fuegos durante la época seca.

Del mismo modo, los comités mencionados denuncian la cacería furtiva y ayudan a controlar los incendios.

El Comité Protector de la Fauna Silvestre de Sarapiquí, la Asociación Conservacionista de Recursos Naturales de Tilarán y el Comité Protector de la Reserva Indígena de Cocles, Limón, entre otros, están integrados por grupos de personas amantes de la naturaleza que colaboran gratuitamente con el Servicio de Vida Silvestre, como inspectores del Departamento que vigilan la acción de los cazadores.

También existen organismos privados internacionales, sin fines de lucro, que tienen representación en el país y que colaboran con el sector ofreciendo recomendaciones sobre la protección de especies faunísticas, como el Consejo Internacional para la Preservación de las Aves. Del mismo modo, la Fundación de Parques Nacionales y la Neotrópica constituyen instituciones privadas, cuya labor es de gran beneficio en el ramo. Realizan investigaciones ecológicas y estudios en tierras del país, para definir cuáles áreas silvestres deben protegerse; financian la compra de las mismas y efectúan labores conjuntas con el Servicio de Parques Nacionales para su manejo.

La Asociación para la Conservación de la Naturaleza, ASCONA, después de mantenerse inactiva durante varios años, nuevamente vuelve a la lucha conservacionista.

Básicamente, esta

agrupación trabaja en el ámbito educativo y denuncia las acciones de quienes atentan contra la legislación ambiental existente. También promueve la creación de leyes, cuyo contenido se dirija hacia la conservación y uso racional de los recursos naturales.

Cuenta también con grupos que colaboran con las instituciones estatales en los trabajos de inspección o vigilancia.

Y, finalmente, se encuentran aquellas personas que, sin estar agrupadas, realizan individualmente funciones, como voluntarias de parques.

Ahora, por ejemplo, en el Parque Nacional Tortuguero tiene lugar el período de desove de las tortugas y muchos jóvenes de entre 18 y 35 años reconocidos en el Servicio de Parques Nacionales, apoyan a los guardaparques en las labores de protección de estos animales y sus huevos, con frecuencia, principalmente durante las madrugadas, se introducen los furtivos en la zona en busca de ambos recursos para comercializarlos.

Las asociaciones, comités y personas que están inscritos en las instituciones estatales del Sector Recursos Naturales, constituyen una gran ayuda para estos organismos gubernamentales, como lo reconocen los tres entes: Parques, Forestal y Vida Silvestre.

Su poder y capacidad aumentarán en la medida en que crezcan en número y continúen trabajando con mistica y dedicación, bajo el principio de la "responsabilidad compartida", como califica a estas acciones conjuntas el jefe de Vida Silvestre, Guillermo Canessa.

El interés por aumentar la capacidad y fuerza de estos grupos se traduce en el deseo de integrarse en una federación.

Pero si necesitan, como lo señalan los directivos de la Apretotas, de un mayor respaldo legal por parte de las instituciones estatales y de una mayor capacitación para el buen desempeño de sus funciones junto a las mismas.



Los miembros de Apretotas colaboran con el personal del Parque Nacional Braulio Carrillo, controlando el curso de plantas o piedras de esta zona protegida.

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Emergencia forestal en todo el país fue decretada ayer. El acuerdo lo firmaron el Dr. Oscar Arias Sánchez, el Dr. Alvaro Umaña C. (derecha) y el Ing. Teófilo de la Torre.

Fuertes sanciones a madereros ilegales

Emergencia forestal

Severas sanciones contra conductores de camiones que sean sorprendidos en el transporte de madera sin portar las guías correspondientes, serán aplicadas.

Así se consigna en un decreto ejecutivo firmado ayer, mediante el cual se declara emergencia forestal, en todo el país, con el objetivo de frenar el deterioro de los bosques, ya arrasados en un 60 por ciento, y promover su recuperación para el desarrollo nacional.

El acuerdo, suscrito ayer por el Presidente de la República, Dr. Oscar Arias Sánchez, y el Ministro de Industria, Energía y Minas, Dr. Alvaro Umaña, y el Viceministro, Ing. Teófilo de la Torre, está orientado a integrar el bosque a la industria, hacer un inventario de la masa boscosa que aún queda y tomar acciones concretas tanto en su conservación como en el uso final de la madera extraída.

Tal medida será tomada con prioridad, puntualiza el decreto, para lo cual se incentivarán aquellas industrias forestales que cuenten con abastecimiento propio de materia prima proveniente de fuentes sostenidas, para su operación continua y permanente; igual será con aquellas empresas que desarrollen proyectos forestales con ese fin.

Se advierte en la disposición ejecutiva que, un mes después de su publicación, todas las instituciones públicas relacionadas con el uso del suelo adoptarán, como método oficial, la calificación de tierras contenida en el documento, titulado "Sistema para la determinación sobre la capacidad del uso de la tierra", elaborado por el Centro Científico Tropical, para el Ministerio de Agricultura y Ganadería (MAG).

Precisa también el decreto que el Sistema Bancario Nacional no asignará créditos agrícolas, ganaderos o de otro tipo que signifiquen la eliminación del bosque hasta tanto se obtenga la resolución de la Dirección General Forestal. Asimismo, el acuerdo garantiza los recursos financieros necesarios para lograr el incremento de la reforestación nacional en forma paulatina, hasta alcanzar la meta mínima de 15 mil hectáreas anuales que requiere el país.

