DRAFT

ENVIRONMENTAL PROFILE

on

The Republic of

COSTA RICA

National Park Service Contract No. CX-0001-0-0003

U.S. Man and the Biosphere Secretariat
Department of State
Washington, D.C.

Funded by A.I.D., Bureau of Science and Technology,
Office of Forestry, Environment and Natural Resources
RSSA #SA/TOA 1-77

JULY 1981

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- Dr. James Silliman, Compiler -

THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE
Department of State, IO/UCS
WASHINGTON. D. C. 20520

An Introductory Note on Draft Environmental Profiles:

The attached draft environmental report has been prepared under a contract between the U.S. Agency for International Development (A.I.D.), Bureau of Science and Technology (ST/FNR) and the U.S. Man and the Biosphere (MAB) Program. It is a preliminary review of information available in the United States on the status of the environment and the natural resources of the identified country and is one of a series of similar studies now underway on countries which receive U.S. bilateral assistance.

This report is the first step in a process to develop better information for the A.I.D. Mission, for host country officials, and others on the environmental situation in specific countries and begins to identify the most critical areas of concern. A more comprehensive study may be undertaken in each country by Regional Bureaus and/or A.I.D. Missions. These would involve local scientists in a more detailed examination of the actual situations as well as a better definition of issues, problems and priorities. Such "Phase II" studies would provide substance for the Agency's Country Development Strategy Statements as well as justifications for program initiatives in the areas of environment and natural resources.

Comments on the attached draft report would be welcomed by USMAB and ST/FNR and should be addressed to either:

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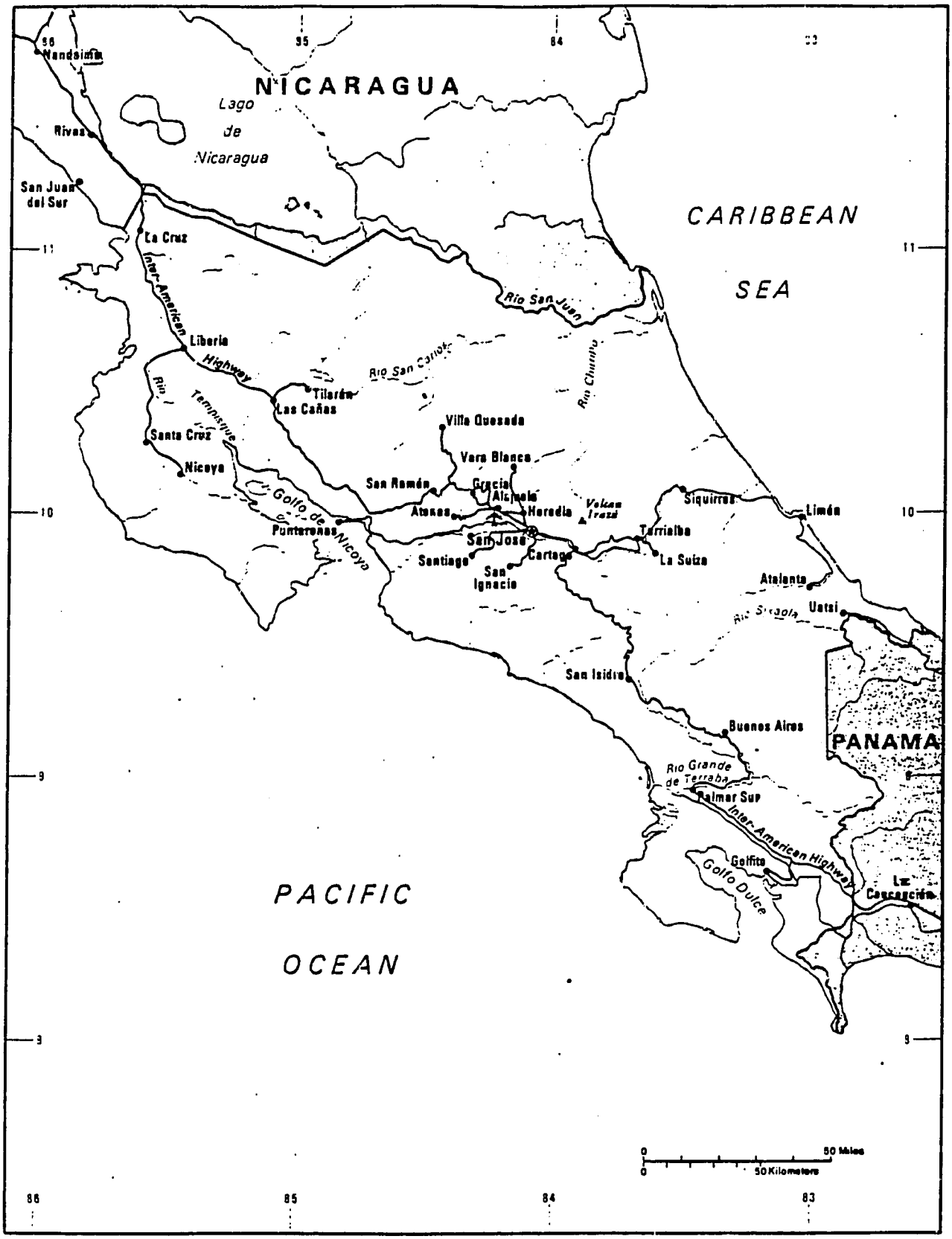
Costa Rica



503488 1-76 (541301)
Lambert Conformal Projection
Standard parallels 9°20' and 14°40'
Scale 1:2,400,000
Boundary representation is not necessarily authoritative

Railroad
Road
Airport

SUMMARY

Costa Rica is a Central American nation endowed with a rich variety of physical and biological resources, despite its relatively small size. A central range of volcanic cones and mountainous ridges, reaching elevations in excess of 3000 meters, separates the wet Caribbean slope from the drier Pacific coast. This diverse range of environments supports an equally diverse flora and fauna, which include elements of both North and South American origin. Mineral resources, still poorly explored, include a variety of heavy metals. Soils range from fertile but local volcanic deposits to the typically fragile and well-leached soils found beneath wet tropical forest. With the exception of the driest parts of the Pacific northwest, both surface water and groundwater supplies are abundant throughout Costa Rica.

Costa Rica's economy traditionally has been based on its agricultural production. Native forests have been extensively cleared and converted to farmland, both for subsistance crops such as corn and beans, and cash crops for export, particularly coffee and bananas. Within the last two decades, a very strong trend has developed to convert both forest and cropland to cattle pasture. Soils near the traditional population center surrounding the capital of San José have been the most heavily used, followed by those of the Pacific slope in general, the next most populous region. Recent road construction on the Caribbean slope has stimulated further clearing and cultivation there, particularly by small farmers seeking to colonize new frontiers.

Costa Rica's most pressing environmental problems are:

Destruction of forest resources. Although forests once covered almost all of Costa Rica, they have now largely been cleared for agriculture. Most of the fallen timber is not put to any economic use, but is instead wasted by burning or rotting. Part of the responsibility for this wastage can be attributed to colonization and land tenure laws which bestow benefits for clearing forest but not for conservation. Economic incentives for reforestation are lacking, and reforestation has been scanty.

Progressive land degradation. More serious than the loss of timber itself is the progressive land degradation which follows deforestation. The most widespread problem is loss of soil fertility after several years of annual cropping, followed by conversion to weedy and unproductive pasture. Intensively used areas, particularly on the Pacific coast, also suffer from flooding, landslides, and general erosion. Land degradation problems originate from inappropriate land use methods.

Lack of information and technical ability. In order to develop a comprehensive and effecitve land use policy, Costa Rica needs better surveys of its natural resources. Monitoring systems for both urban and rural environmental pollution are virtually non-existant. There is also a scarcity of technicians capable of conducting natural resources and pollution surveys.

Although Costa Rica suffers from serious natural resources management problems, it has made great strides towards achieving important conservation goals, particularly in the last 20 years. A successful family-planning program has reduced the population growth rate from 3.1 to 2.2 percent. The enactment of the Forest Law of 1969 spawned Central America's best national park system and marked the beginning of efforts to control deforestation. Recent government re-settlement programs, such as one currently underway in Guanacaste, are emphasizing more efficient use of land. The General Health Law of 1973 gave the Ministry of Health broad powers to control environmental pollution. Costa Ricans are also growing more aware of environmental problems and the value of conservation. With determined leadership, and given the necessary technical resources, Costa Rica could become a model for tropical American environmental management.

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1.0 Introduction

This draft environmental profile summarizes information available in the United States on the natural resources and environment of the Republic of Costa Rica. The report reviews the major environmental problems of Costa Rica and the impact of the development process upon resources and the environment. This draft report represents the first step in developing an environmental profile for use by the U.S. Agency for International Development (U.S. AID) and Costa Rican government officials. The next step in this process should be a field study to evaluate the information presented here, obtain additional information, and define the issues, problems, and priorities in greater detail. This entire process should help provide direction in future efforts to deal with the management, conservation, and rehabilitation of the environment and natural resources.

The information and interpretations in this report are preliminary and are not intended to attain the detail and accuracy required for development planning. The report represents a cooperative effort by the Man and the Biosphere (MAB) project staff of the Arid Lands Information Center (ALIC). The primary research, writing, and analysis were done by James Silliman, through the resources of ALIC and the University of Arizona Library. The cooperation of James Corson, AID/MAB Project Coordinator, and other AID personnel is gratefully acknowledged.

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2.0 General Description

2.1 Geographic Features[1/]

Costa Rica is located in a narrow section of the Central American isthmus, between Nicaragua to the north and Panama to the east. With an area of 51,000 square km., Costa Rica is one of the smallest Central American republics, extending only about 460 km at its greatest length between the two borders. The flat, open Caribbean coast, 210 km long, constrasts sharply with the irregular and hilly Pacific coast, some 1016 km long. Although the coasts are separated at the narrowest point by just 125 km, the coastal regions differ considerably in climate, partly due to the influence of the high interior mountain ranges which run the length of the country. The Caribbean lowlands, the interior highlands, and the Pacific coastal region comprise the three major geographic regions of Costa Rica (Figs. 1 and 2).

2.1.1 The Caribbean Lowlands

Comprising about one fifth of the country, the Caribbean lowlands are a continuation of the vast Nicaraguan lowlands. Widest along the border with Nicaragua, the lowlands narrow to the south where foothills of the interior mountains extend almost to the coast. The land is predominantly flat plains, dissected by incised streams spaced 10 to 30 km apart. Most interstream areas are less than 15 m above the adjacent valley bottoms. Hills are scattered, but more common in the north, and generally consist of rounded ridges and peaks between 150 and 300 m above the plain. The hill area north of Pital is the most extensive, while the hills northeast of Guapiles are the most rugged. Most hillside slopes range from 10 to 30 percent, the remaining steeper hills have slopes of 30 to 45 percent.

The northern part of the lowlands is drained by the Rio San Juan, which forms the eastern boundary with Nicaragua. An extensive delta has built up at the mouth of the San Juan, which is in flood from September through November. Though shallow, the San Juan is navigable from the Caribbean to Lake Nicaragua. All but one of the remaining rivers draining the area south of the San Juan are too small to have extensive flood plains or deltas. The exception is the Rio Sixaola,

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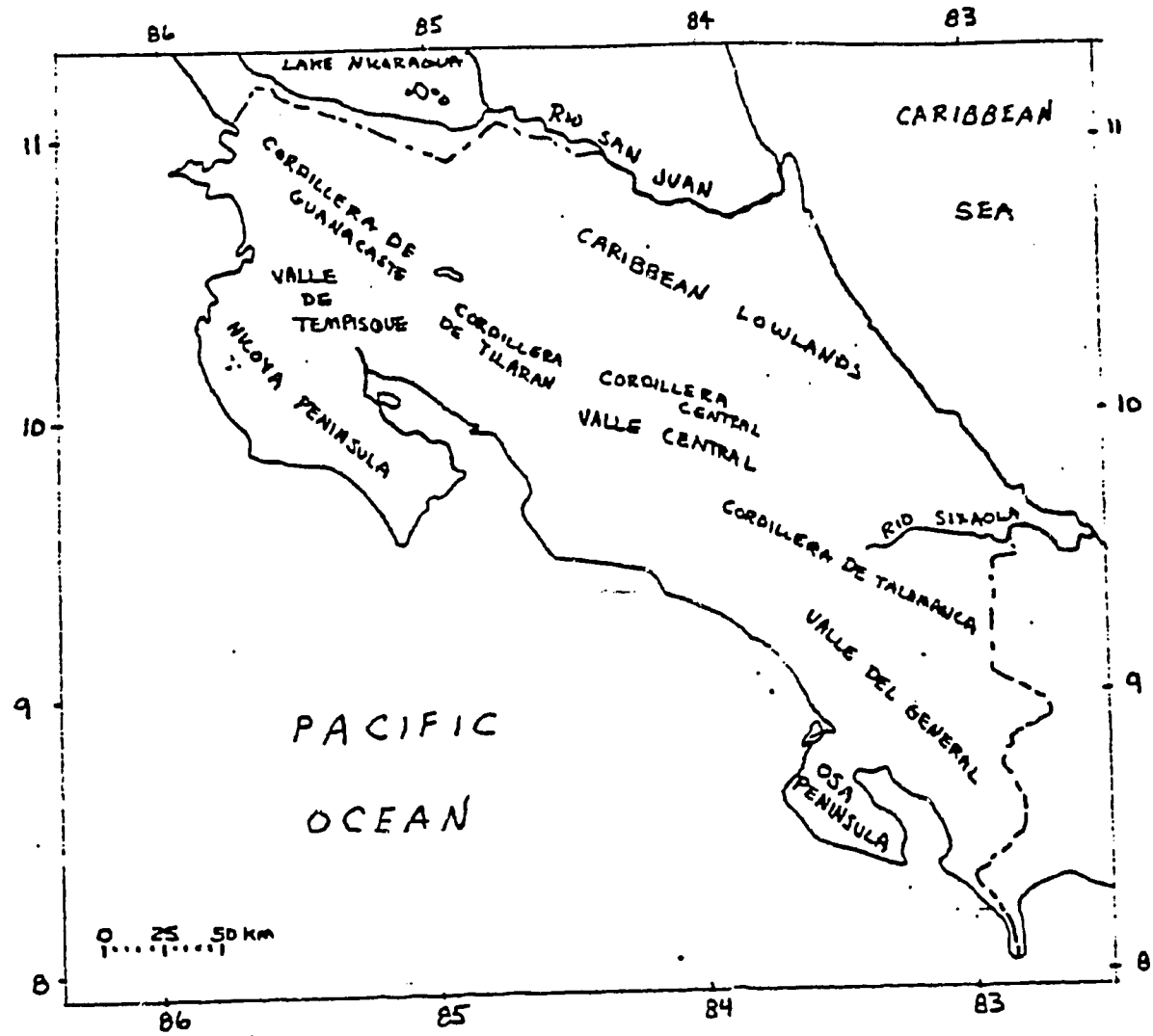
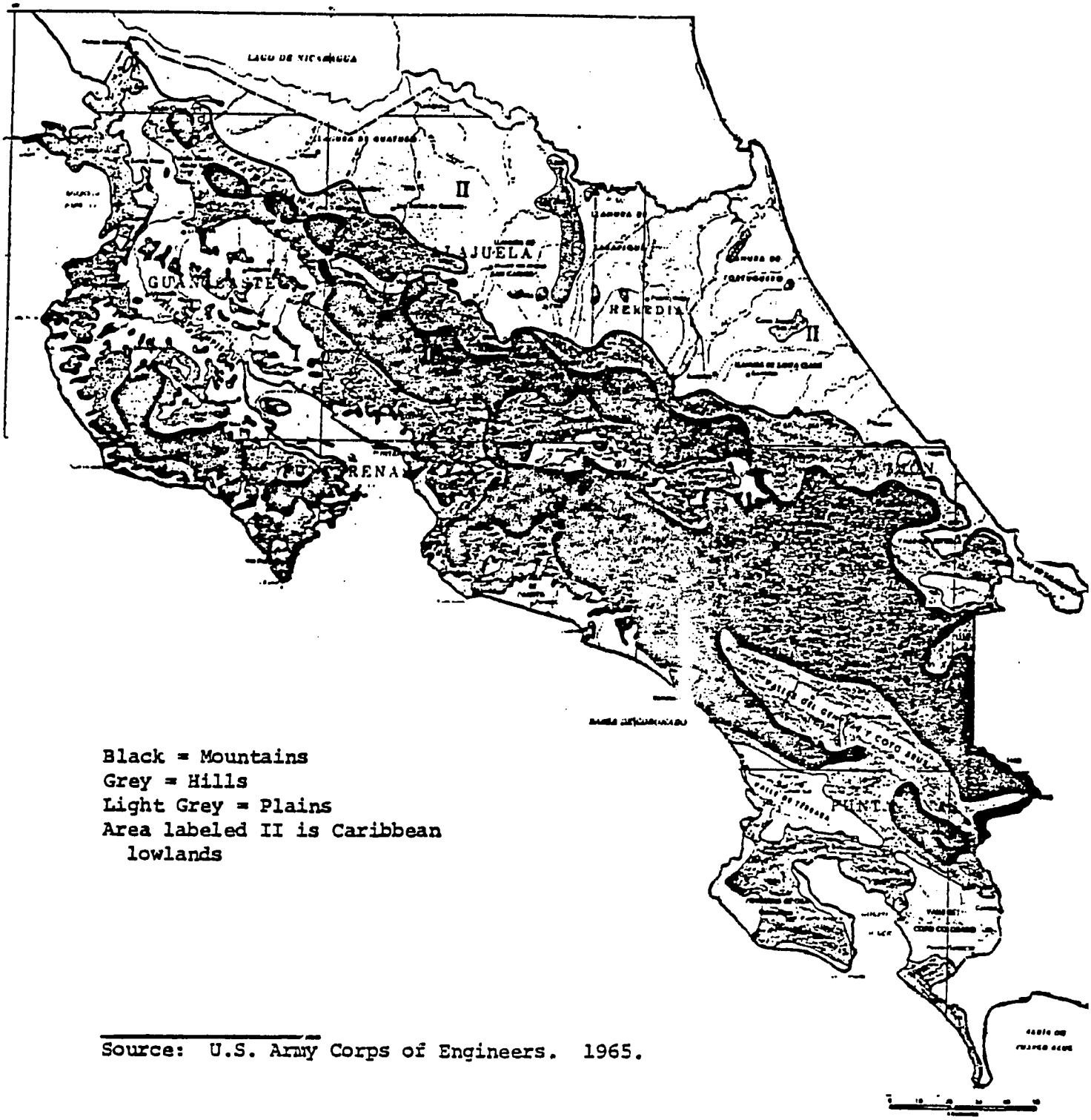
[1] Sources: American University. 1970.
Kurian. 1978.
U.S. Army Corps of Engineers. 1965.

Figure 1. Major Geographic Features of Costa Rica



Source: U.S. Army Corps of Engineers. 1965.

Figure 2. Major Features of Relief



Black = Mountains
Grey = Hills
Light Grey = Plains
Area labeled II is Caribbean lowlands

Source: U.S. Army Corps of Engineers. 1965.

the lower reaches of which form the border with Panama. The Sixaola has a small delta referred to in Costa Rica as the Valle de Talamanca (Fig. 2).

2.1.2 The Interior Highlands

A chain of mountains and ridges runs almost the entire length of Costa Rica, from northwest to southeast. These mountains, together with their associated foothills and upland basins, form the interior highlands (Figs. 1 and 2).

The mountain chain is divided into four ranges: the Cordillera de Guanacaste to the northwest, followed in sequence by the Cordillera de Tilaran, the Cordillera Central, and the Cordillera de Talamanca, extending to the Panamanian border. The granitic Cordillera de Talamanca has ten peaks over 2950 m, including Chirripo Grande (3810 m), the highest point in the country. Four volcanos form the backbone of the Cordillera Central, including Barba (2906 m), Poás (2705 m), Irazú (3432 m), and Turrialba (3339 m). Poás and Irazú are both active; Irazú erupted destructively in 1963-65. The Guanacaste range also contains four major volcanos, the highest of which is Miravalles (2020 m). Volcán Arenal (1633m) is an outlying peak southeast of the Guanacaste range. A pass marked by Laguna Arenal separates the Cordillera de Guanacaste from the Cordillera de Tilaran, which is not volcanic. Extending from Tilaran south to San Ramón, it consists of hills and ridges less than 1500 m in elevation. Rugged mountain country is characterized throughout by steep slopes and narrow valleys, with differences in elevation between crests and adjacent valley bottoms ranging from 900 to 1800 m.

Upland basins of importance are the Valle Central and Valle del General. Of these, the Valle Central (also called the Meseta Central) is the higher and more densely settled. It includes the capital city of San Jose and the provincial capitals of Alajuela, Heredia, and Cartago. Lying between the Cordillera Central to the north and low mountains and hills to the south, the Valle Central is located in cooler country, 1000 to 1500 m above sea level. It is actually composed of two basins separated by low volcanic hills. The slightly higher and smaller eastern basin, called the Cartago basin, is drained by the Río Revantazón, which flows through a deeply gorged valley to the Caribbean. The larger San José basin is drained by the Río Grande de Tárcoles, which empties into the Pacific south of Puntarenas. Southeast of the Valle Central is the Valle de General, bordered by the Cordillera de Talamanca to the north and the southwestern coastal mountains. About the same size as the Valle Central, the floor of

the Valle del General is lower, ranging from 200 to 1000 m in elevation. It drains via the Río General and Río Grande de Térraba to the Pacific at Puerto Cortes. The relief of the upland basins consists of low hills and small scattered flat to rolling plains. Hills slope from 10 to 30 percent and hill tops are generally 150 to 450 m above adjacent low areas.

2.1.3 Pacific Coastal Region

In contrast to the low, broad, sandy beaches of the Caribbean, the Pacific coast mainly consists of steep cliffs, with occasional narrow beaches. Islands scattered along the coast are generally hilly and dissected, and from 90 to 210 m high. The two major coastal peninsulas, Nicoya to the north and Osa to the south, are mostly rugged hills with small, fringing plains. Slopes are commonly between 30 and 45 percent, with differences between crests and adjacent valley bottoms ranging from 360 m in the hills to 910 m in more mountainous country. The highest peak on the Nicoya peninsula is Cerro Azul at 1018 m, and the highest on the Osa peninsula is Cerro Tigre at 782 m.

A narrow, alluvial coastal plain extends northward from the Osa peninsula to the port of Puntarenas. This plain is squeezed out in some places by low coastal mountains. North of Puntarenas, the plain widens and merges with the broad valley of the Río Tempisque, which extends north from the head of the Nicoya gulf. The Tempisque Valley is a largely low, smooth plain with scattered escarpments, elongated hillocks, and low hills. Slopes in the valley are generally less than 2 percent, while hills and escarpments of 120 to 180 m above the plain slope from 10 to 30 percent. The northern reaches of the plain are separated from the Pacific Ocean and Nicaragua only by low hills.

2.2 Climate[2/]

As is typical of tropical climates, temperatures in Costa Rica are determined primarily by elevation. A gain of 1000 m in elevation lowers mean temperatures by about 5°C (Table 1). Thus Esparta, at 208 m, has average daily highs of 31°C (87°F) and

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[2]Sources: American University. 1970.
U.S. Army Corps of Engineers. 1965.

lows of 22°C (71°F), while San José at 1172 m, has average highs of 26°C (79°F), and lows of 15°C (59°F). Another 1000 m higher, at 2337 m on the slopes of Volcán Irazú, Sanatorio Durán records typical highs of 20°C (68°F) and lows of 10°C (50°F).

The interior highlands also affect climate by blocking the rain-bearing northeast trade winds, causing heavy and continual rainfall along the Caribbean coast (Fig. 3, Table 2). The heart of the rainy season on the Pacific coast is May to October, when southwest winds blow on shore. The wetter conditions on the Caribbean slope are related to cooler temperatures. For example, Siquirres, on the Caribbean plain and at an elevation 100 m lower than Esparta on the Pacific side, is normally 1-3°C cooler than Esparta (Table 1, Fig. 3). Another example is Buena Vista de San Carlos, located on the Caribbean slope at an elevation 100 m lower than San Jose. Its average high is only 23°C, compared to 26°C for San Jose (Table 1, Fig. 3).

Rainfall patterns vary considerably from region to region, as indicated by the local differences in rainy season duration shown in Figure 3. These differences are generally a function of local topography interacting with prevailing winds and are correlated with annual rainfall. For example, the Golfo Dulce region in the Pacific southwest has a 9-month rainy season and a high annual rainfall (4600 mm at Golfito), whereas the Valle de Tempisque region of the Pacific northwest has a 6-month rainy season and is rather dry (1900 mm per year at Canas). The Valle de Tempisque sometimes suffers severe drought even during the rainy season and receives practically no rain in the dry season (Table 2). The heavy rains at Golfo Dulce are caused by the coastal mountains of the region acting as a watershed for onshore winds, while the Valle de Tempisque is dry because it is in the lee of the Nicoya peninsula. However, even the Caribbean coast, with its lack of relief and absence of seasonal rainfall, still shows considerable local variation in annual rainfall. The delta region of the Rio San Juan receives more than 6000 mm of annual rainfall, while the delta of the Rio Sixaola, just 175 km southeast, receives only a third of that amount. The causes of this extreme regional variation are unclear.

Data on relative humidity, wind direction and wind velocity, available for only a few stations, are given in Table 3.

Table 1. Temperature Records, °C. For station localities, see Fig. 3.

STATION	ELEVATION	YEARS OF RECORD	ENE	FEB	MAR	ABR	MAY	JUN	
Avance, Tres Ríos	1,870 m.	10	22.4	23.8	24.6	24.3	22.5	22.3	Máxima
		10	16.1	16.7	17.3	17.8	17.5	17.5	Media
		10	9.8	9.7	10.0	11.2	12.5	12.7	Mínima
Buena Vista de San Carlos	1,090 m.	10	21.9	22.6	23.9	24.6	23.8	23.2	Maximum
		10	17.9	18.4	19.4	20.0	20.2	19.7	Mean
		10	13.9	14.2	14.7	15.4	16.3	16.4	Minimum
Cairo, Siquirres	100 m.	20	29.4	29.4	30.0	30.6	31.2	31.1	
		20	23.4	23.4	24.1	24.8	25.4	25.5	
		20	17.4	17.5	18.4	19.0	19.7	19.8	
El Coco, Alajuela (Aeropuerto)	920 m.	5	27.4	28.6	29.6	30.0	28.9	27.8	
		5	22.0	22.8	23.5	23.8	23.1	22.5	
		5	16.7	16.9	16.8	17.2	17.4	17.6	
Esparta	208 m.	10	30.4	31.8	34.2	33.8	31.1	29.9	
		10	26.0	27.1	28.8	28.8	26.9	26.2	
		10	21.7	22.3	23.4	23.6	22.8	22.5	
Palmares	1,017 m.	5	28.0	27.8	30.3	30.1	28.6	28.1	
		5	21.0	21.1	22.8	22.5	22.9	22.8	
		5	13.9	14.2	15.3	15.2	17.2	17.4	
San Isidro de El General	703 m.	10	28.2	29.3	29.9	29.8	28.2	27.6	
		10	22.5	23.1	23.8	24.0	23.5	23.1	
		10	16.9	17.0	17.6	18.3	18.5	18.4	
San José	1,172 m.	20	23.9	24.5	28.0	26.8	26.7	26.5	
		20	19.0	19.3	20.3	21.0	21.4	21.4	
		20	14.2	14.3	14.7	15.5	16.1	16.1	
San Vito de la Jaba	1,019 m.	5	28.7	28.4	30.8	29.6	28.5	28.1	Máxima
Sanatorio Durán	2,337 m.	10	19.4	19.2	19.6	20.1	19.6	19.5	
		10	14.4	14.5	14.8	15.4	15.0	14.7	
		10	9.5	9.7	10.1	10.7	10.3	9.9	
Tilarán	562 m.	10	27.6	28.2	29.2	30.3	29.9	28.8	
		10	22.9	23.3	24.0	24.9	24.9	24.4	
		10	18.3	18.5	18.9	19.5	19.9	19.9	
Turrialba (I.I.C.A.)	602 m.	10	28.7	26.2	27.7	28.2	29.0	28.6	Máxima

	JUL	AGO	SET	OCT	NOV	DIC	AÑO YEAR	
Avance, Tres Ríos	22.4	22.8	22.9	21.6	21.8	22.2	22.8	Máxima
	17.2	17.2	17.3	17.2	16.4	16.3	17.0	Media
	11.9	11.7	11.8	12.1	11.1	10.4	11.2	Mínima
Buena Vista de San Carlos	22.2	22.9	24.3	22.0	21.5	21.4	22.9	Maximum
	19.1	19.5	19.7	19.0	18.4	18.0	19.1	Mean
	16.0	16.2	16.1	15.9	15.4	14.7	15.4	Minimum
Cairo, Siquirres	30.1	30.9	31.9	31.1	30.2	29.5	30.4	
	24.8	25.2	25.8	25.3	24.6	23.9	24.7	
	19.5	19.6	19.6	19.5	19.0	18.3	18.9	
El Coco, Alajuela (Aeropuerto)	27.6	27.6	27.5	27.1	27.0	27.0	28.0	
	22.5	22.5	22.3	22.0	22.1	22.1	22.6	
	17.8	17.4	17.3	16.8	17.2	17.2	17.2	
Esparta	29.8	29.7	29.7	28.7	28.8	29.6	30.8	
	26.0	25.8	25.8	25.4	25.3	25.5	26.5	
	22.2	21.9	22.0	22.1	21.8	21.4	22.3	
Palmares	27.9	28.1	27.8	26.7	26.4	26.5	28.0	
	22.0	22.2	22.1	21.7	21.0	20.6	21.9	
	16.9	16.4	16.6	16.7	15.8	14.8	15.9	
San Isidro de El General	27.2	27.7	27.8	27.2	27.3	27.5	28.1	
	22.7	22.8	22.8	22.5	22.4	22.4	23.0	
	18.0	17.9	17.8	17.9	17.5	17.3	17.8	
San José	25.5	25.9	26.8	25.9	24.8	24.1	25.6	
	20.6	20.8	20.9	20.6	19.9	19.3	20.4	
	15.8	15.8	15.5	15.2	15.1	14.6	15.2	
San Vito de la Jaba	27.6	27.8	27.6	27.1	27.1	28.0	28.4	Máxima
Sanatorio Durán	19.9	19.4	19.5	19.1	19.4	19.2	19.5	
	14.9	14.9	14.8	14.4	14.8	14.5	14.7	
	10.0	10.5	10.1	9.8	9.7	9.7	10.0	
Tilarán	29.5	29.6	29.1	28.8	27.9	28.5	28.6	
	24.0	24.2	24.3	23.8	23.6	23.8	23.9	
	19.7	19.7	19.3	19.4	19.3	19.0	19.3	
Turrialba (I.I.C.A.)	28.1	28.1	28.7	27.9	26.8	26.3	27.6	Máxima

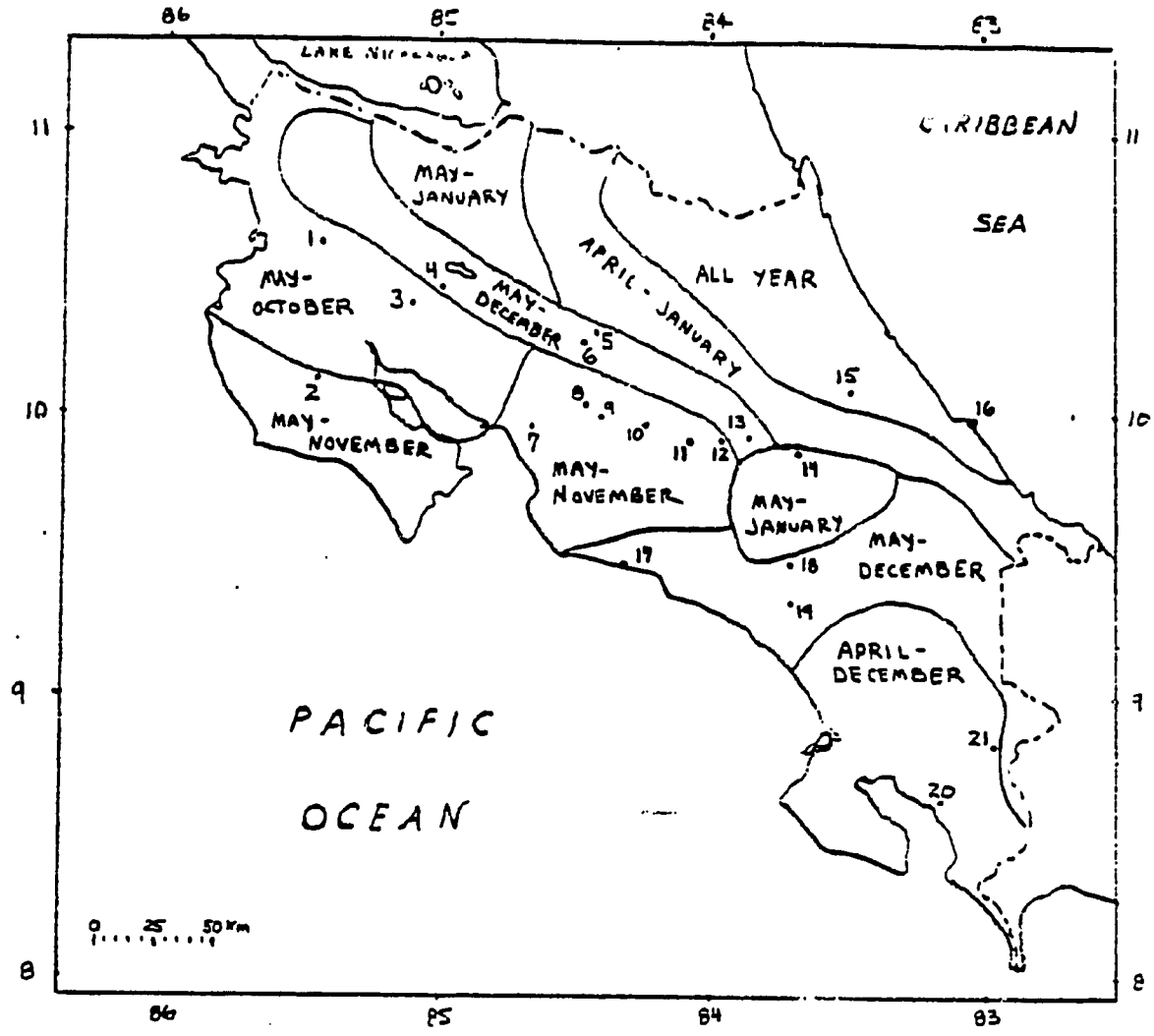
Source: U.S. Army Corps of Engineers. 1965.

Table 2. Precipitation Records, mm. For station localities, see Fig. 3.

STATION	ELEVATION	YEARS OF RECORD	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SET	OCT	NOV	DIC	YEAR
Cairo, Siquirres	100 m.	20	283.5	217.5	160.6	214.4	382.1	368.5	407.7	271.3	202.8	334.0	395.1	432.0	3669.7
Cañas	68 m.	10	6.8	22.2	2.4	45.6	284.3	280.2	186.3	235.3	350.6	442.1	61.8	8.5	1926.1
Golfito	15 m.	20	145.7	131.1	176.8	255.0	436.6	416.6	484.1	504.4	526.2	713.4	517.7	302.4	4612.0
La Argentina de Grecia	825 m.	30	5.9	5.1	9.6	46.3	299.6	324.4	259.9	281.5	348.7	421.9	152.8	43.8	2179.5
Liberia	144 m.	10	0.9	0.2	2.6	20.4	259.1	282.1	195.3	180.2	352.5	345.1	54.8	7.0	1880.2
Liaño	3 m.	20	323.0	229.8	216.1	245.4	321.7	303.8	410.8	322.9	121.4	246.4	386.5	498.9	3626.7
Nicoya	130 m.	10	4.3	10.2	26.4	34.7	281.5	339.0	220.6	337.4	421.5	473.2	98.6	15.2	2262.6
Pocares, Parrita	6 m.	20	45.1	15.8	23.3	108.5	335.7	417.0	424.0	363.3	402.1	601.1	316.5	129.8	3182.2
San Isidro de El General	703 m.	20	28.4	15.2	22.6	139.4	370.1	318.1	337.6	387.3	385.2	584.6	268.8	86.8	2944.1
San José	1,172 m.	30	8.4	5.3	10.5	36.8	244.5	284.4	229.5	233.3	342.4	333.0	171.7	46.5	1946.3
Sanatorio Durán	2,337 m.	20	38.5	15.7	6.6	20.2	203.2	223.3	129.7	136.4	187.4	284.8	152.7	84.5	1482.6
Turrialba (I.I.C.A.)	602 m.	30	170.8	113.5	78.7	98.9	216.6	246.8	258.7	206.6	207.3	240.6	271.9	300.2	2410.8
Villa Mills	3,096 m.	15	37.3	22.9	26.8	78.7	405.9	361.8	249.4	298.2	427.3	536.2	223.7	103.0	2772.6
Villa Quesada	656 m.	10	320.3	213.1	116.2	66.3	324.3	431.2	512.4	493.4	468.2	514.5	442.0	562.7	4464.6

Source: U.S. Army Corps of Engineers. 1965.