Contempla, además, prohibir la exportación de los productos forestales que clasifiquen en las respectivas partidas arancelarias, tal el caso de: madera en bruto, incluso descortezada o simplemente desbastada; madera escuadrada, así como aserrada longitudinalmente; cortada en hojas de "desenrollada", de más de cinco milímetros de espesor, al igual que traviesas para vías férreas, entre otras. Tampoco se permitirá la exportación de marcos para puertas y ventanas.

Por otra parte, estipula que el Ministerio de Economía y Comercio y la Dirección Forestal establecerán los mecanismos tendientes a controlar la importación de materia prima, su procesamiento y exportación.

El decreto, calificado por el ministro Umaña como "una respuesta a la crisis forestal que vive el país", contempla la creación de una comisión de emergencia forestal de la que formarán parte, entre otros, el Vicepresidente de la República, Ing. Jorge Manuel Dengo, y los ministros de Industria, Energía y Minas, Economía, Hacienda y Gobernación, o sus respectivos viceministros.

Costa Rica Swaps Debt for Trees

SAN JOSE—Viewed from the perspective of the international community, Costa Rica is a country of contradictions. It is one of the most stable democracies in all of Latin America, yet with one of the highest per capita foreign debts in the world; its economy is hamstrung by debt service obligations. It has perhaps the best record on conservation of any country in Latin America, but also one of the highest rates of tropical deforestation.

These facts are interrelated and inseparable. Our democratic values and our

The Americas

By Alvaro Umana

strong desire to protect our natural patrimony are the hallmarks of a peaceful, highly educated and socially conscious population. What is so troublesome about the current economic crisis in Costa Rica is that it threatens to undermine the human values and the natural resources that make our country unique.

The riches of Costa Rica are found in the variety of natural habitats—rain forests, mangrove swamps, cloud forests, coral reefs—crowded into an area the size of West Virginia. The system of national parks and reserves, started in 1970, has grown to protect 10% of Costa Rica's territory. Within the 28 parks and biological reserves, there are an estimated 12,000 plant species, beaches for sea turtles, sanctuaries for hundreds of birds and mammals. Costa Ricans are justly proud of their conservation efforts—more notable than any other developing country.

At the same time, no country in Latin America has a higher deforestation rate outside the parks—about 1% of the total land area each year. In 10 years' time, no productive forests will exist outside the protected areas. This means that Costa Ri-

cans will have to choose between shutting down lumber industries and importing wood or eating into some of the reserves. Declaring an area a park does not grant it eternal protection; social pressures often are stronger than laws. Landless farmers, unemployed miners and hungry families will use whatever resources they can find to live on. More and more poor individuals throughout the countryside—left without economic alternatives by the economic crunch—daily clear forests for cattle ranching and move into our national parks in search of minerals and sustenance.

What does this have to do with Costa Rica's \$3.7 billion debt? We are spending three-fourths of the money earned on exports just to pay the banks. This leaves practically no money to improve the economy, not to mention the ecology. The depressed economy leads more hunters, prospectors and unemployed farmhands to invade protected areas in search of some means of supporting their families. Costa Rica, the only country in Latin America without an army, cannot keep everyone out of the wildlife areas except by offering the poor an alternative through integrated rural development.

The international conservation community has helped Costa Rica generously in the past, having provided more than \$4 million in grants to assist us in building our National Parks system. Today those who want to help Costa Rica build the parks and protect its wildlife can save two birds with one buck.

We propose that the donors who want to help preserve our natural heritage should use their dollars to buy some of Costa Rica's debt. The banks that hold much of the Latin American debt are selling these international equity notes on the market at well below their full value—in Costa Rica's case at about 45 cents to the dollar. In other words, you can buy \$1 million worth of Costa Rican obligations for \$450,000.

The Costa Rican government is in the

final stages of approving a plan to buy debt notes in local currency at close to 75 cents on the dollar at the real rate of exchange for conservation projects. That money would be placed in a special account, mutually controlled by the donor and the government for purposes they both agree on. For example, the World Wildlife Fund of the United States is now negotiating the purchase of \$100,000 of Costa Rican debt, to be used in support of our national parks.

Both the donor and the government benefit from this arrangement. The donor receives a greater value—an additional two-thirds more than his original dollar amount—to be invested in environmental projects. The Costa Rican government is able to save more of its dollar reserves—which otherwise would be used to service its debt—and to cancel some of its debt at a considerable discount.

Unless some of these innovative approaches to the debt crisis are tried, there will be no progress in such vital areas as conservation, education and health. Costa Rica's high level of education and social services has distinguished this nation from neighboring countries by laying the basis for a stable democracy. But if our standard of living deteriorates significantly, Costa Rica could become more prone to social upheaval. And as long as the debt continues to drain our nation of capital, there will be no economic growth.

We are willing to pay what we can afford to pay to service our debt. But without any development, the debts can never be paid. In order for Costa Rica to grow, some money must be invested in such long-term projects as reforestation. Innovative approaches such as the one suggested here will help protect our natural resources while helping to build a more stable economic system.

Mr. Umana is Costa Rica's Minister of Natural Resources, Energy and Mines.

DECRETO DE EMERGENCIA

EL PRESIDENTE DE LA REPUBLICA

EL MINISTRO DE INDUSTRIA, ENERGIA Y MINAS

Y EL MINISTRO DE AGRICULTURA Y GANADERIA

En ejercicio de las funciones que les confiere el inciso 18 del Artículo 140 de la Constitución Política y el Artículo 1º de la Ley 4374 de 14 de agosto de 1969 y su modificación

CONSIDERANDO:

1º. Que la conservación de los Recursos Naturales corresponde no sólo al sector público, sino que es deber de todos los ciudadanos de la República.

2º. Que actualmente el 60% de los terrenos de aptitud forestal ya han sido deforestados, lo que ha provocado que alrededor de un 42% de todos los suelos de Costa Rica, muestran rasgos diversos de erosión, estimándose las pérdidas de suelos en seiscientos ochenta millones de toneladas por año.

3º. Que muchas especies de fauna y flora de alto valor económico y científico han desaparecido o están en vías de extinción entre las cuales se encuentran aproximadamente veintidós especies maderables, veintidós especies de mamíferos y once especies de aves.

4º. Que la mayor parte de las cuencas se han deteriorado a un grado crítico provocando peligro de vidas humanas, daños en las cosechas agrícolas y producción pesquera, pérdidas en el hato ganadero y destrucción de infraestructura por inundaciones, sedimentación de los embalses ocasionando una disminución en la vida útil de los mismos y disminución del potencial hidroeléctrico del país.

5º. Que muchos ecosistemas han sido eliminados, o cuando menos alterados drásticamente, como es el bosque tropical seco y bosque húmedo premontano tropical.

6º. Que en los últimos años los bosques han sido diezmados aceleradamente por la acción de la explotación forestal irracional e incontrolable y el cambio de uso sin ninguna planificación, acción que sobrepasa los límites de control establecidos por la Dirección General Forestal del Ministerio de Agricultura y Ganadería, al no contar con los recursos operativos necesarios para establecer un efectivo sistema de seguimiento y control.

7º. Que la tasa de reforestación artificial actual está muy por debajo de las necesidades futuras del país, provocando una potencial erogación alta de divisas para importar madera.

8º. Que la falta de uniformidad en la legislación y políticas de las diversas instituciones públicas que se relacionan con el sector ha provocado una descoordinación que ha contribuido con este proceso de destrucción del recurso forestal.

9º. Que en vista del acelerado agotamiento del bosque natural es necesario la aplicación de incentivos para el manejo del bosque.

Por tanto;

DECRETAN:

ARTICULO 1º. Declarar estado de emergencia la actividad forestal con el propósito de detener el deterioro de este recurso y promover su recuperación para el desarrollo del país.

ARTICULO 2º. Créase una Comisión de Emergencia Forestal que estará integrada de la siguiente forma:

- El Primer Vicepresidente de la República quien la presidirá.
- El Ministro de Industria, Energía y Minas o Viceministro.
- El Ministro de Economía y Comercio o Viceministro.
- El Ministro de Hacienda o Viceministro.
- El Ministro de Gobernación y Policía o Viceministro.
- El Director General Forestal, quien fungirá como Secretario.
- Un Representante de la Organización que agrupe a los profesionales en Ciencias Forestales.
- Tres Representantes del sector privado: uno del sector forestal, otro del sector industrial primario y otro del sector industrial secundario, los cuales serán nombrados por sus respectivas organizaciones.
- Un Representante de los grupos conservacionistas privados.

Esta Comisión será la responsable del cumplimiento de todas las acciones establecidas en el presente Decreto y rendirá informes trimestrales al Presidente de la República a partir de la publicación del mismo.

Dicha Comisión dará la directrices y formulará una estrategia para el desarrollo forestal el país a corto y mediano plazo, e igualmente,

determinará los mecanismos necesarios para la elaboración del Plan Nacional de Desarrollo Forestal. Para lo anterior se rendirá un informe al Señor Presidente de la República en un plazo no mayor de tres meses a partir de la publicación de este Decreto.

Asimismo, la Comisión señalará los mecanismos de renovación sostenida del recurso forestal, dentro del marco de la Estrategia Nacional de Conservación para el Desarrollo Sostenido.

ARTICULO 3º. A fin de lograr el objetivo de esta declaratoria se aprueban las siguientes directrices:

a) Se garantizará permanencia de los bosques naturales existentes a través de su adecuado manejo. Para lo anterior se dispone lo siguiente:

a.1) Que la Dirección General Forestal en un plazo de tres meses identifique las áreas de bosque comercial y de protección que actualmente quedan en el país y realice los estudios necesarios con la finalidad de determinar las existencias reales de materia prima, ordenar el aprovechamiento y concentrar en ellas todos los esfuerzos para su adecuado manejo.

Una vez identificadas las áreas, se pondrá en práctica un plan para su protección y control.

a.2) Se promoverá activamente la integración del bosque productor remanente con la industria forestal como acción prioritaria a corto plazo, para lo cual se incentivarán aquellas industrias forestales que demuestren a la Dirección General Forestal que cuentan con abastecimiento propio de materia prima de fuentes sostenidas, para su operación continua y permanente, asimismo, a aquellas industrias que desarrollen proyectos forestales con ese mismo fin.

Para este caso, la Dirección General Forestal coordinará lo que corresponda con la Dirección General de Industrias del Ministerio e Economía y Comercio.

a.3) Un mes después de la publicación de este Decreto todas las instituciones públicas relacionadas con el uso del suelo, adoptarán como sistema oficial la metodología para calificación de tierras, contenida en el documento titulado "Sistema para la Determinación de la Capacidad de Uso de la Tierra", elaborado por el Centro Científico Tropical para el Ministerio de Agricultura y Ganadería en el año 1985.

a.4) El Sistema Bancario no asignará créditos agrícolas, ganaderos o de otro tipo, que conlleven a la eliminación del bosque, hasta tanto se obtenga la resolución de la Dirección General Forestal. En todo caso, el cambio de uso del suelo a otras actividades no forestales, solo será permitido con la debida autorización de la Dirección General Forestal.

a.5) La Dirección General Forestal difundirá los incentivos existentes que tiendan a la protección y permanencia de los bosques existentes.

b) Se impulsará agresivamente y de inmediato la reforestación nacional con el afán de abastecer las necesidades de productos forestales del país.