Figure 3. Regional Rainy Seasons and Station Localities



Numbered stations:

1. Liberia
2. Nicoya
3. Cañas
4. Tilarán
5. Villa Quesada
6. Buena Vista de San Carlos
7. Esparta
8. Palmares
9. Las Argentina de Grecia
10. El Coco, Alajuela
11. San José
12. Avance, Tres Rios
13. Sanatorio Durán
14. Turrialba
15. Cairo, Siquirres
16. Limón
17. Pocares, Parrita
18. Villa Mills
19. San Isidro
20. Golfito
21. San Vito

Source: U.S. Army Corps of Engineers. 1965.

Table 3. Humidity and Wind Records

MEAN VALUES OF RELATIVE HUMIDITY

ESTACION STATION	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SET	OCT	NOV	DIC	AÑO YEAR	
El Coco,	89	84	89	92	96	98	99	99	99	99	97	93	91	Máxima
Alajuela	39	40	38	39	43	55	50	49	50	57	49	43	46	Mínima
(Aeropuerto)	67	65	67	69	79	87	81	84	86	88	81	71	77	Media
1958-1960														
San José	93	94	94	95	96	97	97	98	97	98	95	91	98	Máxima
1952-1960	60	58	55	55	57	60	61	60	58	61	62	62	59	Mínima
	80	80	78	79	84	88	85	85	88	88	84	82	83	Media
Turrialba	100	98	98	98	99	100	100	99	99	100	99	99	99	Máxima
(I.I.C.A.)	59	54	55	55	57	60	62	51	59	61	62	64	59	Mínima
1950-1960	88	86	83	84	86	88	89	88	87	88	88	88	87	Media

PREDOMINANT WIND DIRECTION AND MEAN VELOCITY

SAN JOSE

	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SET	OCT	NOV	DIC
1954	NNE 20	NE 16	NE 17	NE 13	*VAR 6	VAR 7	NNE 9	NE 8	NW 8	NW 9	NE 12	NE 18
1955	NE 17	NE 10	NE 20	NE 16	NE 14	NE 9	NE 10	NE 9	NW 10	NW 11	ENE 12	NE 14
1956	ENE 15	ENE 15	ENE 18	NE 17	ENE 14	ENE 12	NE 15	NE 14	NE 12	NE 11	NE 14	NE 15
1957	NE 20	NE 19	NNE 16	NE 14	NW 11	NE 12	NE 14	NE 14	NE 10	NE 9	NNE 14	NNE 18
1958	NE 15	NE 18	NE 14	NNE 14	NNE 13	NE 8	NNE 8	NNE 11	NNE 8	NNE 7	NNE 10	NNE 14
1959	NNE 15	NNA 17	NE 13	NE 13	NNE 11	CALMO	---	---	---	---	NNE 15	NNE 17
1960	NE 20	NE 17	NNE 18	NE 14	NE 10	VAR 6	NE 10	NNE 12	NE 9	NE 7	NE 13	NE 15

Nota: Registro diario con anemovariógrafo.
Note: Registered daily with an anemovariograph.

*VAR: Variable.

Ráfaga más fuerte: 68.5 km./h. del N. el 4 de marzo de 1954.
Strongest gust of wind: 68.5 km./h. from the north on 4 March 1954.

Source: U.S. Army Corps of Engineers. 1965.

2.3 Population[3/]

2.3.1 Cultural and Political Background

When Europeans arrived in the 16th century, the indigenous populations of Costa Rica were relatively small, totaling approximately 30,000 people. These consisted of the Bribrí and Cabecar peoples on both sides of the Cordillera de Talamanca, the Boruca on the southern Pacific coast, the Guatuso on the northern plains, and the Orotiña in the Pacific northwest. All of these groups spoke languages related to the Chibcha speech of Colombia, except for the Orotiña, who were oriented toward Mexico. The indigenous people depended on farming such crops as corn, beans, cocoa, cotton and yuca, supplemented by fishing and hunting. They resisted European colonization, but were eventually overwhelmed by armed force and disease. At present the indigenous population is less than 10,000, or 0.5 percent of the total population. Except for a few thousand Bribrí and Cabecar people in the far south, these groups have been assimilated into the Spanish colonial culture. Current government policy is to integrate the indigenous peoples into Costa Rican society without destroying their culture. For this purpose, the Council for Protection of the Native Races of the Nation was established in 1945, and reservations with special schools were established in 1956.

Christopher Columbus sailed along the Caribbean coast and landed at Limón in 1502, but not until the 1560s did Spanish colonists overcome the difficult terrain and fierce resistance of the inhabitants and establish permanent settlements. Relatively small numbers of Spanish immigrants came to Costa Rica during the colonial period. The population remained less than 20,000 for centuries and was confined mainly to the two upland valleys comprising the Meseta Central (see Section 2.1.2), still the most important center of Spanish population. Costa Ricans with European origins, many of pure Spanish descent, currently form about 97 percent of the population. Their language is Spanish and their religion is Roman Catholicism, the official religion of the country.

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[3] Sources: American University. 1970.
Kurian. 1978.
Parker. 1979.
U. S. AID. 1980.
U.S. State Department. 1980.

Costa Rica achieved independence from Spain in 1821, and after breaking with the United Provinces of Central America in 1848, became a sovereign republic. The beginning of coffee exportation in 1880 opened important new sources of wealth. Slaves were brought from the West Indies in the late 19th century to help build the railroad from Limón to the highlands. The black people who live in the Caribbean lowlands today are descendants of those slaves, and retain a strong attachment to the British West Indian style of life, the English language, and the Protestant Anglican religion. Numbering about 30,000 individuals, the Caribbean black population constitutes only two percent of the present population.

Throughout its history, Costa Rica has steadily developed and maintained democratic conditions and has achieved today an orderly constitutional government. The beginnings of the modern political era in Costa Rican government are considered to be the free elections of 1889. Since that time, there have been only two significant interruptions in constitutional government: a 30-month dictatorship which began in 1917, and the civil war of 1948, which broke out over a disputed presidential election. The war was brief, and a new constitution, instituted in 1949, abolished the army and nationalized the banking system. Since that time, there have been seven presidential elections, and only in 1974 was the candidate in office elected to a second four-year term.

2.3.2 Population Growth and Distribution

Costa Rica's population was estimated at 2.19 million in 1979, based on an annual growth rate of 2.6 percent since the last official census in 1973, when the population was 1,872,000. Composition of the population in 1976 by age and sex is shown in Figure 4.

Costa Rica is remarkable among Latin American nations in that its population growth rate has been steadily declining over the last 30 years, from 3.1 percent in 1950 to less than 2.4 percent in 1976 (Table 4). This has occurred despite a

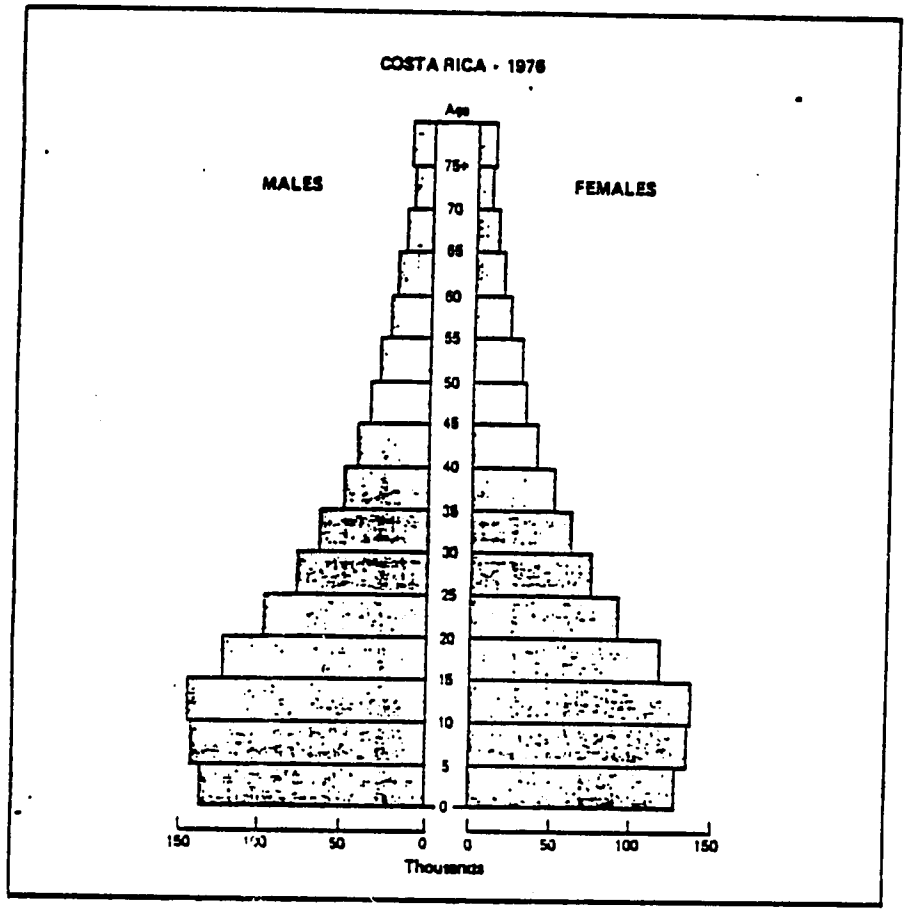
Table 4. Estimated Vital Rates for Selected Years, 1950-1976

Year	Births per 1,000 population	Deaths per 1,000 population	Rate of natural increase (percent)	Growth rate (percent)
1950	45	13	3.1	3.1
1963	45	10	3.6	3.5
1970	33	7	2.6	2.9
1971	33	6	2.6	2.8
1972	32	6	2.5	2.6
1973	29	6	2.4	2.9
1974	29	5	2.4	2.0
1976	28-29	5-6	2.2-2.4	2.2-2.4

Source: U.S. Dept. of Commerce. 1977.

decreasing death rate, and immigration and emigration rates balanced at about 250,000 per year. This declining growth rate in the Costa Rican population is due to a declining birth rate (Table 4), which is correlated with a general increase in prosperity (Parker 1979); Costa Rica's standard of living is the highest in Central America.

Figure 4. Population Composition by Sex and Age



Source: U.S. Dept. of Commerce. 1977.

Another factor of importance in the declining birth rate is the increased use of birth control by Costa Rican women of childbearing age (Table 5). By 1976, 46 percent of married women were using birth control devices. Family planning programs are coordinated by the Maternal and Child Care Division of the Ministry of Health. The private Costa Rica Demographic Association administers the distribution system for the national program. A Department of Population Studies was established in 1972. In 1978, 11 hospitals, 14 clinics, and 127 other units were engaged in family planning work.

Table 5. New Acceptors of Contraceptive Devices, 1966-1976 (thousands)

1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
8.7	7.5	7.8	15.2	18.3	25.5	26.7	27.6	29.0	30.9	25.6

ource: U.S. Dept. of Commerce. 1977.

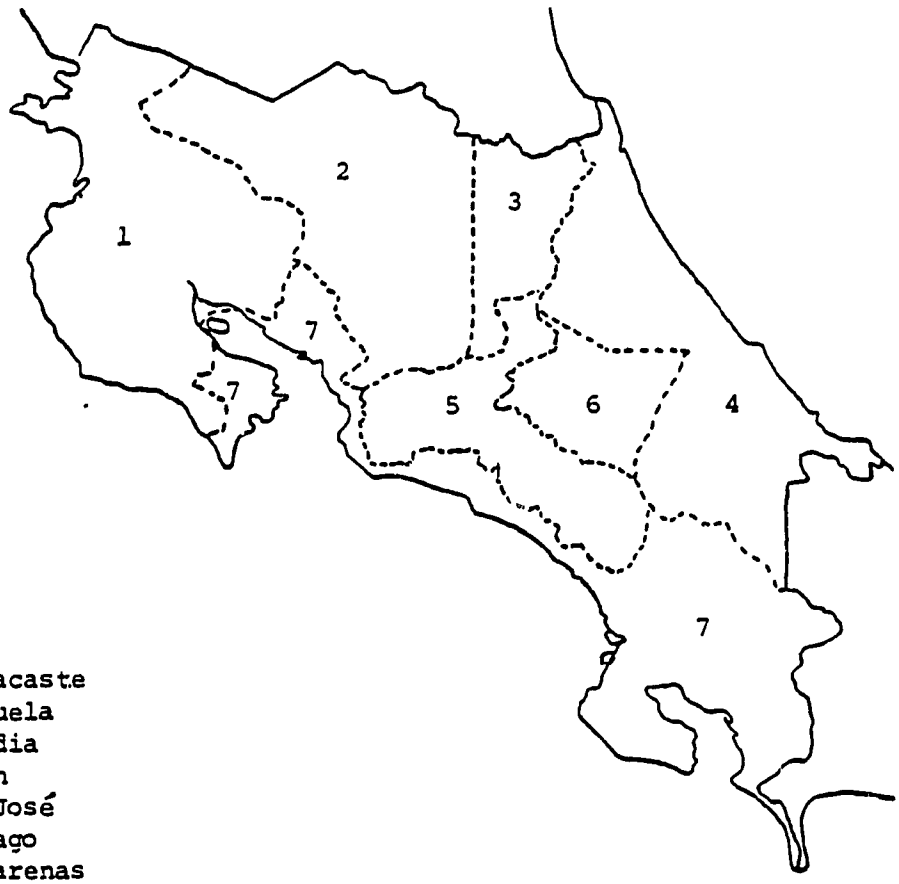
Half of the population is concentrated in the Meseta Central, with close to 450,000 inhabitants in the San José metropolitan area alone. In 1973, 40 percent of the population lived in urban areas, which were growing at a moderate rate of 4.7 percent. Regional population densities (Table 6) also reflect the tendency for population to concentrate in the Meseta Central, with lowest densities occurring in the coastal provinces of Limón, Guanacaste, and Puntarenas (Fig. 5). Of these, Limón showed the fastest rate of growth during the decade 1963-1973, probably reflecting increased immigration as road access was made available.

Table 6. Regional Population Distribution, Density, and Growth Rate

Province	Area (square km)	Population (1000s) 1963	1973	Density, 1973 (per square km.)	Annual Growth Rate 1963-1973 Percent
Alajuela	9,500	240.7	326.0	34	3.0
Cartago	2,600	155.4	204.7	79	2.8
Guanacaste	10,400	142.6	178.7	17	2.3
Heredia	2,900	85.1	133.8	46	4.5
Limón	9,300	68.4	115.1	12	5.2
Puntarenas	11,300	156.5	218.2	19	3.3
San José	4,900	487.7	695.1	142	3.5

Source: U.S. Dept. of Commerce. 1977.

Figure 5. Provinces of Costa Rica



1. Guanacaste
2. Alajuela
3. Heredia
4. Limón
5. San José
6. Certago
7. Puntarenas

2.3.3 Health and Nutrition[4/]

General health conditions in Costa Rica are good in comparison to those in other Central American Nations, and have been improving. The estimated life expectancy in 1979 was 68 years,

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[4]Sources: American University. 1970.
Kurian. 1978.
Parker. 1979.

compared with an average of 56 years for the surrounding nations of Panama, Nicaragua, Honduras, El Salvador and Guatemala (U.S. Dept. of Commerce 1980). The crude death rate in 1950 was 12.2 per 1,000 inhabitants, compared to 8.1 in 1965 and 5.8 in 1974. The infant mortality rate has also decreased, from 70 per 1,000 live births in 1965 to 37.6 in 1974. Major causes of sickness and death in Costa Rica are shown in Tables 7 and 8. Digestive problems caused by parasites in the water supply are the most important causes.

The impressive decrease in the mortality rate over the last two decades can be attributed to the improvement of sanitary and medical facilities. Costa Rica's health services are under the direction of the Ministry of Public Health which is divided into the General Directorates of Medical Care and Preventive Medicine. There is a National Health Plan, started in 1974, and health care constitutes about 6 percent of the national budget. In 1974 there was 1 hospital bed per 260 inhabitants, and 1 physician per 1,649 inhabitants.

According to Parker (1979), the greatest health problem in Costa Rica is protein-calorie malnutrition. The standard diet is high in calories, consisting of tortillas, tamales, rice, beans, and bread. Sugared water is a common beverage. Malnutrition renders the body less able to combat other forms of disease which may then become fatal. According to American University (1970), gastroenteritis complicated by malnutrition is the major cause of infant mortality in Costa Rica, and Parker (1979) cites Vitamin A deficiency and goiter as two common indicators of malnutrition.

Table 7. Chief Causes of Illness, 1963

		Rate per 100,000 inhabitants
1.	Worm infection and other unspecified types.	3,915.6
2.	Other avitaminosis and conditions of nutrition deficiency.	1,960.1
3.	Bronchitis.	1,687.1
4.	Gastroenteritis and colitis except ulcerous colitis at the age of four weeks and over.	1,537.1
5.	Influenza or grippe.	1,360.9
6.	Anemia.	1,007.9
7.	Acute infections of the upper respiratory tract.	650.5
8	Infections of the skin and subcutaneous tissue.	489.0
9.	Infant diseases.	452.1
10.	Arthritis and rheumatism, except rheumatic fever.	400.1

Source: U.S. Army Corps of Engineers. 1965.

Table 8. Chief Causes of Death, 1966

		Number	Percent
1.	Diseases of the digestive system	1,928	17.0
2.	Diseases peculiar to the first year of life	1,376	12.1
3.	Diseases of the respiratory system	1,309	11.5
4.	Diseases of the circulatory system	1,233	10.8
5.	Neoplasms	1,181	10.4
6.	Infectious and parasite diseases	1,010	8.9
7.	Accidents and violence	690	6.1
8.	Diseases of the nervous system and sensory organs	655	5.8
9.	Allergic diseases and those of endocrine glands, of metabolism and nutrition	355	3.1
10.	Congenital malformations	227	2.0
11.	Diseases of the urogenital system	150	1.3
	Other causes	1,265	11.0
	TOTAL	11,379	100.0

Source: American University. 1970.

2.4 Land Use[5/]

2.4.1 Land Use Potential

Costa Rica's surface area amounts to about 5.1 million hectares. According to Tosi (1978), no more than half of this area is physically suitable for sustained and profitable agricultural use. The remainder is unsuitable for reasons of topography, soil conditions, or climate.

[5] Sources: Kurian. 1978.
Parker. 1979.
Quart. Econ. Rev. 1980.
U.S. AID. 1979.
U.S. AID. 1980.
UNEP. 1976.

Other estimates of land use potential are somewhat at variance with Tosi's. Figures published by UNEP in 1976 (Table 9) show only 3.0 percent of the land as suitable for agriculture, while U.S. AID (1980, Table 10) classifies 42 percent as agricultural land. The latter figure, however, does not include lands classified as suitable either for forests or permanent tree crops. If these are included, the area classified as agricultural lands in Table 10 climbs to 72 percent. The three estimates therefore encompass a range of 30 to 70 percent of the total area of Costa Rica which is considered useable for agriculture, with the remainder suited for forestry or protection.

Table 9. Land Use Potential by Climatic Zones

	Unsuitable for Agriculture (Forest)		Suitable for Agriculture		Total	
	millions of ha	%	millions of ha	%	millions of ha	
Cold, rainy lands	1.0	19.6	-	-	1.0	19.6
Rainy lands	2.0	39.2	0.5	9.8	2.5	49.0
Sub-humid lands	0.6	11.8	1.0	19.6	1.6	31.4
Total	3.6	70.6	1.5	29.4	5.1	100.0

Source: Adapted from Holdridge and Tosi (1971) in UNEP 1976.

Table 10. Land Use Potential

	Potential use	Area Thousands of ha.	Percent
A.	Intensive use	595.5	11.6
B.	Extensive or selective	259.0	5.0
C.	Permanent crops or pasture lands (intensive)	342.1	6.7
D.	Permanent crops or pasture lands (extensive)	967.4	18.8
E.	Forestry or permanent tree crops	1,542.3	30.0
F.	Inundated areas	351.8	6.9
G.	Protection areas	1,077.3	21.0
	TOTAL	5,135.4	100.0

Source: U.S. AID. 1980.

2.4.2 Agricultural Land Use Patterns and Trends

According to Tosi (1974), 47.5 percent of Costa Rica's land, or 2.42 million hectares, was in use for agriculture in 1973, with the remainder in forest. U.S. AID (1980) presents a more detailed breakdown of land use patterns in 1973 (Table 11), but this analysis only accounts for 3.12 million of Costa Rica's 5.1 million hectares. The figures in Table 11 are useful, however, in showing the very large proportion of agricultural lands (76 percent) which is devoted to livestock pasture. Table 12 shows that the conversion of land to pasture was the overwhelming trend during the decade 1963-73. In 1978 it was estimated that there were 2.0 million head of cattle, 215,000 pigs, and 109,000 horses in the country. According to the Quarterly Economic Review (1980), the government is currently encouraging expansion of the cattle industry.

Table 11. Land Use (1973)

Use	Area (thousands of ha)		Percent	
Agriculture	2048.5		100	65.6
I. Croplands	490.5		24	
1. Permanent crops		207.2		
2. Annual crops		141.0		
3. Horticulture		3.3		
4. Fallow		124.8		
5. Other		14.2		
II. Pastureland	1558.0		76	
1. Cultivated pasture		732.5		
2. Uncultivated pasture		825.5		
Forestry	1001.1		100	32.0
I. Forests	716.5		72	
1. Exploited		190.9		
2. Unexploited		525.6		
II. Brushland	283.6		28	
Other Lands	73.8		100	2.4
Total	3123.4			100.0

Source: U.S. AID. 1980.

Table 12. Land Use Changes, 1963-1973

Decreased Uses (ha)		Increased Uses (ha)	
Annual Crops	-126,200	Pasture	+622,540
Forests	-557,206	Permanent crops	+ 6,682
		Second Growth Forest	+ 5,779
		Unclassfied	+ 48,597
Total	-683,406		
		Total	+683,598

Source: U.S. AID. 1979.

Although livestock has been increasing in export value (Table 13), coffee and bananas, which make up about 60 percent of agriculture production, are the principal export commodities. The tremendous increase in banana production from the early 1960s to 1970 seen in Table 13 is also shown by the increase in land devoted to permanent crops (Table 12). Other export crops are sugarcane, cocoa, and cotton. Corn is grown less widely than in other Central American countries, but corn and beans remain the most significant crops for home consumption. Corn, beans, and rice are grown chiefly on the Pacific side of the mountains. The center of coffee production is the Valle Central, while bananas are grown in the Pacific southwest near Golfito and Puerto Cortes, and northeast of Limón on the Atlantic coast. Sugarcane is grown at lower elevations in the vicinity of the Valle Central, and cocoa in the eastern Caribbean lowlands. Guanacaste is the largest cattle producing province, followed by Alajuela.

As is typical of Latin America, most Costa Rican farms are small, but most of the area is occupied by a few large landholders (Table 14). About 80 percent of the farms, occupying 90 percent of the farm area, are cultivated by the owners, and only 2 percent are cultivated by renters. About 1.5 percent are under a special type of tenancy called esquilmo, which is tenancy for a single harvest season. Eleven percent are cultivated by a mixed system such as mediera, in which the owner provides everything but labor. The remaining farms are cultivated by squatters called colonos or precaristas. There are also five kinds of non-private land ownership: municipal land, institutional land (such as church lands), national public land, state land, and cooperative land (Kurian 1978).

Table 13. Economic and Volume Trends in Agricultural Production

COMMODITY	Unit Price	Production						
		AVERAGE 1961-65	1970	1975	1976	1977	1978	1979
	DOLLARS	-1,000 METRIC TONS-						
RICE, PADDY	96	64	79	158	165	149	195	213
CORN	66	67	45	92	52	94	64	98
BEANS, DRY	160	17	8	16	11	15	10	12
POTATOES	69	10	16	25	25	25	25	24
TOBACCO	445	1	1	3	3	3	2	3
BANANAS	65	511	1,230	1,250	1,187	1,124	1,149	1,100
COFFEE	640	62	75	78	81	87	96	93
COCOA BEANS	300	11	4	7	6	8	9	10
SUGAR, RAW (CENTRIFUGAL)	7¤	83	151	178	172	194	191	194
SUGAR, NONCENTRIFUGAL	75	70	41	40	43	40	40	41
CATTLE EXPORTS 1/	2/110	12	1	25	17	25	3	1
BEEF AND VEAL	365	27	42	60	63	74	81	81
PORK	360	7	7	6	7	7	7	7
MILK	95	147	177	258	280	308	316	310
AGGREGATES OF PRODUCTION		-MILLION DOLLARS AT CONSTANT PRICES-						
CROPS		102.3	157.6	177.3	171.6	175.4	184.0	184.2
LIVESTOCK		27.8	34.7	51.4	54.0	61.6	62.4	61.7
TOTAL AGRICULTURE		130.1	192.3	228.7	225.6	237.0	246.4	245.9
TOTAL FOOD		98.0	143.9	177.5	172.5	180.0	184.1	185.1

1/ IN 1,000 HEAD.
2/ PRICE PER HEAD.

Source: USDA. 1980.

Table 14. Farm Size Distribution

Farm size (ha)	Percentage of farms		Percentage of area	
	1963	1973	1963	1973
1-10	49.8	47.8	4.7	3.8
10-50	33.8	33.9	18.3	16.4
50-500	15.3	17.0	41.0	43.8
>500	1.1	1.3	36.0	36.0

Source: U.S. AID. 1980.

Due to steep terrain and small farm size, mechanization is not common, with only 5,650 tractors and 900 harvester-threshers in the country as of 1975. Small farmers cultivate with hand tools. Clearing land by burning, although illegal, is common. Only 3 percent of the cultivated land is under irrigation. Fertilizer consumption is increasing, encouraged by credit institutions. In 1975, 68,600 tons of fertilizer were used on about 3.5 percent of the cultivated land (Kurian 1978).

2.4.3 Forest Exploitation and Deforestation

Figure 6 illustrates the extensive deforestation of Costa Rica over the last four decades. From 1940, when dense forests still covered more than 75 percent of the land, forest coverage has dropped to less than 31 percent of the country at present. Studies by Perez and Protti (1978), cited by U.S. AID (1979), show that the rate of deforestation increased by 25 percent from 43,940 hectares per year in the decade 1950-61 to 55,060 hectares per year during the following decade (Table 15).

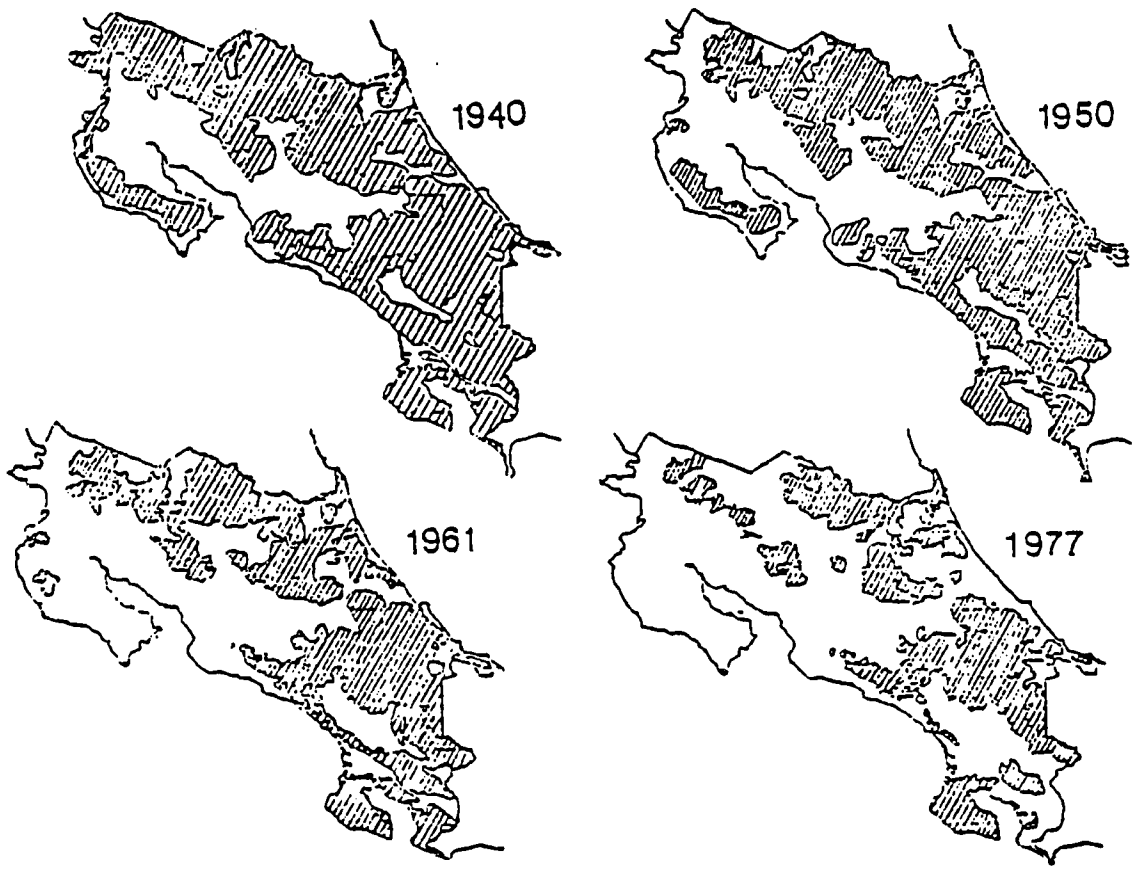
Table 15. Deforestation Rates

	1950-61 (ha/year)	1961-77 (ha/year)
Dense Forests Cut	35,800	45,000
Medium Density Forests Cut	8,140	10,060
Total Cut	43,940	55,060

Source: U.S. AID. 1979.

Table 16 shows that although the Atlantic, north, and south Pacific regions still have the largest forest reserves, they have also experienced the largest increases in deforestation rates in recent years.

Figure 6. Extent of Thick Forest, 1940-1977 (> 80% canopy coverage)



Source: U.S. AID. 1979.

Table 16. Regional Deforestation Rates, Dense Forests Only

REGION	Total Area (sq.km).	Percent of Area Covered with Dense Forest			Deforestation Rate (ha/sq.km/year)	
		1950	1961	1977	1950-61	1961-77
Central	7,956	41.9	34.8	30.9	0.64	0.24
North Pacific	10,200	16.1	9.3	4.7	0.62	0.29
Central Pacific	4,345	27.0	9.5	6.8	1.60	0.16
South Pacific	9,543	63.0	60.4	37.0	0.30	1.46
North Atlantic	9,270	76.9	69.7	44.9	0.65	1.55
	9,788	78.9	69.1	50.8	0.89	1.14
Costa Rica (Total)	51,102	53.0	45.2	31.1	0.70	0.88

Source: U.S. AID. 1979.

Only a relatively small proportion of the timber being cut is used for commercial wood products. U.S. AID (1979) estimates that of 60,000 ha per year of forests cut, only 5,000 to 10,000 ha are used for forest industries. At an estimated 150 cubic meters of commercially usable wood per hectare of forested land (Tosi 1974, fide UNEP 1976), commercial wood consumption amounts to 1.5 million cubic meters per year. The remaining 5.5 million cubic meters are simply wasted by rotting or burning when land is cleared for agriculture. Reasons for this wastage are discussed in Section 4.1.2.

According to the Bureau of Forestry (DGF), current rates of deforestation are not as high as the figure of 60,000 ha per year quoted by U.S. AID (op. cit.). In a recent statement to the press (La Repulica, 31 March 1981, p. 28), Luis Fernando Gonzalez, head of the Department of Forest Management and Usage, says that the rate has been declining since 1973, when efforts by agents of the Bureau of Forestry to control deforestation began to show effect. This statement, however, is apparently based on the area for which official permits to clear forest were given, rather than surveys of the area actually cleared. The figures cited by Gonzalez are that

599 permits to clear forest for agricultural purposes were given in 1979. These amounted to 33,345 ha, while the average area for which permits were given from 1975 to 1979 was 24,674 ha. This area cut by permit probably represents only a fraction of that actually cut. In fact, Gonzalez goes on to state in the same article that illegal deforestation by colonists and various other causes of deforestation remain "a grave problem." In view of these considerations, the article's headline "Deforestation considerably reduced," seems misleading.

This does not mean that efforts by the Bureau of Forestry have been ineffectual. Figures given by Gonzalez show that the permit system has been used to help stop the clearing of forests. For example, in 1979, 1,757 property holders requested permits to cut wood, but 38 percent of these requests were denied after inspection of the property. Furthermore, permits given by the office are not all for clear-cutting, but include permits for selective timber cutting, and clearing of trees from lands already used as pasture or for crops.

The two major economic uses of forest resources are wood products and firewood. A figure of 1.5 million cubic meters per year of timber used for commercial wood products has been cited from U.S. AID (1979), but Kurian (1978) specifies 3.3 million cubic meters of roundwood removals in 197[illegible]. Kurian also gives the number of sawmills as 200, and notes that relatively few of 1315 species of timber are used by the lumber industry. MITRE (1980) states that about 66 percent of Costa Rican households rely on firewood for cooking, the remainder use electricity, kerosene, or gas. The same source estimates total firewood consumption at 470,000 tons per year, based upon a rate of 3 tons per household per year.

2.4.4 National Land Use Planning

The National Planning Office (OFIPLAN), located in the Ministry of the President, has responsibility for comprehensive medium and long range development planning for Costa Rica. According to UNEP (1976), the establishment of an Advisory Commission to OFIPLAN in 1976 for the purposes of incorporating environmental planning in the national development plan was an important step in national environmental planning. U.S. AID (1979) reports that OFIPLAN includes a National Resources Department composed of two staff members, who are responsible for evaluation of the national plan with respect to environmental policy.

The Ministry of Agriculture (MAG) is the government agency with primary responsibility for rural development. The budget law (Ley de Presupuesto) for 1979 specifies that a fundamental goal of MAG is to assure adequate use of lands and natural resources. The Office of Planning for the Agricultural Sector (OPSA), within MAG, elaborates the National Agricultural Development Plan in cooperation with OFIPLAN and is therefore the agency with primary rural land use planning responsibility. Both the Bureau of Forestry (DGF) and National Parks Service (SPN), also within the MAG, have particular land use survey responsibilities. One of the responsibilities of DGF is to carry out a complete national forest inventory, while a specific function of SPN is to determine areas which require biological protection (U.S. AID. 1979).

Information on the current status of land use planning in Costa Rica is difficult to locate. Lovejoy (1978) comments that MAG is currently preparing a detailed set of land use maps for the entire country. These are based on soils, temperature, and precipitation, although slope is apparently not included. Lovejoy also mentions that the Tropical Science Center in Turrialba has drawn up a series of maps presenting various options for conserving the remaining forest cover, but whether these are being incorporated into government policy is not clear.

3.0 Environmental Resources

3.1 Geology and Mineral Resources[6/]

3.1.1 Geologic History

Costa Rica forms the central part of a region with a common geological history that extends from southern Nicaragua to northwestern Panama. It was formed by a complex sequence of volcanic and sedimentary processes, as indicated by the exposed stratigraphy (Fig. 7). Characteristics of exposed rocks are given in Figure 8. The brief historical sketch given here follows that of U. S. Army Corps of Engineers (1965). A much more comprehensive recent review is provided by Weyl (1980).

There is no true continental crust in the area now occupied by Costa Rica. Nuclear Central America to the north was the closest land mass at the time the first Costa Rican land was formed. The oldest rocks, dating from the late Jurassic to early Cretaceous (135-140 million years ago) are found in an area referred to as the "outer arch" which includes the Pacific peninsulas of Santa Elena, Nicoya, Osa, and Buricá. An arc of volcanic islands most likely existed initially along the axis of the outer arch, creating the oldest igneous rock in the area (pKgp in Fig. 7). The oldest sedimentary deposits (K in Fig. 7) were also formed at this time.

The next major land building phase occurred from late Cretaceous through mid-tertiary times (70 through 15 million years ago), in the southeastern part of Costa Rica. The igneous rock of the Cordillera de Talamanca (Tmgd in Fig. 7) was formed by volcanic activity in Eocene times, and during the same period, the Limón Basin and Térraba Basin resulted from marine sedimentation. Marine sedimentation lasted in these basins throughout the Oligocene and Miocene, but while the Térraba Basin was stable, the Limón Basin folded and accumulated a great depth of sediments. The Cordillera de Talamanca was finally elevated by intense folding in the beginning of the Miocene. Volcanic activity in the Miocene concluded by forming the rock which now comprises the Cordillera de Tilarán.

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[6] Sources: Quart. Econ. Rev. 1980.
U.S. Army Corps of Engineers. 1965.

Figure 7. Exposed Stratigraphy

Sedimentary Rocks

Plio-Pleistocene and Quaternary - Qp, Qta, Qal

Includes Pleistocene glaciation (Wisconsin). Recent unconsolidated material.

Pliocene - Tp

Includes the following formations: Peñita; the Caps of Moin; Puerto Limón; Armuelles and Burica; so-called clay boulders; Carco Azul; Suretka.

Miocene - Tm

Included on this map are the following formations: Barranca; Gatún; 'D'; Zapote; Sherolí; Agujas.

Oligocene - Miocene Undifferentiated - Tmo

Includes the following formations: La Uscari; Watsi; AAB; La Amoura; La Bonilla; Canuita; calcareous sand and sandy conglomerates; la Cartago; la Desamparaos; El Brazil; Bancos de Pectén; San Miguel limestone.