Para lo anterior se dispone lo siguiente:

b.1) Garantizar los recursos financieros necesarios para lograr el incremento de la reforestación nacional en forma paulatina hasta alcanzar una meta mínima de quince mil hectáreas anuales que requiere el país, a través de incentivos a la reforestación, créditos internos, externos, donaciones y otros. Para este propósito, la Comisión acelerará y propondrá lo que corresponda, con el fin de alcanzar las metas propuestas.

b.2) El Instituto de Desarrollo Agrario establecerá en forma obligatoria, que en toda finca que adquiera para parcelación agropecuaria, designará como mínimo un 10% del área para desarrollo forestal colectivo.

c) Se prohíbe la exportación de los productos forestales que clasifiquen en las siguientes partidas arancelarias:

- 44.03 00 00 Madera en bruto, incluso descortezada o simplemente desbastada.
- 44.04 00 00 Madera simplemente escuadrada.
- 44.05.00.00 Madera simplemente aserrada, en sentido longitudinal, cortada en hojas de desenrollada, de más de cinco milímetros de espesor.
- 44.07 00 00 Traviesas de madera para vías férreas.
- 44.09 00 00 Flejes de madera; rodrigones hendidos; madera en tablillas; madera simplemente desbastada o redondeada, pero sin tornear, curvar, ni haber sufrido otro trabajo, para bastones, paraguas, mangos y herramientas y similares.

44.13 00 00 Madera (incluidas las tablas o frisos para entarimados, sin ensamblar), cepillar, ranurada, machihembrada, con legüetas, rebajes, chaflanes o análogos.

No se permitirá la exportación de marcos para puertas y ventanas, por sí solos, contemplados en la partida arancelaria 44.19 00 00.

La Dirección General Forestal podrá prohibir la exportación de cualquier producto de madera que no esté incluida en la clasificación anterior, cuando lo considere conveniente en base a estudios realizados.

La Dirección General Forestal previo estudio y conveniencia podrá permitir la exportación de maderas conocidas como no comerciales, siempre y cuando provengan de plantaciones forestales y que no tengan mercado nacional.

Con el propósito de regular la exportación de productos forestales elaborados con materia prima proveniente del exterior, la Dirección General Forestal determinará administrativamente el grado de elaboración que se exigirá para esos productos.

c.1) El Ministerio de Economía y Comercio, conjuntamente con la Dirección General Forestal establecerán los mecanismos tendientes a controlar la importación de materia prima y también su procesamiento y exportación.

d) Se promoverá intensivamente el desarrollo de una cultura forestal que enseñe a la población a valorar y apreciar los productos y servicios del bosque. Para lo anterior se dispone lo siguiente:

d.1) El Ministerio de Educación Pública incluirá dentro de los programas académicos y dentro de las materias que así lo admitan, los temas que conduzcan a una mayor comprensión del uso y conservación de los recursos naturales renovables.

Para lo anterior, dentro de un plazo no mayor de tres meses, el Ministerio de Educación Pública rendirá un informe a la Comisión de Emergencia Forestal, sobre las medidas concretas a realizar para el cumplimiento de lo aquí indicado.

d.2) Bajo la orientación de la Dirección General Forestal, el Instituto Costarricense de Electricidad, el Instituto Costarricense de Acueductos y Alcantarillados, el Instituto de Fomento y Asesoría Municipal, el Instituto Nacional de Aprendizaje y entes de educación utilizando los medios a su disposición, deberán emprender acciones para fomentar la cultura forestal; las dependencias mencionadas rendirán ante la Comisión de Emergencia Forestal en un plazo no mayor de tres meses, un informe de las medidas propuestas para cumplir con esta disposición.

d.3) El Sistema Nacional de Radio y Televisión emprenderá de inmediato campañas intensivas de difusión sobre aspectos que tiendan a la protección de los bosques y a la reforestación. Para ello contará con la colaboración de la Dirección General Forestal, universidades y de los grupos forestales privados organizados.

d.4) Con el propósito de integrar al campesino a la actividad forestal, la Dirección General Forestal, con la colaboración de los entes de educación superior, desarrollará un programa de silvicultura social.

ARTICULO 4º. La Dirección General Forestal presentará en un plazo de quince días a partir de la publicación de este Decreto, un informe a la Comisión de Emergencia Forestal sobre los recursos financieros necesarios para atender adecuadamente el control y supervisión del aprovechamiento del bosque, de los proyectos de reforestación y de las exportaciones e importaciones de productos forestales, asimismo, de los recursos para el desarrollo de las acciones que promuevan la cultura forestal, la realización del inventario forestal y otros estudios técnicos.

ARTICULO 5º. Dentro de un plazo de 60 días a partir de la publicación de este Decreto, la Dirección General Forestal revisará los procedimientos técnico-administrativos que rigen el manejo y aprovechamiento del bosque y la reforestación; para lo cual, en su oportunidad, se tomarán en consideración las observaciones de los grupos privados organizados.

ARTICULO 6º. Los Ministerios de Obras Públicas y Transportes, de Gobernación y Policía, de Seguridad Pública, las Municipalidades y Asociaciones de Desarrollo Comunal colaborarán en el control de la tala de árboles, transporte de la madera y protección de acuíferos.

Para lo anterior, las instituciones mencionadas dispondrán de grupos debidamente capacitados por la Dirección General Forestal.