Oligocene - To

Includes the following formations: Sensori and Nona shales.

Eocene - Oligocene - Toe

Southern Costa Rica, bounded by Panama and the Pacific Ocean, there is a zone of limestone, limesite, and sandstone outcrops that are thought to be of Eocene-Oligocene age.

Eocene - Te

Includes the formations: Brito; 'C'; Nochuca; Colorado limestone; Chira quartzite; Caps of Manzanillo.

Paleocene - Tpal

Includes part of what is called limestone and chert; Nicoya limestone.

Pre-Eocene - Tpe

This term is used to indicate the rocks which are older than Eocene whose real age is not known, because of absence of fossils.

Cretaceous - K

Includes the Sabana Grande formation; the Rivas formation; a portion of the Sedimentary Series of Nicoya; the Nicoyan shales; the Santa Elena formations.

Igneous Rocks

Undifferentiated Quaternary Volcanics - Qv

Includes some of the indurated tuffs of the Central Valley.

Plio-Pleistocene Andesitic and Rhyolitic Pyroclastics - Qpr, Qta

Includes some of the indurated tuffs of the Central Valley.

Miocene Volcanics - Tmv

Includes the Aguacate volcanic series.

Undifferentiated Tertiary Volcanics - Tv

Includes the following formations: Talamanca Volcanic series; a portion of the Candelaria Volcanic series.

Granodiorite Intrusives - Tagd

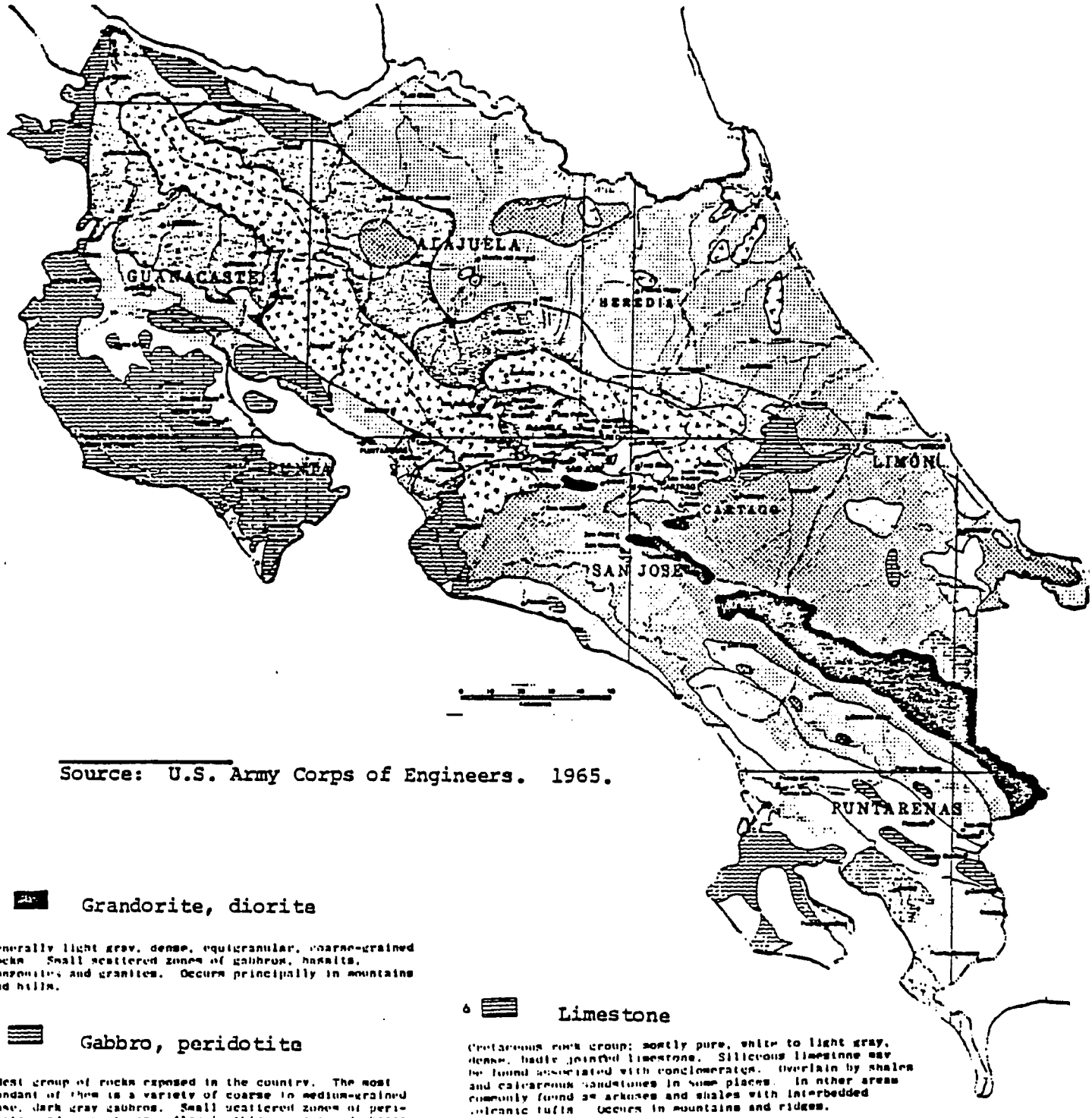
Includes the Talamanca plutonic series.

Gabbro-Peridotite Intrusives - pTgp

Includes the Nicoyan Peninsula lavas; Rio Seco diabase; Santa Elena peridotite; quartzites of Sardinal and Santa Rosa; and a portion of the Nicoyan Series.

Source: U.S. Army Corps of Engineers. 1965.

Figure 8. Exposed Rock Types



Source: U.S. Army Corps of Engineers. 1965.

1 Grandorite, diorite

Generally light gray, dense, equigranular, coarse-grained rocks. Small scattered zones of gabbros, basalts, monzonites and granites. Occurs principally in mountains and hills.

2 Gabbro, peridotite

Oldest group of rocks exposed in the country. The most abundant of them is a variety of coarse to medium-grained dense, dark gray gabbros. Small scattered zones of peridotites and serpentines. Also in this group are diabases, diorites and basalts as well as some sediments, especially siliceous limestone and graywackes. Occurs principally in mountains and hills.

3 Andesite, basalt, tuff

4 Rhyolite, dacite, tuff

Group of ignimbrites varying from ash to welded tuff. Described as fine labradorite crystals contained in a vitreous matrix with small amounts of pyroxenes, especially augite and hypersthene as well as lithic fragments of pyroxenic andesite. A thick mantle of clays and sands of the andesitic type varying from 10 - 15 m. in thickness also forms part of this group. Occurs in mountains, ridges, and plains.

5 Volcanic pyroclastics, lava

Generally medium-grained, dark gray to black rocks. Very badly jointed in some regions. Some of them show advanced weathering, with vesicles filled mostly with calcite and cristobalite. Generally the pyroxenic andesite type. Mineralized and cut by dikes without apparent differentiation in some places. Occurs in mountains and very dissected hills.

6 Limestone

Cretaceous rock group; mostly pure, white to light gray, dense, badly jointed limestone. Siliceous limestone may be found associated with conglomerates. Overlain by shales and calcareous sandstones in some places. In other areas commonly found as arkoses and shales with interbedded volcanic tuffs. Occurs in mountains and ridges.

7 Sandstone, tuff

Occurs as fine-grained, calcareous sandstones in some areas and as siliceous sandstones in others. Usually poorly stratified. These hard to soft rocks are broken and bluish gray. Found in some places very badly broken and deeply weathered. Also exposed in other areas as hard, medium-grained, thin-bedded sandstones. Occurs in mountains and hills.

8 Sand, marl, shale

Thin-bedded, dark gray, soft shales and siltstones. Badly jointed and deeply weathered in some places. Generally interbedded with marls, limestones, calcareous sandstones, volcanic tuffs and breccias which in turn appear interbedded with shale. Occurs in mountains, ridges and hills.

9 Igneous conglomerates with a fine pyroclastic cement. Occuring as thick layers of boulder fragments of andesite and basalt, interbedded with lenticular layers of clay and sandstone. Localized lenses of shales with organic remains. Occurs especially in ridges and hills.

10 This type includes all of the recent alluvial plains as well as some of the Plio-Pleistocene terraces such as the large San Isidro del General Terrace.

The final and most recent land building process occurred in the Quaternary, and is characterized by the general elevation of the entire central range and continued deposition in the basins of Limón and Térraba. Volcanic activity during this period occurred in the Cordillera Central and the Cordillera de Guanacaste, resulting in the deposition of pyroclastics around these ranges.

3.1.2 Mineral Resources

Mining is not a major activity in Costa Rica, contributing only 2 percent to the GDP (Kurian 1978). There are small deposits of manganese, mercury, gold, and silver, but only the last two are worked. Figure 9 shows the location of mineral resources in Costa Rica and Table 17 describes their general characteristics, as known in 1965. The most important are bauxite deposits in the General and Coto Brus valleys. Manganese is found in and around the Nicoya Peninsula, some gold in the Osa Peninsula, and magnetite sand on scattered beaches, particularly on the southern Caribbean coastline.

The Aluminum Company of America (ALCOA) terminated its contract for the development of bauxite deposits at San Isidro el General in May 1976. The government now intends to develop the deposits itself, but this must await the completion of the Boruca hydroelectric plant to supply the mine with power. Sulphur deposits, estimated at 11 million tons, are to be developed by the state development company, CODESA, and two private companies working on a joint venture. Due to the increase in world gold prices, two gold mines, closed for 30 years, are to be reopened (Quart. Econ. Rev. 1980).

ELF-Petroleos, a subsidiary of ELF-Erap of France, is involved in joint exploratory work with CODESA off the Caribbean coast. Oceanic Exploration and Continental Oil are interested in offshore concessions in the Pacific. The government has acquired the 8000 barrels/day oil refinery at Puerto Limón from Allied Chemical Corporation.

According to UNEP (1976), the Office of Geology is underbudgeted and the country's metal mining possibilities are still far from being assessed. In addition to gold, other minerals which may have potential for economic mining include manganese, chromite, nickel, magnetic and titaniferous sands, copper, lead, zinc, sulfur, bauxite, and carbon.

Figure 9. Mineral Resources*

*Note: Numbers refer to numbers in Table 17. Symbols defined below.

- Aluminum
- Asbestos
- Sulfur
- Coal
- Zinc & Lead
- Copper
- Methane
- Petroleum
- Iron
- Magnetic Sand
- Magnetic Rock
- Lateritic Iron
- Manganese
- Gold & Silver (veins)
- Gold (placer deposits)
- Lead
- Exploitation Mines
- Abandoned Mines

Source: U.S. Army Corps of Engineers. 1965.

Table 17. Mineral Resources. Numbers refer to localities shown in Figure 9.

MAP UNIT	LOCATION AND NAME	RESOURCE	GEOLOGY	PRODUCTION
1	Rio General Valley. San José Province.	Aluminum	Laterites and bauxite formed in alluvial Plio-pleistocene terraces.	Inactive. Estimated reserves 150,000,000 tons. 35% Al_2O_3. 1,500,000 tons.
2	Vecinta de San Carlos. Alajuela Province. Approximately 1 km. east of Venecia.	Aluminum	Lateritic bauxite formed in recent volcanic rocks. Contains 37% Al_2O_3.	Inactive.
3	South from Guacimo, Loma Piedra Negra. Limón Province.	Aluminum	Lateritic bauxite formed in Tertiary basalt flows. Contains 29% Al_2O_3.	Inactive.
4	Puntarenas Province.	Aluminum	Lateritic bauxite formed in alluvial terraces. Contains 28% Al_2O_3.	Inactive.
5	El Congo Hill. Alajuela Province.	Sulphur	Sulphur pockets of volcanic origin.	Inactive. Small deposits.
6	26 km. northeast of Liberia. Guanacaste Province.	Sulphur	Sulphur deposits of hydrothermal origin.	Inactive. Shallow deposit.
7	Catarat of Puerto Viejo. 12 km. west of Puerto Viejo. Limón Province.	Lignite	Lignite lenses in siltstone beds of Gatún formation.	Inactive.
8	El Tablazo Hills. 2 km. south of El Higuito. San José Province.	Lignite	Lignite lenses in siliceous sandstones. Poor quality.	Inactive. In 1918 partially exploited as a fuel.
9	Río Poás. San José Province.	Zinc, Lead	Thin veins of galena, blende and pyrite in altered intrusive rocks.	Inactive. Low-grade mineralization.
10	Salitral of Santa Ana. San José Province.	Zinc, Lead	Veins of galena and blende.	Inactive. Thin mineralization.
11	Linda Mine. 12 km. south of Turrucares railroad station. San José Province.	Zinc, Lead	Sulphide mineralization, principally galena and blende in volcanic rocks.	Inactive. Initiated exploitation in 1954 terminated because of metallurgical problems.
12	Guanimal Mine. 20 km. northeast of Tomalé. Puntarenas Province.	Lead	Thin veins of galena mineralization in volcanic rocks.	Inactive. Low-grade deposit.
13	Headwaters of Río Uren. Limón Province.	Copper, Iron	Veins of galena, blende and other minerals.	Inactive.
14	Cartagena. Guanacaste Province.	Copper, Iron	Small deposit of copper minerals (malachite, azurite) and iron mineral (siderite) in siliceous rocks.	Inactive.
15	Bajo Las Claras. San José Province.	Copper	Native copper sheets in altered andesitic rocks.	Inactive.
16	San José Province.	Copper	Intrusive rocks with varying amounts of copper minerals.	Inactive.
17	San José Province.	Copper	Irregular veins of malachite and chalcocite in sedimentary rocks.	Inactive.
18	Las Cóncavas. Cartago Province.	Copper	Impregnation of volcanic rocks with malachite and azurite.	Inactive. Small deposit.
19	Headwaters of Río Pacaca. San José Province.	Copper	Pockets of malachite and chalcocite. High grade ore. Primary deposit has not been found.	Inactive.
20	Limón Province.	Iron	Magnetitic sands with ilmenite in beach deposits.	Inactive. Thicknesses of mineral concentration between 2 and 3 m. wide. Width of deposit 30 to 40 m.
21	Puntarenas Province. Angostura Beach, Caldera, Tivives.	Iron	Impure magnetitic sands in beach deposits.	Inactive.
22	Costal Beach, 2 km. south of El Coco Beach. Guanacaste Province.	Iron	Magnetitic sands of high concentration. Beach deposit.	Inactive.
23	Beach Coronado. Puntarenas Province.	Iron	Magnetitic sands in variable concentrations. Beach deposit.	Inactive. Unofficial estimated reserves: 3,000,000 tons of 15-35% Fe.
24	San José Province.	Iron	Lateritic iron in variable concentrations.	Inactive.
25	Guanacaste Province.	Iron	See Item 23.	Inactive.
26	Guanacaste Province.	Iron	Magnetitic veins.	Inactive.
27	West of San José. Alajuela Province.	Iron	Hematite layers, lateritic origin.	Inactive.
28	District Sardinal. Guanacaste Province.	Manganese	Deposits of minerals of manganese of hypogene origin (braunite, rhodonite) and supergene and residual origin (pirolusite, psilomelane) associated with igneous rocks.	Inactive. 1915-1918, this district produced around 80,000 tons of high grade mineral. In 1943, 461 tons were exported to Japan with 36% Mn. Ore averages 20-33% Fe. Reserves estimated at 20,000 tons.
29	Natal Zone. Limón Province.	Methane	Methaniferous sandstones in the low part of Uscari formation.	Inactive.
30	Miedalo Beach. Puntarenas Province.	Methane	Gaseous emanations at the beach coming from Charco Azul formation of Pliocene. Analysis: Methane - 98.4%.	Inactive.
31	Moin Bay. Limón Province.	Methane	Gaseous emanations at several points along the coast.	Inactive.
32	Aguacate formations. Mineral Districts of Abangares, Montes de Oro, Aguacate. Guanacaste, Puntarenas and Alajuela Provinces.	Gold, Silver	Aguacate formation: extensive Tertiary volcanic formation with andesitic and basaltic flows, volcanic agglomerates, intruded by basic dikes and mineralized with veins of auriferous quartz and metallic sulphides. Yields: 0.3 - 0.6 - 3.3 and 6.73 troy ounces.	Active. Prospectors working alone obtain small amounts of mineral. At close of last century, the mines were fully exploited by foreign companies. Total production for Costa Rica is 1-42 - 3,000 troy ozs. Large undetermined reserves.
33	Bactical Beach. Puntarenas Province.	Gold	Gold placers as much as 4 m. thick. Yields: $0.23 cubic yard.	Active. At present placers are worked by manual methods - prospectors that are not under legal pr[illegible]ties.
34	Cerro Chato Zone. Limón Province.	Petroleum	Located in thin sand lenses and fractured igneous rocks.	Inactive. Non-commercial.
35	Alajuela Hill. San José Province.	Aluminum	Bauxite nodules in earthy loams in high grade superficial mantle.	Inactive.
36	Alajuela Province.	Lignite	Seam of lignite interbedded with limestone.	Inactive. Large deposit. Analysis - 3,54 ash with 12% volatiles.
37	Puntarenas and Guanacaste Provinces.	Salt	Solar evaporation.	1962 - 3,856 tons.

Source: U.S. Army Corps of Engineers. 1965.

3.2 Soils

A considerable amount of soil survey work has been done in Costa Rica. Interested readers are referred to the 322 text references and 46 maps cited in Orvedal (1978). Harris et al (1971) is a good recent general summary, and Holdridge et al (1971) contains soil profiles of 20 different forest sites. The following brief summary is from U.S. Army Corps of Engineers (1965).

Fourteen major soil groups of Costa Rica are mapped in Figure 10. The following descriptions and remarks on agricultural potential are numbered to match the map.

1. Alluvial soils, acid and hydromorphic.

   Description:

   Recently deposited alluvial materials which do not yet strongly reflect soil forming processes. Mainly dark brown to dary gray, imperfectly to poorly drained loam to clay soils overlying generally variable textured materials. Soils are acid and subjected to seasonal inundation. Locally, ground water table at or near surface much of year. Soils probably saline near coast. Inclusions of soils with better drainage occur on terraces near streams.

   Agricultural potential:

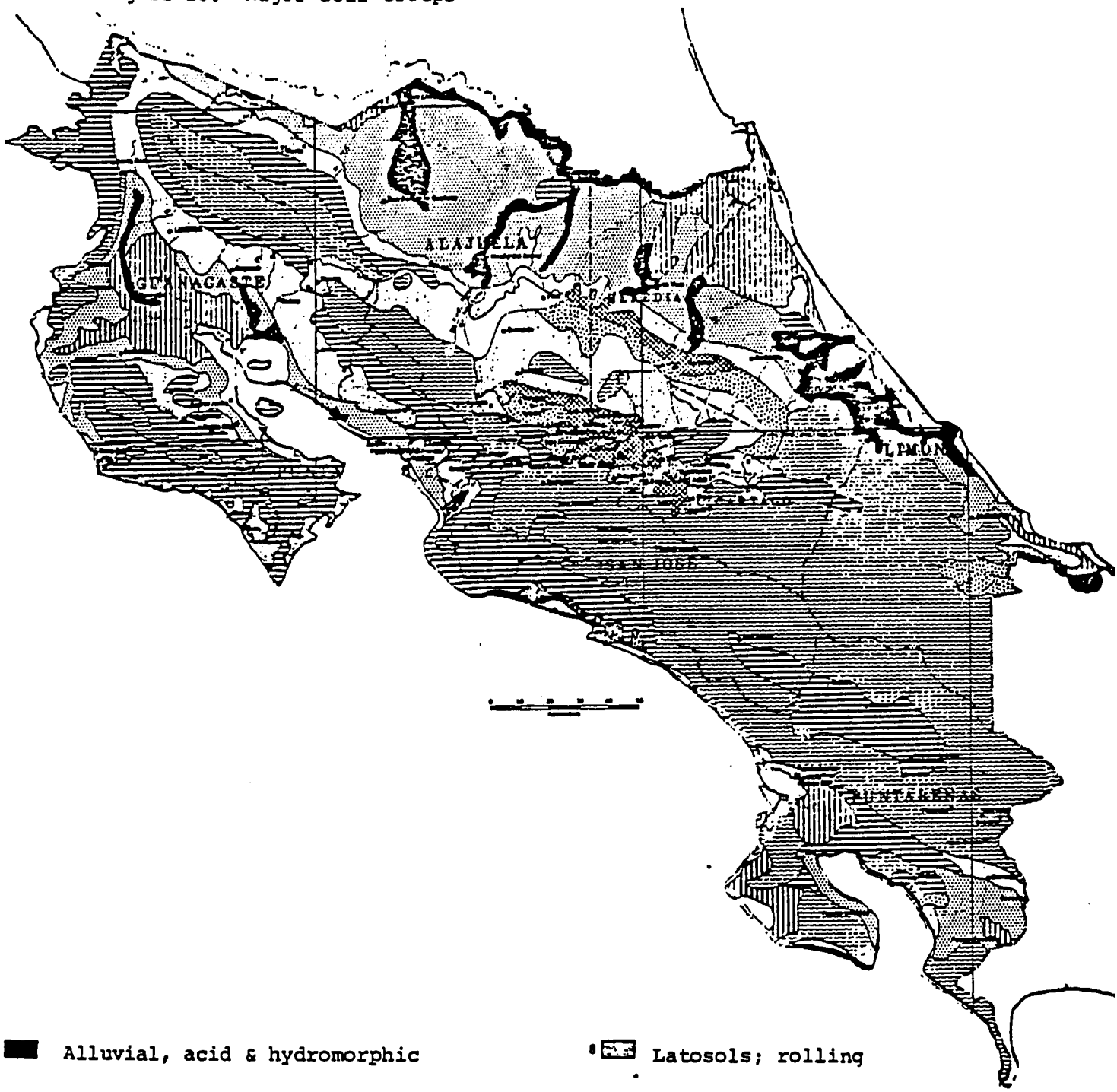
   High. Soils too wet much of the year for high production of most crops. More area could be brought into production with adequate water control, i.e., drainage for sugarcane and controlled flooding for rice. Presently supports native and improved pasture, some forest and subsistence crops.

2. Alluvial soils, well drained.

   Description:

   Recently deposited alluvial materials which do not yet strongly reflect soil forming processes. Mainly brownish grayish, well drained to poorly drained loamy soils. In some areas, soils seasonally inundated; in other places irrigation necessary in dry season. Soils probably saline in areas near coast.

Figure 10. Major Soil Groups



1 Alluvial, acid & hydromorphic

2 Alluvial, well-drained

3 Ando & regosol soils; gently sloping

4 Ando & regosol soils; dissected

5 Ando & regosol soils; hills, mountains

6 Latosols; gently sloping

7 Latosols; dissected

8 Latosols; rolling

9 Latosols; mainly hills

10 Planosols

11 Grumosols

12 Low-humic gley soils

13 Lithosols; mainly lithosolic

14 Regosol, alluvial, bog, and low-humic gley soils

Source: U.S. Army Corps of Engineers. 1965.

Agricultural potential:

High. Soils fertile but drainage required in some places and irrigation in others to bring them into moderate production. Presently supports bananas under dry season irrigation and some corn, pasture and subsistence crops.

3. Ando and regosol soils, gently sloping.
Description:

Soils developed on various aged volcanic materials. North of Irazu and near Naranjo and San Jose, soils are deep and acid with brown to black loam surface layer overlying grayish coarse-textured ash and volcanic outwash.

Agricultural potential:

High. Initially fertile but erosion may have reduced fertility greatly in some places. Good response to nitrogen fertilizer and irrigation. Some areas suited for growing coffee; other areas are suited for subsistence production of corn, sugarcane, and pasture.

4. Ando and regosol soils, dissected.
Description:

Soils developed on various aged volcanic materials. Deep, acid, with brown to black loam surface layers over-lying gray to yellow coarse-textured volcanic materials. Inclusions of Lithosols on steep slopes of uplands.

Agricultural potential:

High. Initially fertile but erosion may have reduced fertility greatly in some places. Good response to nitrogen fertilizer and irrigation. Soil and water conserving practices required for safe maximum use of soils. Tillage operations with machinery would be hindered by dissection.

5. Ando and regosol soils, hills and mountains.
Description:

Soils developed from lava, ash, and alluvial-colluvial materials. Mostly thin, black, stony and bouldery, sandy and loamy. Inclusions of Lithosols and areas of bare rock.

Agricultural potential:

Medium to low. Steep slopes, dissection, and local areas of very shallow soil restricts use and production similar to other Ando and Regosol soils. High erosion hazard. Presently supports some coffee, subsistence crops and pasture.

6. Latosols, gently sloping.
Description:

Dominantly deep, well-drained, strongly weathered and friable loam to clay loam soils derived from volcanic materials. Generally, highly leached, acid, and low in plant nutrients. Inclusions of alluvial soils in narrow valleys.

Agricultural potential:

Low. Generally low to very low in fertility but widely used for subsistence and commerical crops. Yields generally low under simple management; they can be increased under complex management including fertilization.

7. Latosols, dissected.
Description:

Dominantly deep, well-drained, strongly weathered and friable loam to clay loam soils derived from volcanic materials. Generally, highly leached, acid, and low in plant nutrients. Inclusions of alluvial soils in narrow valleys.

Agricultural potential:

Low. Generally low to very low in fertility but widely used for subsistence and commercial crops. Yields generally low under simple management; they can be increased under complex management including fertilization. Soil and water conserving practices required for safe and maximum use of land. Dissected land makes tillage operations with machinery very difficult.

8. Latosols, rolling.
Description:

Dominantly deep, well-drained, strongly weathered and friable loam to clay soils derived mainly from consolidated sedimentary rocks although in some places from outwash and volcanic material. Soil highly leached, acid, and low in plant nutrients.

Agricultural potential:

Low. Generally low to very low in fertility. Soil and water conserving practices needed for safe and maximum use of land. Much of area best suited for present use as pasture, timber, and subsistence crops.

9. Latosols, mainly hilly.
Description:

Dominantly deep, well-drained, strongly weathered and friable loam to clay soils overlying stony, deeply weathered rocks. Soils acid and low in plant nutrients. Stony and shallow in some places.

Agricultural potential:

Low. Steep slopes, stoniness, and roughness make soils unsuited for intensive crop production. Best suited for forest, pasture, and subsistence cropping.

10. Planosols.
Description:

Soils which have impeded drainage caused by a heavy, dense, impermeable layer about one-half m below the surface. They are not necessarily poorly drained. Near Tibas and Guanacaste, soils are loams and clay loams over-lying a mottled dense claypan. Inclusions of Latosols.

Agricultural potential:

Medium. Because claypan makes soil slowly permeable to roots, air, and water, the soils are difficult to manage successfully for crop production and are better suited for shallow-rooted than for deep-rooted crops.

11. Grumosols.
Description:

Soils which are high in clay content and exhibit marked signs of swelling upon wetting and shrinking upon drying. Dark gray and black soils about 1 m thick over-lying clayey, commonly calcareous, shales, sandstones and some limestones. Mostly stony and with inclusions of Lithosol and alluvial soils.

Agricultural potential:

Medium. Although these soils are moderately high in plant nutrients and productivity, they are difficult to manage. They are heavy to work and have a very narrow moisture range in which they can be cultivated.

12. Low-humic gley soils.
Description:

Low-humic gley soils are poorly to very poorly drained, acid, and generally have a relatively thick, dark surface layer; they dry out and crack deeply in the dry season. In Tibás and Guanacaste, these soils have a dark gray to black surface layer which overlies gray plastic clay and old alluvial materials. During the wet season, they are flooded to as much as a meter part of the time. Locally, there are areas similar to Planosols; here, there is generally a fluctuating water table.

Agricultural potential:

Low. Soils have poor drainage, are wet much of the year, and are low in plant nutrients. Too wet for many food crops. Difficult to work because either too plastic and sticky when wet or too hard when dry. Rice culture possible after adequate water control and overcoming nutrient deficiencies. If drained and managed well, soils could become reasonably productive.

13. Lithosols, mainly lithosolic soils.
Description:

Shallow, stony soils and rockland. Inclusions of alluvial soils.

Agricultural potential:

Very low. Suited for forestry, although low in productivity. Locally, soils are deep enough for subsistence crops.

14. Regosols, alluvial, bog and low-humic gley soils.
Description:

Regosols generally sterile dune and beach sand. Alluvial soils similar to those in alluvial map unit. Bog soils consist of peat and muck over variable textured materials. Low-humic gleys like those in corresponding map unit.

Agricultural potential:

Soils occur in very complex pattern. Very little forseeable potential except local areas of subsistence crops on alluvial and Low-Humic Gley soils. Rice culture probably could be initiated and extended but would need to overcome many difficult problems, such as water control including maintenance of water table level to prevent drying out of soils and possible formation of highly acid and toxic conditions for plant growth.

3.3 Water Resources[6/]

3.3.1 Surface and Groundwater Resources

The distribution and extent of surface and groundwater resources are shown in Figures 11 and 12, respectively. Figure 11 also shows the major drainage basins, for which salient characteristics are given in Table 18. Table 19 contains more detailed information on the groundwater resources of selected river basins.

As might be expected on the basis of climatic patterns (Section 2.2), the Atlantic slope has generally more abundant water than the Pacific (Table 19, Figs. 11 and 12). Costa Rica is fortunate in that the area with the least rainfall and surface water resources, namely the Tempisque Valley region in the northwest, has good groundwater resources (Fig. 12, Table 19).

In general, Costa Rican water resources are abundant and exceed demand. However, UNEP (1976) reported intra-governmental conflicts for water access rights for hydro-electric energy or irrigation, and water use has increased considerably in the last decade (Table 20). Nevertheless, the quantity of water available is more than adequate for the agricultural and industrial development of the country.

3.3.2 Water Quality and Supply Systems

Problems with water quality and water supply systems are more important to Costa Rica than the quantity of available water per se. According to UNEP (1976), the most serious

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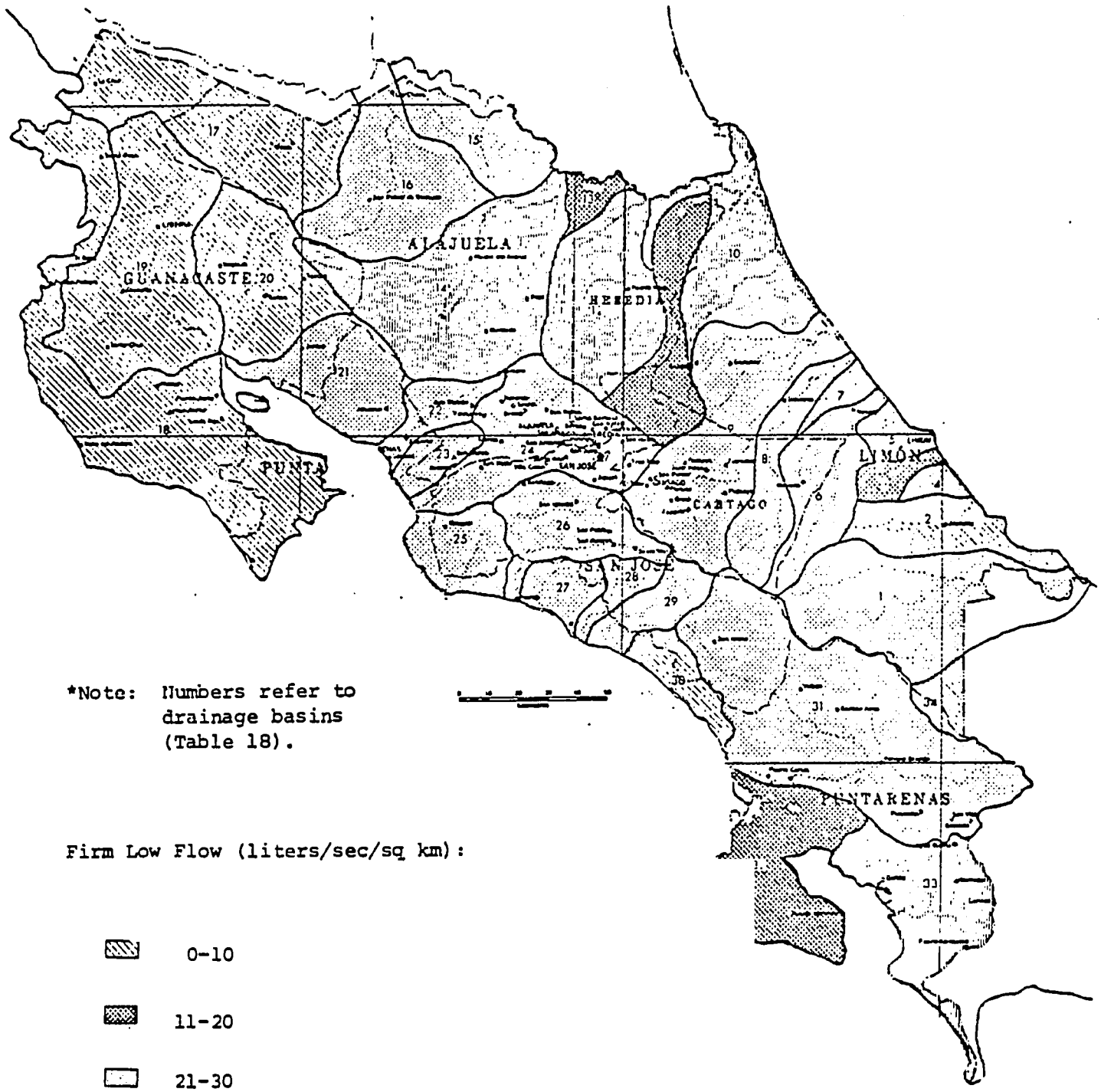
[6] Sources: UNEP. 1976.
U.S. Army Corps of Engineers. 1965.
van der Leedens. 1975.

Figure 11. Surface Water Resources*



*Note: Numbers refer to drainage basins (Table 18).

Firm Low Flow (liters/sec/sq km):

- 0-10
- 11-20
- 21-30
- 31-40
- 41-50

Source: U.S. Army Corps of Engineers. 1965.

Figure 12. Groundwater Resources

Flow quantities per well:

large - More than 5,300,000 liters/day.

moderate - 300,000 to 5,300,000 liters/day.

small - 50,000 to 300,000 liters/day.

meager - Less than 50,000 liters/day.

	SOURCES AND DEPTH	QUANTITY	QUALITY	DEVELOPMENT
1	Shallow wells in lenses of sand and gravel in plains and river valleys.	Moderate to large quantities available all year.	Moderately hard, clear; generally biologically contaminated.	Siting difficult because of locally soft ground and dense vegetation. Drilling or digging of wells easy in soft alluvium.
2	Shallow to moderately deep wells in sandstone in lowlands; in lenses of sand and gravel in river valleys.	Moderate quantities available all year.	Moderately hard, clear; shallow wells generally biologically contaminated.	Siting difficult because of dense vegetation and locally soft ground. Drilling moderately difficult in soft rock.
3	Fracture zones in andesite, limestone and granite; beds of permeable tuff, sandstone, and conglomerate, interbedded with basalt and shale; sources at varied depth. Scattered springs in andesite and lava flows interbedded with impermeable tuff, especially in an east-west belt chiefly in the Central Valley.	Small to moderate quantities from wells, generally moderate to large quantities from springs. Zone of great local differences. Structural geology determines amount.	Moderately hard to soft and clear. May be hot and acid or sulfurous near volcanoes. Locally biologically contaminated near settlements.	Siting difficult because of vegetation and locally steep slopes. Drilling difficult in hard rock.
4	Shallow wells in lenses of sand and gravel underlying coastal swamps.	Meager quantities of fresh water locally available above predominantly saline ground water. Large quantities of saline water available.	Generally brackish to saline.	Siting difficult because of soft ground.

Source: U.S. Army Corps of Engineers. 1965.

Table 18. Characteristics of Major Drainage Basins. See Fig. 11 for localities.

Map Area	River Basin Name	Total Area (Sq Km)	Total Length (Km)	Channel Width (m)	Mean Annual Discharge (cumecs)
1	Sixaola	2,190	140	75-150	145
2	Estrella (and others)	1,176	60	20-75	44
3	Banano	215	-	20-75	38
4	Bananito (and others)	163	-	-	12
5	Moin (and others)	330	-	-	22
6	Matina	1,321	80	20-75	147
7	Madre de Dios (and others)	257	-	-	9
8	Pacuare	948	105	20-75	59
9	Reventazón	2,787	145	20-75	231
10	Rio Tortuguero, Rio Colorado, (and others)	2,061	85	20-150	385
11	Chirripó	1,271	100	20-75	252
12	Sarapiquí	2,036	85	20-150	346
13	Cureña	201	-	-	40
14	San Carlos	3,535	125	75-150	594
15	Poco Sol (and others)	1,148	-	20-75	76
16	Frío	1,843	70	20-75	120
17	Zapote (and others)	2,650	-	< 20	93
18	Nicoya Peninsula and North Coast	4,124	-	< 20	140
19	Tempisque	3,412	136	-	89
20	Bebedero	2,078	68	75-150	67
21	Abangares (and others)	1,316	-	-	54
22	Barranca	380	-	-	28
23	Jesús María	448	-	-	25
24	Grande de Tárcoles	2,019	85	20-150	87
25	Tusubres (and others)	740	-	-	53
26	Parrita (or Pirrís)	1,344	80	20-75	56
27	Damas (and others)	443	-	-	29
28	Naranjo	426	-	-	24
29	Savegre	532	-	-	46

Table 18 Continued.