ARTICULO 7º. Para contribuir a garantizar a las generaciones futuras el abastecimiento del agua y de energía eléctrica en cantidad y calidad suficiente, dentro de los tres meses siguientes a la publicación del presente Decreto, el Instituto Costarricense de Electricidad (ICE) y el Instituto Costarricense de Acueductos y Alcantarillados (ICAA), deberá proponer con su respectivo contenido económico, programas de manejo integral y protección de cuencas hidrográficas a la Comisión de Emergencia Forestal.,

Dichas cuencas serán previamente identificadas, conjuntamente con la Dirección General Forestal y el "Grupo Ejecutivo", constituido mediante "Convenio de Colaboración Interinstitucional para el Manejo Integral de Cuencas Hidrográficas en Costa Rica", firmado el 14

de agosto de 1987 entre el Ministerio de Agricultura y Ganadería, el Ministerio de Industria, Energía y Minas, el Instituto Costarricense de Electricidad, el Servicio Nacional de Electricidad, el Servicio Nacional de Aguas Subterráneas, Riego y Avenamiento y el Instituto Costarricense de Acueductos y Alcantarillados.

ARTICULO 8º. La Comisión de Emergencia Forestal realizará las gestiones tendientes a lograr que el árbol en sus distintas fases de desarrollo, pueda ser considerado como garantía para fines crediticios, asimismo, el establecimiento de un sistema de seguros adecuados a la actividad forestal.

ARTICULO 9º. La Dirección General Forestal, con el propósito de detener el acelerado proceso de deforestación que vive el país, restringirá severamente el otorgamiento de permisos para la eliminación o tala de árboles, aprovechamiento del bosque o demás productos forestales, hasta tanto no cuenten con:

a) La identificación en un plazo no mayor de tres meses a partir de la publicación de este Decreto, de las áreas con bosque productor y de protección.

b) La revisión de todos los procedimientos técnico-administrativos, que regulan el aprovechamiento forestal en el país, conforme lo estipulado en el Artículo 5º.

c) Los recursos económicos para poder contar con los medios operativos y humanos necesarios, con el fin de poner en ejecución todas las actividades establecidas en el presente Decreto.

ARTICULO 10º. La Dirección General Forestal, dentro de un plazo no mayor de un mes a partir de la publicación de este Decreto, efectuará un inventario de trozas en patio de aserraderos y de finca.

ARTICULO 11º. La Dirección General Forestal, dentro de un plazo no mayor de tres meses a partir de la publicación de este Decreto, establecerá un registro de transportistas y extractores de la madera, a los cuales mediante una licencia, se les autorizará para dichas labores. Aquellos que violen cualquier disposición, le será cancelada la licencia correspondiente.

ARTICULO 12º. Ante cualquier abuso en precios y acaparamiento, o de cualquier otro tipo, se aplicará lo establecido en la Ley de Protección al Consumidos, #5665 de 28 de febrero de 1975 y sus reformas.

ARTICULO 13º. Todos los fondos que se designen para el desarrollo de las actividades aquí establecidas estarán exentas de los trámites

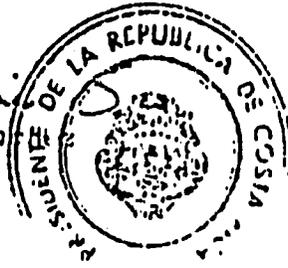
previstos en la Ley de Administración Financiera de la República y sus reformas, de acuerdo con lo estipulado en la Ley #4174, de 14 de agosto de 1969 y sus reformas.

ARTICULO 149. Rige a partir de su publicación.

Dado en la Presidencia de la República. San José a los dieciocho días del mes de setiembre de mil novecientos ochenta y siete.

Oscar Arias

Oscar Arias Sánchez



[Handwritten signature]

El Ministro de Industria, Energía y Minas

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El Ministro de Agricultura y Ganadería

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AUG 8 1987

III 8 1987

SENIOR ASSISTANT ADMINISTRATOR

Director Nadine M. Plaster
Regional Office for Central
American Programs (ROCAP)
Guatemala City, Guatemala

Dear Nadine:

As you know, there has been increased interest in the alarming rate of destruction and degradation of tropical forests. This matter has received international attention not only by the developing nations but by the donors as well. The UN Food and Agriculture Organization in collaboration with others has developed a Tropical Forestry Action Plan, the World Resources Institute has helped to give greater attention to tropical forests, and the World Bank has increased its funding for tropical forestry from one to two percent of its portfolio (\$138 million to \$250 million). The United Nations Development Program (UNDP) has also given additional emphasis to natural resources, including tropical forestry.

The three international organizations joined with the World Resources Institute and the Rockefeller Foundation in sponsoring a special conference at the Rockefeller Foundation Conference Center in Bellagio, Italy. The participants included national leaders from a number of the developing countries in addition to several donor organizations, including the Agency for International Development (A.I.D.). A list of the participants is enclosed.

After a two-day meeting, a report of the conference was given. Later a press conference was held to give some publicity to the suggestions of the participants. Enclosed is a statement prepared at the conference which summarizes some of the discussion.

I am making this information available to you to keep you informed. While A.I.D. took no major part in organizing the conference or in its implementation, should some of the actions be taken which were recommended, there would likely be involvement of the Agency, particularly in our field programs.

I would be particularly interested in any interaction you may have had with FAO, the World Bank, and others in developing national tropical forestry action programs or otherwise enhancing programs to reduce the destruction of tropical forests. Any other comments you may care to make concerning cooperation on tropical forests would be most welcome.