Map Area	River Basin Name	Total Area (Sq Km)	Total Length (Km)	Channel Width (m)	Mean Annual Discharge (cumecs)
30	Barú (and others)	560	-	-	20
31	Grande de Térraba	5,182	175	75-150	337
32	Osa Península	1,624	-	-	304
33	Esquinas	1,933	-	-	350
34	Changuinola (Costa Rican Territory)	207	-	-	8

Source: U.S. Army Corps of Engineers. 1965

Table 19. Groundwater Reserves

(Estimated replenishable resource, ground water in storage excluded: in million m3)

River basin	Total infiltration	Discharge to ocean		Evapotranspiration		Base Flow		Dependable yield[e]
		Total	Recoverable[a]	Total	Recoverable[b]	Total	Recoverable	
Atlantic Slope								
San Juan	9,900	2,010	14	-	-	7,890	4,720 [d]	4,735
Chirripo, Matina	304	68	5	68	20	168	79 [c]	105
Pacuare	221	45	3	68	21	108	51 [c]	75
Reventazon	1,120	102	5	226	68	852	506 [d]	520
Tortuguero	1,840	540	15	523	157	777	451 [d]	625
Banano, Estrella	247	247	-	-	-	-	-	-
Changuinola	14	14	-	-	-	-	-	-
Sixaola	194	146	-	-	-	48	24 [c]	25
Total	13,900	3,172	42	885	266	9,843	5,231	6,145
Pacific Slope								
R. Nicoya	265	140	-	125	38	-	-	40
Temoisque	1,380	91	7	206	62	15,841	785 [c]	855
Bebedero and others	958	316	14	205	61	437	206 [c]	280
G. Tarcoles	1,560	9	2	-	-	1,551	922 [d]	925
G. Candelaria, Naranjo, Savegre	550	296	14	-	-	254	113 [c]	130
G. Terraba	2,040	23	3	62	20	1,949	1,166 [d]	1,190
Golfo Dulce	2,370	248	18	432	130	1,690	827 [c]	975
Total	9,623	1,123	58	1,035	311	7,465	3,419	4,295
Total Costa Rica	23,523	4,320	100	1,920	577 *	17,308	9,250	10,540

a) Based on aquifer characteristics.
b) Estimated at 30% of total.
c) Estimated at 60% of base flow less recoverable discharge to sea.
d) Estimated at 60% of base flow less recoverable discharge to sea.
e) Total of recoverable ground water.

Source: van der Leedens. 1975.

Table 20. Water Use

	Total use, m^3/s			Irrigation			Drinking water and industrial supply		Hydroelectric power generation	
	Water withdrawn	Net use	Water consumed	Area under irrigation 1,000 ha	Total water demand m^3/s	Water consumed m^3/s	Total water demand m^3/s	Water consumed m^3/s	Installed capacity MW	Water use m^3/s
1970	217.1	43.0	20.5	45.7	39.6	19.4	3.4	1.1	166	69.6
1980	285.2	61.7	29.3	55.2	56.2	27.5	5.5	1.8	346	119.0

Source: van der Leedens. 1975.

water quality problem is the pollution of soils by pesticides which percolate into the groundwater. In urban centers, water pollution problems are indicated by a high incidence of gastro-intestinal diseases, principally affecting the infant and child population. An out-of-date, but still useful summary of major urban water supply and sewage facilities is given in Appendix II. Van der Leedens (1975) identifies the three most important detriments to improvement of community water supply systems as insufficient financing, inadequate legal framework, and lack of tr ined personnel.

A number of Costa Rican federal agencies are involved with the administration and management of national water resources. These include the Instituto Nacional Geografico (IGN), Instituto Costarricense de Electricidad (ICE), Servicio Nacional de Aguas Subterraneas (SENAS), Servicio Nacional de Aguas y Alcantarillas (SNAA), and the Servicio Nacional de Electricidad (SNE). ccording to UNEP (op cit) the overlapping responsibilities of these agencies, and the lack of adequate equipment and trained personnel hinder the effectiveness of water resources monitoring and management in Costa Rica.

3.4 Natural Vegetation[7/]

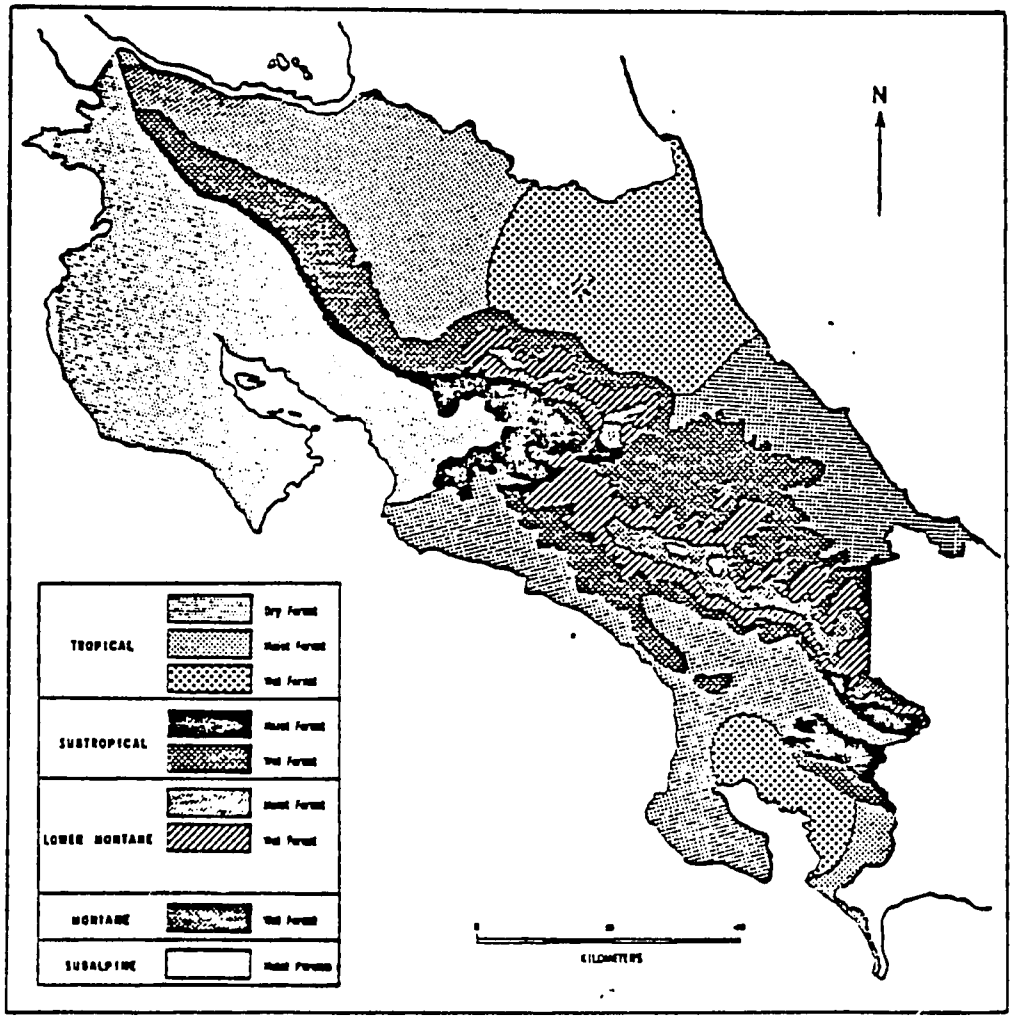
Costa Rica contains one of the world's richest and most complex vegetations in a relatively small area. Several factors contribute to this circumstance, including the tropical locale, the meeting of northern and southern floras, and the wide range of elevations, precipitation patterns, and soil conditions. Since the arrival of Europeans, the native flora has been further complicated by the addition of introduced weeds, escaped ornamental and crop plants,

[7] Sources: OTS. 1972.
Slud. 1964.
U.S. Army Corps of Engineers. 1965.

and artificial changes in environmental conditions which have expanded or contracted the ranges of native plants. Maps of vegetational communities, however, attempt to reconstruct the original conditions.

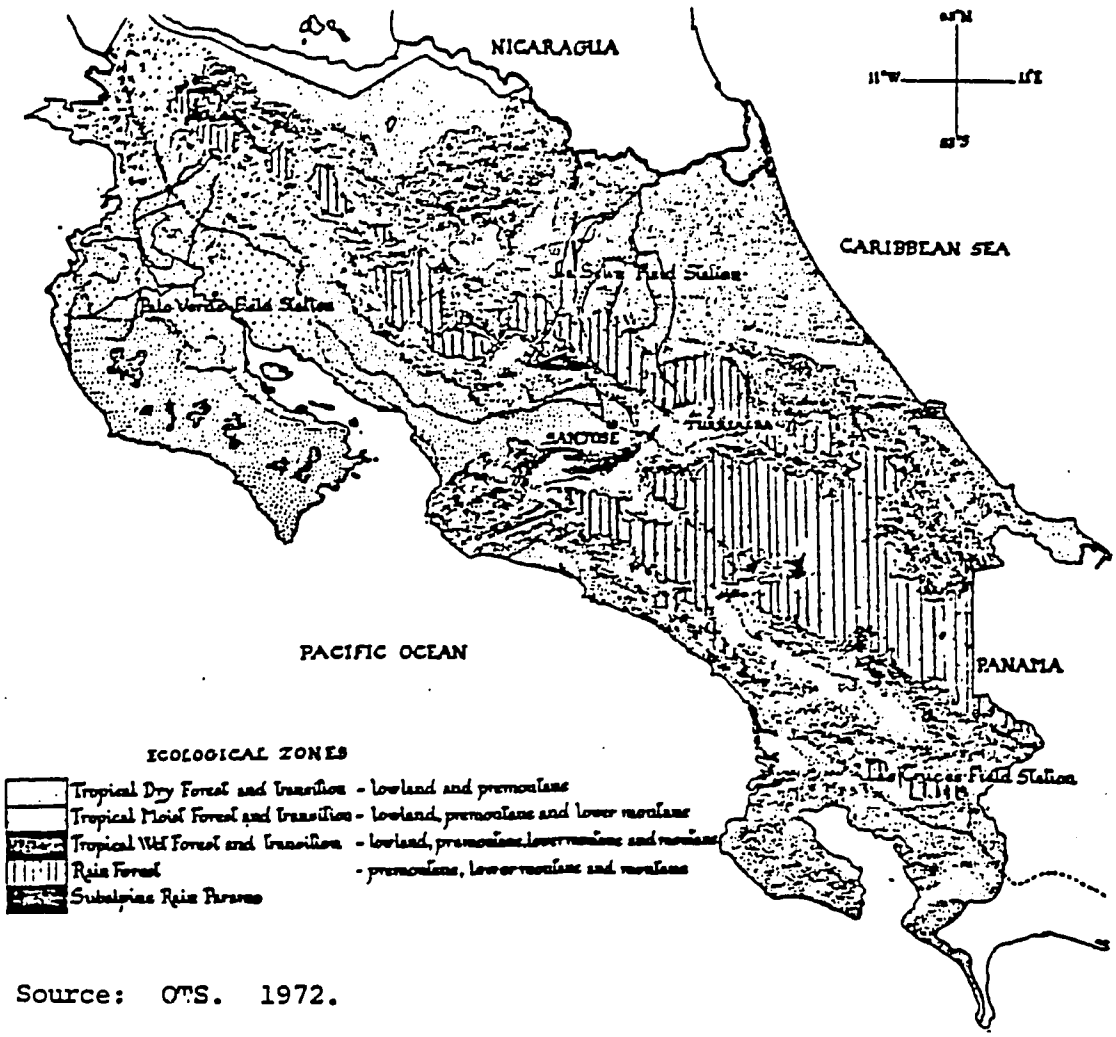
The classification of vegetational communities followed here is that of Holdridge (1959) as summarized by Slud (1964). Nine different zones are mapped in this scheme (Fig. 13); they are separated by elevation and moisture. The most extensive zones at any elevation are the moist and wet forests. The upper limits of the five elevational belts are actually determined by temperature and are therefore related only indirectly to elevation. The tropical zone, for example, rises to 700 m on the Pacific slope, but reaches only 500 to 600 m on the Caribbean slope, due to the cooling effects of increased moisture (Section 2.2). Upper limits for the remaining zones, subject to local variations, are: subtropical, 1400-1500 m; lower montane, 2500-2600 m; montane, 3500-3600 m; and subalpine, above 3600 m. Both the montane and subalpine zones are restricted to small areas in the Cordillera de Talamanca.

Figure 13. Ecological zones of Costa Rica, from Holdridge.



Source: Slud. 1960.

Figure 14. Ecological Zones of Costa Rica, from Tosi, Locations of three Organization for Tropical Studies field stations also shown.



Source: OTS. 1972.

A more recent treatment of Costa Rican ecological zones adapted from a 1969 map by Tosi (OTS 1972) is shown in Figure 14 for comparison. It includes only five zones, again separated by factors related to moisture and elevation. A much more detailed map by Tosi (scale of 1:750,000) depicts 19 different vegetational formations based on the Holdridge system. This map is included in Holdridge et al (1971), which also contains detailed floristic surveys from 20 Costa Rican localities.

Despite its greater generality, the modified Tosi map (Fig. 14) gives a fairly sensitive treatment of topographic effects, especially in the northwestern cordilleras and on the Nicoya peninsula. Tropical dry forest is shown as being limited to the lowlands of the Tempisque valley and vicinity, rather than widespread in the northwest, as shown in the older Holdridge map (Fig. 13). On the other hand, Figure 13 distinguishes the very wet forests of the Caribbean northeast and

Gulfo Dulce areas, whereas Figure 14 includes these with other forests in the general category of tropical wet forest.

A third treatment of the vegetation, by the U.S. Army Corps of Engineers (1965), is also shown for comparative purposes (Fig. 15). It is not a true map of natural vegetational communities because it includes such human alterations as coffee plantations and croplands, but it is useful for distinguishing areas of coastal swamp and evergreen oak forest. Elements from this treatment of the vegetation are also used in the following summary of vegetational zones.

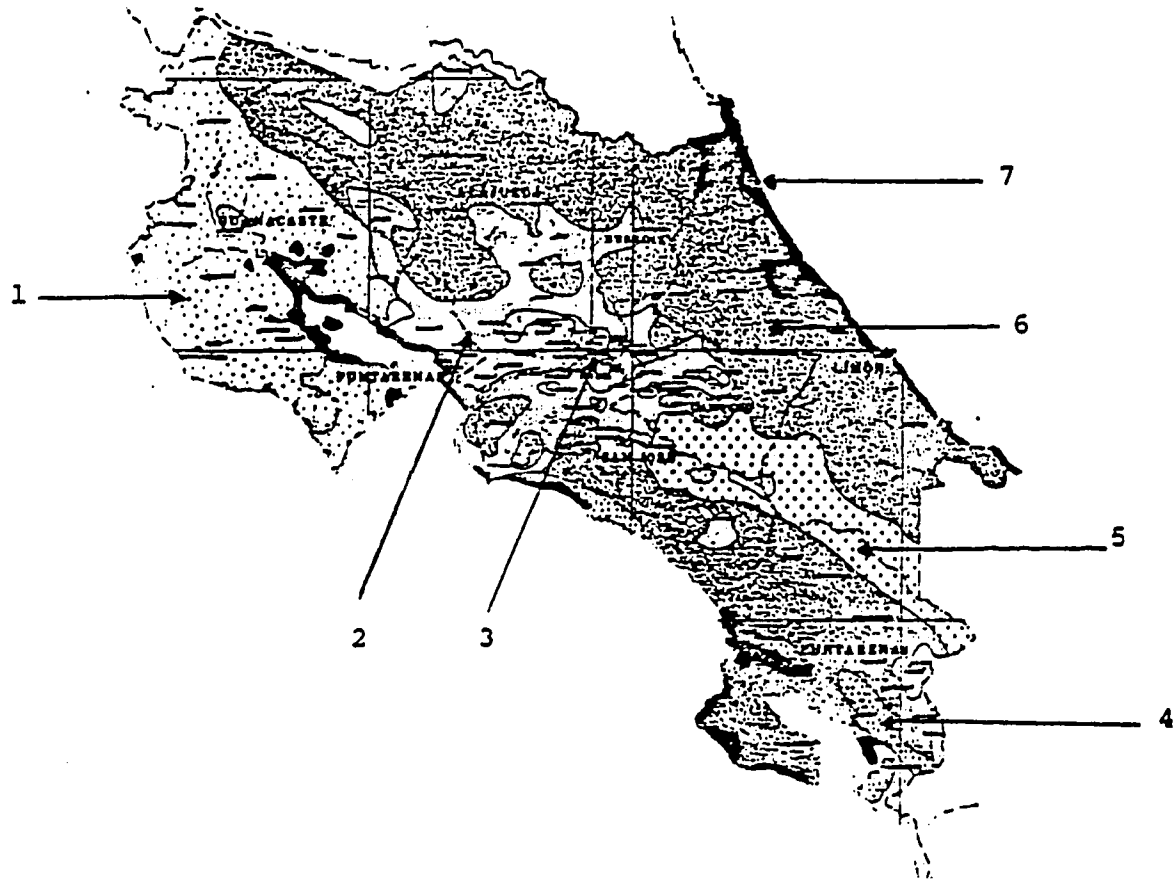
Tropical Dry Forest. Tropical dry forest is typical of the lowlands fringing the Gulf of Nicoya and surrounding the Rio Tempisque in the province of Guanacaste (Fig. 14). The forest canopy, composed of deciduous trees with spreading crowns of small leaves, reaches 20-25 m in height. A thick understory of smaller trees, vines, and low branching shrubs gives the forest a tangled appearance. The typical forest association includes *Tabebuia chrysantha, Swietenia humilis, Pithecellobium saman, Astronium graveolens, Guazuma ulmifolia, Ceiba pentandra, Sloanea quadrivalvis, Bombacopis quinatum, Acrocomia binifera,* and the Guanacaste tree, *Enterolobium cyclocarpum,* national tree of Costa Rica. Occasional very large specimens of *Enterolobium, Ceiba,* and *Pithecellobium* stand out above the other trees. A large spiny bromeliad, *Bromelia pinguin,* grows terrestrially.

Besides this basic forest community, the tropical dry forest zone contains a number of well-marked special associations. From Las Cañas to beyond Liberia there is a zone of very poor soils dominated by *Byrsonima crassifolia* and *Curatella americana,* and including *Quercus oleoides,* which is generally found at higher elevations. Unflooded stream and river banks have a taller, more luxuriant riparian forest, with species more typical of the wetter Pacific slope of southern Costa Rica, and with a greater tendency to be evergreen. Lowlands subject to seasonal flooding have almost pure thickets of the spiny palm (*Bactris*) and the paloverde (*Parkinsonia aculeata*).