Very truly yours,



N. C. Brady
Senior Assistant Administrator
for Science and Technology

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STATEMENT
OF
THE BELLAGIO STRATEGY MEETING ON TROPICAL FORESTS

(held under the auspices of the Food and Agriculture Organization, the World Bank, the United Nations Development Programme, the World Resources Institute and the Rockefeller Foundation)

1 and 2 July 1987

A CONFERENCE AT BELLAGIO, ITALY, ON THE STATE OF THE WORLD'S TROPICAL FORESTS CALLED UPON WORLD LEADERS TO JOIN IN A "TROPICAL FORESTRY ACTION PLAN" AIMED AT CONSERVATION AND SUSTAINABLE USE OF REMAINING NATURAL TROPICAL FORESTS FOR THE BENEFIT OF DEVELOPING COUNTRY POPULATIONS AND THE WORLD AT LARGE.

THE NATURE OF THE TROPICAL FOREST CRISIS

TROPICAL FORESTS ARE BEING DESTROYED SO RAPIDLY THAT THEIR LOSS IS ONE OF THE MOST SERIOUS ENVIRONMENTAL THREATS OF OUR TIME.

DEFORESTATION IN THE TROPICS IS HAVING A DEVASTATING EFFECT IN DEVELOPING COUNTRIES ON FOOD PRODUCTION, FUELWOOD AND FODDER SUPPLIES, SOIL FERTILITY AND WATER RESOURCES. IT IS UNDERMINING AGRICULTURE IN THESE COUNTRIES AND EXACERBATING RURAL POVERTY. SPECIFICALLY:

- MORE THAN HALF OF THE WORLD'S TROPICAL FORESTS HAVE DISAPPEARED SINCE THE TURN OF THE CENTURY.
- THE CURRENT RATE OF DEFORESTATION EXCEEDS 11 MILLION HECTARES A YEAR.
- THE LIVELIHOOD OF 200 MILLION FOREST DWELLERS IS THREATENED.

people?

- MORE THAN ONE BILLION PEOPLE ARE SUFFERING FROM SHORTAGES OF FUELWOOD AND FODDER.
- DEVELOPING COUNTRY IMPORTS OF FOREST PRODUCTS ALREADY EXCEED US\$10 BILLION.
- THE DESTRUCTION OF TROPICAL FORESTS IS RESULTING IN WIDESPREAD LOSS OF UNIQUE ECOSYSTEMS, DIRECTLY CONTRIBUTING TO THE EXTINCTION OF PLANT AND ANIMAL GENETIC RESOURCES.

THE 56 WORST AFFECTED COUNTRIES CONTAIN MORE THAN HALF OF THE DEVELOPING WORLD'S POPULATION.

THE CAUSES OF DEFORESTATION ARE WELL KNOWN, INCLUDING POPULATION PRESSURE FOR AGRICULTURAL LAND, DEMAND FOR FUELWOOD AND FODDER, AND THE UNSUSTAINABLE EXPLOITATION OF FORESTS FOR INDUSTRIAL TIMBER PRODUCTION AND EXPORT. INAPPROPRIATE GOVERNMENT LAND TENURE, SUBSIDY, FOREST SETTLEMENT, AND POPULATION POLICIES ARE FACTORS IN FOREST DESTRUCTION. DEVELOPMENT ASSISTANCE AGENCIES CONTRIBUTE TO THE PROBLEM WHEN THEY FINANCE ENVIRONMENTALLY UNSOUND LARGE-SCALE DEVELOPMENT PROJECTS.

THE TROPICAL FORESTRY ACTION PLAN HAS FOCUSED WORLD ATTENTION ON THIS CRISIS. THE PLAN HAS BEEN ENDORSED BY FORESTRY LEADERS OF MORE THAN 60 DEVELOPING COUNTRIES AND ACCEPTED AS A BASIS FOR ACTION BY A SCORE OF BILATERAL AND MULTILATERAL DEVELOPMENT ASSISTANCE AGENCIES. A DOUBLING OF ANNUAL FOREST ASSISTANCE IN SUPPORT OF THE PLAN HAS BEEN PLEDGED, FROM US\$500 MILLION IN 1984 TO US\$1 BILLION IN 1988.

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THE CONFERENCE RECOMMENDATIONS

THE BELLAGIO CONFERENCE SHARES THE SENSE OF URGENCY FOR GLOBAL ACTION CALLED FOR IN THE TROPICAL FORESTRY ACTION PLAN. IT CONCENTRATED ON 10 MAJOR RECOMMENDATIONS FOR ADDRESSING THE CRISIS.

1. QUANTIFYING THE COSTS OF INACTION

THE ISSUE OF TROPICAL DEFORESTATION HAS BEEN IGNORED OR INADEQUATELY REFLECTED IN MOST GOVERNMENT DEVELOPMENT PLANS. ACTION IS NEEDED ON A COUNTRY BY COUNTRY BASIS TO SPECIFY THE IMPACTS ON HUMAN WELFARE AND THE ENVIRONMENT OF FAILURE TO CONTAIN DEFORESTATION. THIS IS A NECESSARY FIRST STEP TO GENERATING POLITICAL COMMITMENT FOR SUPPORT OF THE ACTION PLAN.

2. INCORPORATING RECOMMENDATIONS FOR ACTION INTO NATIONAL DEVELOPMENT PLANS

THE URGENCY OF THE FORESTRY CRISIS MUST BE COMMUNICATED TO NATIONAL ECONOMIC PLANNERS AND TO FINANCIAL AND POLITICAL LEADERS. THE OBJECTIVE SHOULD BE TO ENSURE THAT WITHIN FIVE YEARS ALL OF THE WORST AFFECTED COUNTRIES WILL HAVE INCORPORATED INTO THEIR NATIONAL DEVELOPMENT PLANS A LONG-RANGE STRATEGY FOR CONSERVATION AND SUSTAINABLE USE OF THEIR TROPICAL FORESTS.

3. PROMOTING PEOPLE'S PARTICIPATION

DEVELOPING COUNTRIES SHOULD BE ASSISTED TO IMPLEMENT A MAJOR PROGRAMME FOR INVOLVING MEN AND WOMEN OF LOCAL COMMUNITIES IN FOREST CONSERVATION AND TREE PLANTING. NON-GOVERNMENTAL ORGANIZATIONS HAVE A CRITICAL ROLE TO PLAY IN PROMOTING ACTION TO SAVE TROPICAL FORESTS AND IN PROMOTING GRASS ROOTS PARTICIPATION. SPECIAL ATTENTION SHOULD BE GIVEN TO RECLAMATION OF AGRICULTURAL WASTELAND AND DEGRADED WATERSHEDS.

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4. ENCOURAGING PARTICIPATION OF THE PRIVATE SECTORS

GOVERNMENT FOREST ADMINISTRATIONS ON THEIR OWN CANNOT COPE WITH THIS CRISIS. POLICY INCENTIVES SHOULD BE INTRODUCED THAT WOULD PROVIDE THE NECESSARY STIMULUS FOR PRIVATE SECTOR PARTICIPATION IN REFORESTATION, PARTICULARLY BY SMALL FARMERS AND LOCAL COMMUNITIES. WOMEN, WHO ARE THE MAIN HARVESTERS AND USERS OF WOOD, SHOULD BE MORE DIRECTLY INVOLVED IN FORMULATING RURAL FOREST POLICIES. PRIVATE INDUSTRY SHOULD BE ENCOURAGED THROUGH FISCAL INCENTIVES AND SIMILAR PROGRAMMES TO UNDERTAKE LARGE-SCALE INDUSTRIAL FOREST MANAGEMENT AND REFORESTATION PROJECTS WITHIN A SUITABLE LEGAL FRAMEWORK WHICH ENSURES NET REPLENISHMENT OF FOREST RESOURCES.

5. POLICY REFORMS

POLICY REFORM IS NEEDED FROM BOTH NATIONAL GOVERNMENTS AND DEVELOPMENT ASSISTANCE AGENCIES. NATIONAL GOVERNMENTS SHOULD, FOR EXAMPLE, ACT TO REMOVE SUBSIDIES AND OTHER INAPPROPRIATE POLICIES THAT ENCOURAGE ECONOMIC INEFFICIENCY AND OVER-HARVESTING OF FOREST RESOURCES. DEVELOPMENT ASSISTANCE AGENCIES SHOULD CONTRIBUTE TO THE PROTECTION RATHER THAN THE DESTRUCTION OF NATURAL ECOSYSTEMS.

6. PROTECTING TROPICAL FOREST ECOSYSTEMS

CONCERTED INTERNATIONAL SUPPORT SHOULD BE GIVEN TO A CAMPAIGN FOR PROTECTING THE 700 MILLION HECTARES OF REMAINING TROPICAL FOREST, THE PLANET'S GREATEST SOURCE OF PLANT AND ANIMAL DIVERSITY. THIS CAN BE ACHIEVED BY MAJOR EXPANSIONS OF PROTECTED AREAS AND BIOSPHERE RESERVES. ALSO BY ENCOURAGING MORE INTENSIVE AND MORE PROFITABLE USE OF DEGRADED FOREST LAND WHICH CAN THEREBY HELP TO RELIEVE PRESSURE ON PROTECTED AREAS.

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7. INTEGRATION OF FORESTRY INTO BROADER LAND USE CONCERNS

MANY OF THE SOLUTIONS TO DEFORESTATION WILL COME FROM OUTSIDE THE FORESTRY SECTOR. PROVIDING PEOPLE WITH AN ALTERNATIVE TO FOREST ENCROACHMENT REQUIRES GIVING THEM THE MEANS FOR INCREASING THEIR AGRICULTURAL PRODUCTIVITY. ENERGY CONSERVATION PROGRAMMES WILL IN MANY SITUATIONS DO MORE TO SAVE THE FOREST THAN INVESTMENT IN CREATION OF NEW RESOURCES. FORESTRY PLANNING NEEDS TO BE MORE CLOSELY INTEGRATED WITH THAT OF OTHER SECTORS.

8. STRENGTHENING RESEARCH

TECHNICAL, SOCIO-ECONOMIC AND POLICY RESEARCH MUST BE INTENSIFIED. THE POTENTIAL OF BIOTECHNOLOGY TO RAISE THE PRODUCTIVITY OF MULTIPURPOSE TREES FOR MEETING RURAL BASIC NEEDS SHOULD BE FULLY REALIZED. THE POSSIBLE SCOPE SHOULD BE EXAMINED FOR A CONSULTATIVE GROUP ON INTERNATIONAL FORESTRY RESEARCH AND POLICY DEVELOPMENT WITH COMPARABLE VISION AND DETERMINATION TO THE ONE ORGANIZED FOR AGRICULTURE ON THIS SAME CONFERENCE SITE ALMOST TWENTY YEARS AGO.

9. MONITORING OF TROPICAL DEFORESTATION

AN ANNUAL REVIEW OF THE STATUS OF WORLD FOREST RESOURCES AND OF PROGRESS BEING MADE IN HALTING FOREST DESTRUCTION IS RECOMMENDED. IN ADDITION TO GOVERNMENT AND AID AGENCY ASSESSMENTS, A CITIZEN'S REPORT SHOULD BE ENCOURAGED ON GRASS ROOTS PERCEPTION OF PROGRESS BEING MADE AT THE NATIONAL LEVEL IN ARRESTING DEFORESTATION.

10. COORDINATING INTERNATIONAL ACTION

THE TROPICAL FORESTRY ACTION PLAN PROVIDES AN EFFECTIVE FRAMEWORK FOR COORDINATING INTERNATIONAL ACTION. TO HELP GOVERNMENTS OF DEVELOPING COUNTRIES TO IMPLEMENT THE PLAN

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THE FOOD AND AGRICULTURE ORGANIZATION IS SUPPORTING EFFORTS TO COORDINATE BILATERAL AND MULTILATERAL AGENCY ASSISTANCE FOR STRENGTHENING FORESTRY SECTOR PLANNING.

FOLLOW-UP ACTION

AN INTERNATIONAL TASK FORCE WILL IMMEDIATELY BEGIN TO PREPARE SPECIFIC RECOMMENDATIONS FOR POLICY RESPONSES, FUNDING STRATEGIES AND INSTITUTIONAL MECHANISMS NECESSARY TO IMPLEMENT THESE AND RELATED RECOMMENDATIONS. A SECOND BELLAGIO FORESTRY CONFERENCE TO BE HELD WITHIN ONE YEAR WILL REVIEW THE TASK FORCE RECOMMENDATIONS AND MAKE PROPOSALS FOR THEIR ADOPTION.

AGREED AT BELLAGIO, ITALY

2 July 1987



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MAJOR POLICY REFORMS NEEDED
IN DEVELOPING COUNTRIES
TO SAVE THE TROPICAL FORESTS

Bellagio, Italy, July 3 -- Reforms at the political policy levels by governments and development assistance agencies are urgently needed for the salvation of the fast disappearing tropical forests of the world. That was the recommendation made yesterday by a meeting of government leaders from developing and developed nations and the heads of the world's principal foreign aid agencies.

The Bellagio Strategy Meeting on Tropical Forests concluded two days of consultations here on what it called "one of the most serious environmental threats of our time", the loss of the world's tropical forests that is taking place at a rate of 11 million hectares a year, an area of about the size of Belgium. They met under the auspices of the Food and Agriculture Organization, the World Bank, the United Nations Development Programme, the World Resources Institute and the Rockefeller Foundation.

As an example of the kind of reforms needed, the meeting recommended that "national governments should ... act to remove subsidies and other inappropriate policies that encourage economic inefficiency and overharvesting of forest resources."

Development assistance agencies, both national and international, were told that they should be sure that their policies "contribute to the protection rather than the destruction of natural ecosystems".

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The twenty-five government and international agency leaders met at the Bellagio Conference Center of the Rockefeller Foundation under the chairmanship of Mahbubul Haq, Minister of Planning and Development of Pakistan and a former Vice-President of the World Bank.

Their recommendations began with a warning that loss of tropical forests is ruining the basis for agriculture in the developing world. They said that the situation is most serious in 56 countries.

"Deforestation in the tropics is having a devastating effect in developing countries on food production, fuelwood and fodder supplies, soil fertility and water resources. It is undermining agriculture in these countries and exacerbating rural poverty."

The level of funds earmarked for assistance to forestry in the tropics has risen dramatically in a very short period, from US\$500 million in 1984 to US\$1 billion for 1988.

The conference gave strong endorsement to a "Tropical Forestry Action Plan" that would conserve and at the same time utilize tropical forests and associated ecosystems. The Plan, which was first brought forth in 1985, has, said the conference; received the approval of all of the world's major development assistance agencies, both bilateral and multilateral.

It said that "more than half of the world's tropical forests have disappeared since the turn of the century", and that "the livelihood of 200 million forest dwellers is threatened".

Once wood-rich countries in the tropics are now heavy importers of forest products. "Developing country imports of forest products already exceed US\$10 billion a year."

The meeting's report warned of the global dangers in terms of disappearing biological resources.

"The destruction of tropical forests is resulting in widespread loss of unique ecosystems, directly contributing to the extinction of plant and animal genetic resources."

The reasons for the accelerating loss of tropical forests, said the report, consist of a complex of inter-dependent factors. These include "population pressure for agricultural land ... the unsustainable exploitation of forests for industrial timber production and export ... inappropriate government land tenure, subsidy, forest settlement, and population policies."

The report, endorsed by high officials of the world's principal development aid agencies, specifically noted that such "agencies contribute to the problem when they finance environmentally unsound large-scale projects." It was in this context that they advised both governments of developing countries that request such projects and the organizations that exist for the purpose of granting funds and carrying out the projects to adopt wise political policies.

Among those attending the meeting were Margaret Catley-Carlson, President, Canadian International Development Agency; Kamla Chowdhry, Chairperson, National Wastelands Development Board, India; Cheikh Cissoko, Minister for the Protection of Nature, Senegal; Jorge Dengo, First Vice-President, Costa Rica; William Draper III, Administrator, United Nations Development Programme; John Evans, Chairman of the Rockefeller Foundation; David Hopper, Senior Vice-President, World Bank; General Olusegun Obasanjo, former Head of State, Nigeria; James Gustave Speth, President, World Resources Institute; M.S. Swaminathan, Director General, International Rice Research Institute, Philippines; Mostafa K. Tolba, Executive Director, United Nations Environment Programme; Declan J. Walton, Deputy Director-General, Food and Agriculture Organization; and Joseph C. Wheeler, Chairman, Development Assistance Committee, Organisation for Economic Cooperation and Development.

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at the VILLA SERBELLONI

627th Conference

STRATEGY MEETING ON TROPICAL FORESTS

June 30 - July 3, 1987

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