Tropical Moist Forest. Tropical moist forest is shown by Holdridge as the most widespread lowland forest type, being native to large areas in the north, east, and southeast (Fig. 13). Tosi, on the other hand, shows tropical moist forest as a type with a much more limited distribution, confined largely to the drier open tropical zone regions of the northwest, Nicoya peninsula, and Valle Central (Fig. 14). The following description, based on Slud (1964), is meant to describe tropical moist forests distributed as shown by Holdridge.

Tropical moist forest is predominantly broadleaf evergreen forest, composed of a great variety of species. The canopy is closed, averaging 30 to 40 m high, and above it project the crowns of taller emergent trees. The majority of trees have straight trunks with buttressed bases, and are free of branches for almost three-quarters of their total height. The shade-tolerant understory trees, 15 to 18 m tall, are characterized by relatively thin trunks and small crowns. The moderately dense undergrowth is composed of shrubs 1 to 3 m high. On excessively humid soils, the proportion of palms is greatly increased and many have stilt roots.

Figure 15. Vegetation Map by U,S, Army Corps of Engineers.



1. Open deciduous forest, savanna, and crops
2. Field crops, upland pasture, and grassland
3. Coffee plantations
4. Banana plantations
5. Dense to open broadleaf evergreen oak forest
6. Dense broadleaf evergreen forest
7. Coastal swamp

Source: U.S. Army Corps of Engineers. 1965.

Typical tree species of tropical moist forest include *Anacardium excelsum, Brosimum* spp., *Luehea seemannii, Cordia alliodora, Castilloa* spp., *Pentaclethra macroloba, Cedrela mexicana, Cecropia* spp., *Virola* spp., *Guarea* spp., *Vitex* spp., *Calophyllum brasiliense, Terminalia amazonia, Dialium guianense, Tabebuia pentaphylla, Ochroma lagopus, Manilkara* spp., *Minquartia guianensis, Coumarana panamensis,* and *Eschweilera calyculata.*

Tropical Wet Forest. Tropical wet forest, as mapped by Holdridge (Fig. 13), is found only in the high rainfall areas of the northeast and the Golfo Dulce lowlands in the southwest. In the Tosi scheme (Fig. 14), tropical wet forest is the dominant lowland forest type, embracing the same areas mapped by Holdrigge as tropical wet forest as well as extensive areas of what Holdridge calls tropical moist forest. In either scheme, the La Selva field station of the Organization for Tropical Studies is located in tropical wet forest (Fig. 14). The following description therefore relies on a description of forest at that station (OTS 1972), as well as information in Slud (1964). A detailed treatment of the Golfo Dulce forests is found in Allen (1956).

The forests are taller and denser than those of tropical moist forest, and include many palms. The tallest trees reach 50 m in height, with large irregular crowns; trees 35 m tall with rounded crowns complete the canopy. Epiphytes, lianas, and stilt-rooted palms are common. The ground layer of vegetation is dominated by dwarf palms and broad-leaved monocots. At least 200 species of trees are present in the 540 ha of primary forest at La Selva, the commonest being *Pentaclethra macroloba,* a legume which comprises about 30 percent of the basal area. Families represented by several species at La Selva include Palmae (at least 25 species), Moraceae, Annonaceae, Myristicaceae, Lauraceae, Mimosaceae, Papilionaceae, Rutaceae, Meliaceae, Euphorbiaceae, Tiliaceae, Bambacaceae, Sterculiaceae, Flacourtiaceae, Apocynaceae, Boraginaceae, and Rubiaceae.

Coastal Swamp Forests. Coastal swamp forests are considered to be a special subset of tropical moist forest in the Holdridge scheme. They are of two basic kinds: palm swamp along the Caribbean coast, and mangrove swamp along the Pacific coast. Figure 15 shows the location of coastal swamps.

Palm swamp occurs in belts as much as several miles wide in areas of fresh to salty water along the Caribbean coast. It may be dense or open and includes thickets of palms of many species, as much as 6 m high. Mangrove swamp occurs along much of the Pacific coast and extends up tidal streams. It is dense, with trees 3 to 6 m high, trunks 30 to 60 cm in diameter, and arching prop roots 1 to 2 m high.

Subtropical Moist Forest. The subtropical zone of Holdridge lies above the upper limits of the tropical zone, marked approximately by the 24°C isotherm, and extends upwards to the lower limits of frost, or, ".... in the wetter districts, a line of critical temperature that produces the same restrictive effect" (Slud 1964). Vegetational associations shown as subtropical in the Holdridge map (Fig. 13) are included as parts of tropical wet, tropical moist, and rain forest zones in the Tosi map (Fig. 14).

The subtropical moist formation is typical of what is now the coffee zone of the central plateau (Figs. 13 and 15). Most of the natural vegetation on good soil is now exterminated, and replaced with coffee under shade. The natural vegetation of this area is a relatively tall evergreen forest with an almost unbroken canopy. Typical trees include *Eugenia* and various species of the Myrtaceae, *Persea caerulea*, *Phoebe mexicana*, and other Lauraceae, *Croton* spp., *Hauya lucida*, *Erblichia odorata*, *Dussia* spp., *Albizzia adinocephala*, and, at lower elevations in the zone, *Myroxylon balsamum*. Poorer soils may have an association of *Conestegia xalapensis* and *Zanthoxylum limoncello*.

Subtropical Wet Forest. The subtropical wet forest of Holdridge (Fig. 13), included as part of the tropical wet and rain forest zones of Tosi (Fig. 14), is denser and much more extensive than subtropical moist forest. It is a tall evergreen forest with a canopy about 30 m high, large emergent trees, and a sparse undergrowth of bushy and herbaceous growth. About 50 tree species are found in a stand, many of which never attain large size. Succession is slow on extensively cleared areas.

The forests are characterized by various species of the family Lauraceae, as well as *Lafoensia*, *Mauria*, and *Talauma gloriensis*. Lower elevations have such tropical zone species as *Cordia alliodora*, *Ochroma lagopus*, and *Goethalsia meiantha*, which reach an elevation of some 800 m. Two distinct associations of the upper Revantazón valley are the *Cedrela mexicana - Simaruba glauca* association, and, at a higher elevation, the *Cedrela tonduzzi* association. Dominants exceeding 30 m in the former association are *Cedrela mexicana*, *Ceiba pentandra*, *Chaetoptela mexicana*, *Engelhardtia pterocarpa*, *Quercus guglielmi - treleasi*, *Q. tomentocaulis*, and *Sideroxylon capiri*. In the second association, only *Cedrela tonduzzi* and *Sideroxylon capiri* are dominant.

Lower Montane Moist Forest. Lower montane moist forest occupies small areas in the protected, less rainy zone behind Irazú volcano (Fig. 13), the west slope of Poás volcano, and possibly along the Pacific slope of the Talamanca range, though it is not mapped in the latter two localities. The original forest on Irazú is virtually extinct, having been replaced by crops. Typical trees include *Eurya theoides*, *Rhamnus pubescens*, *Citharexylum lankesteri*, *Meliosma irazuensis*, *Quercus irazuensis* and *Q. alata*. Dominants are typically young members of the Lauraceae. Tree ferns occur fairly commonly, and highland palms and *Chusquea* thickets are found in wetter areas. Ground-dwelling plants resistant to dryness and cold are common: lichens, mosses and club mosses, ferns, terrestrial herbs, and pepperomias. Epiphytes, lianas, and climbers are scarce.

Lower Montane Wet Forest. Lower montane wet forest occurs in a cold, wet zone where the dry season lasts two months and low temperatures average 3° to 6°C. It occurs chiefly on the Cordillera de Talamanca above 2000 m (Fig. 13) and is included in rain forest by Tosi (Fig. 14). As shown in Figure 15, this forest is primarily an evergreen oak forest, commonly mixed with other species of broadleaf trees, but with some extensive stands of pure oak on poorer soils. Trees are 25 to 30 m high, and free of branches for two-thirds of their total height. The heavily shaded undergrowth is generally thin, and composed of tree

ferns, small palms and other monocotyledonous shrubs, many climbers, and *Chusquea* in openings. Many ferns and mosses and a thin layer of dicotyledonous herbs cover the thick layer of organic matter on the forest floor. Epiphytes, especially orchids and bromeliads, are abundant on tree trunks and branches, as are climbers, ferns, mosses and lichens. Among the trees are *Cornus disciflora, Cedrela tonduzzi, Alnus jorullensis, Magnolia poasana,* and *Persea schiedeana.* Oaks include *Quercus oocarpa* at lower elevations, *Q. copeyensis* in the upper elevations, and *Q. tomentocaulis.*

Montane Wet Forest. Montane wet forest (Fig. 13) described as montane rain forest in Slud (1964), occupies high mountain areas with abrupt topography and excessive humidity. Rains, heavy mists, and low cloud cover occur almost daily, and there is no dry season. Average temperatures range from 6° to 12° C.

Trees in this forest are often deformed, with internal defects and twisted trunks averaging 25 to 50 cm in diameter. The crowns are typically small or open, with many dead branches and small, hard leaves at the extremities of the branches. Epiphytic growth is abundant, and the understory is crowded with perennial herbs, shrubs, and climbers, or thickets of *Chusquea.* The soil surface is covered with partially decomposed trunks, dead leaves, superficial roots, and layers of organic matter.

Only about 12 or 13 tree species occur in the association. Among these are *Buddleia alpina, Escallonia poasana, Oreopanax xalapense, Weinmannia pinnata, Miconia bipulifera, Rapanea pittieri, Quercus costaricensis, Drimys winteri,* and *Podocarpus standleyi.* Two minor treeless associations are *Chusquea subtessellata* on exposed slopes and *Puya dasyliroides - Lomaria wercklei* in *Sphagnum* bogs.

Subalpine Paramo. The subalpine paramo, occupying the tops of the highest peaks in the Cordillera Talamanea, is related to paramo vegetation of South America. Plants include the ground bromeliad *Puya dasyliroides,* ferns (*Jamersonia* spp.), and other Andean plants which reach their northernmost limit here.

3.5 Fauna and Conservation Measures

3.5.1 Native Terrestrial Fauna

That Costa Rica has a diverse fauna is no surprise, despite its relatively small size. Among the factors contributing to Costa Rica's faunal diversity are its tropical locale, its extensive variation in both elevation and local climate (Sections 2.1 and 2.2), and its position as a link between North and South America. Humid forests and their animals extend directly from South America to Costa Rica, where many South American species reach their northern limits. On the other hand, many northern species associated with dry forest habitats reach their southern limits in Guanacaste, which forms the southern terminus of the arid Pacific coastal zone.

Goodwin (1946) recorded 186 species of mammals for Costa Rica, and

lists an additional 73 species believed likely to occur there based on their ranges as known at that time. Of these 259 species, 90 are bats, most of which occur in tropical forest. The tropical wet forest reserve at La Selva (Figure 14, Section 3.4.1), only 720 ha in size, has 63 species of bats. Larger mammals of the tropical forests include six species of cats (jaguar, puma, ocelot, margay, jaguarundi, and tigercat), tapir, peccary, sloths, and monkeys. The Caribbean manatee (*Trichechus manatus*) frequents the coastal marshes of the northeast.

The entire avifauna is surveyed by Slud (1964), and some recent revisions are included in Ridgely (1976). Slud lists 758 species, of which about 120 are North American migrants, including 31 shorebird species and 29 warblers. The resident avifauna is mostly of tropical South American origin, and is most diverse in the tropical zone. The tropical forest reserve at La Selva has recorded 388 species, more than half of the country's total. Five species of small, forest dwelling birds are known only from Costa Rica (Table 21).

Table 21. Endemic Birds

English Name	Latin Name	Range
Mangrove Humingbird	*Amazilia boucardi*	Pacific coast mangroves
Coppery-headed Emerald	*Elvira cupriceps*	Caribbean slope
Cerise-throated Hummingbird	*Silasphorus simoni*	Central highlands
Black-cheeked Ant-tanager	*Habia atrimaxillaris*	Golfo Dulce
Peg-billed Finch	*Acanthidops bairdii*	Central highlands

Sources: Slud 1964; Ridgely 1976.

There is apparently no comprehensive survey of the herpetofauna, although there are surveys of particular groups and areas. Particular groups discussed in recent works include the giant anoles of the forest canopy (Savage and Talbot 1978), the plethodontid salamanders of the highland forests (Wake and Lynch 1976), and marine turtles breeding on the coasts (Richard and Hughes 1972, Carr and Stancyk 1975). Recent treatments of local areas include a transect of the Cordillera de Tilarán by Heyer (1967) and a survey of forest litter species at OTS field stations by Scott (1976).

Costa Rica's extensive highlands make it an important center of salamander diversity. Western Panama and Costa Rica together have 25 endemic species of salamanders, as compared with 2 for Nicaragua and Honduras combined, or 12 for northwestern South America (Wake and Lynch 1976). Most salamanders are residents of wet montane forests.

Costa Rica's beaches are important breeding grounds for sea turtles. Tortugero, on the north Caribbean coast, is the most heavily used green turtle (*Chelonia mydas*) beach in American waters (Carr and Stancyk 1975). Pacific beaches are equally important to the Pacific ridley (*Lepidochelys olivacea*); Richard and Hughes (1972) found 2 beaches in Guanacaste with over 100 thousand turtles offshore during September-November.

3.5.2 Fisheries[8/]

Marine Fisheries. Industrial fisheries account for most of the marine products produced in Costa Rica. They are specifically responsible for the tuna, thread herring, and shrimp catches, most of which is processed for export. Artesanal fishermen produce a significant amount of fish classified as "white" fish, as well as shark, lobster, mollusks, and turtle. The most important fish in national markets is croaker (Sciaenidae) followed by shark, mero (Serranidae), and snapper (Lutjanidae). The most abundant sharks are *Sphyrna zygaena, Carcharhinus leucas,* and *Prionace glauca*. Shrimp taken by commercial vessels include *Penaeus duorarum, P. schmitti,* and *Xiphopenaeus kroyeri*.

With the exceptions of lobster and turtle, marine fisheries production is much greater from the Pacific than from the Atlantic (Table 22). The major Pacific fishing port is Puntarenas, while Puerto Limón is the most important Atlantic port. Golfito on the southern Pacific coast has a small fishing fleet.

Table 22. Average Annual Fish Production (metric tons) for Both Coasts, 1968-1970.

	Pacific	Atlantic
White fish	1490	12
Shark	327.5	42.1
Lobster	5.5	65.9 (range 13.2-128.6)
Mollusks	20.9	-
Turtle	-	87

Source: Pollnac. 1974

Various methods are employed by artisanal fishermen, depending on the quarry. Sharks are taken with handlines and gill nets, with handlines being preferred. White fish are captured with throw nets, gill nets and handlines. Boats are usually 8-10 m long with either inboard or outboard motors on the Pacific coast and 8-12 m long, usually dugouts with outboard motors, on the Atlantic.

Lobster, including *Panulirus gracilis* and *Evibacus princeps* on the Pacific, and *Panulirus argus* on the Atlantic, are taken by diving or in traps on both coasts. Mollusks are collected by hand except for squid which are captured in small gill nets. Important mollusks are *Anadara tuberculosa, A. multicostata, A. grandis, Donax* spp., *Prototheca* spp., *Mytella speciosa, M. guayanensis, M. falcata, Ostrea iridescens, O. columbiensis, Pinna rugosa* and *Strombus gigas*.

[8] Sources: Lovell and Moss. 1971.
Pollnac. 1974.

Green sea turtles *(Chelonia midas)* are captured on the Atlantic coast with either harpoons or large mesh nets. Harpoons are usually favored. Three men in an outboard powered dugout, traveling approximately 50 km to a hunting area, can capture as many as 8 or 9 turtles a day. From 1956 to 1970 the annual average turtle production was 117.4 metric tons, with a considerable range of 3.7 to 435.2 metric tons.

Improvement of Costa Rica's fishing industry depends primarily on improving storage, distribution, and marketing systems. Fish are often not iced while on ship, and are also transported on land without cooling, causing deterioration. Another area for potential growth and improvement is mariculture. Experiments in mussel culture have been quite successful, and potential areas for such an industry exist on both coasts.

Inland Fisheries and Aquaculture. Because Costa Rica has no large lakes, freshwater fishing is not an established industry. The Fisheries Section of the Division of Forestry, Ministry of Agriculture, began stocking trout in mountain streams for sport fishing in the 1960s, and populations are still good in some areas. In 1968, the Extension Division of the Ministry of Agriculture initiated a program for farmers to produce *Tilapia* in ponds. However, uncontrolled reproduction resulted in numerous small fish and few large fish, so the program was abandoned. The Turrialba Agricultural Diversification Project, an autonamous organization affiliated with the Instituto Interamericano de Ciencia Agricola (IICA), has subsequently developed a hybrid *Tilapia* that will grow to suitable size in farm ponds when properly managed. Given the natural potential for farm ponds provided by small streams and valleys, the prospects for developing *Tilapia* culture for family use are good.

3.5.3 Endangered Species

Table 23 lists 80 vertebrates considered to be endangered or threatened by the Department of Continental Fisheries and Wildlife (Departamento de Pesca Continental y Vida Silvestre) of Costa Rica. By the law of Conservation of Wildlife and by Executive Decrees 2517-A, 5959-A, and 5915-A, it is prohibited to harass, capture, or kill any of these species anywhere in national territory. On the international level, the species are protected by the Convention on International Commerce of Endangered Species of Flora and Fauna (Lopez Pizarro 1978?).

Many of the 80 species protected by Costa Rican law are valued for pelts, meat, or pets. Among the mammals, these include the cats, primates, and tapir, while birds and reptiles in this category include the parrots and crocodiles. The Costa Rican list is unusual in offering protection to all of the hawks *(Falconiformes)* of the country, ranging from the large, rare Harpy Eagle *(Harpia harpyja)* to the small and relatively common American Kestrel *(Falco sparverius)*. This is a progressive step which recognizes both the importance of hawks to natural ecosystems and their vulnerability to destruction by casual shooting.

Table 23. Vertebrates Protected by Costa Rican Law

I. Species in Danger of Extinction

Class	Family	Species
Amphibians	Bufonidae	*Bufo periglenes*[a]
Reptiles	Crocodylidae	*Crocodylus acutus*[a]
	Alligatoridae	*Caiman crocodilus*
Birds	Accipitridae	*Morphnus guianensis*
		Harpia harpyja[a]
		Harpyhalieatus solitarius
		Spizaetus melanoleucus
		S. ornatus
		S. tyrannus
	Falconidae	*Falco deiroleucus*
	Psittacidae	*Ara macao*
	Cracidae	*Crax rubra*
	Ciconidae	*Jabiru mycteria*
	Trogonidae	*Pharomachrus mocinno*[a]
Mammals	Felidae	*Felis tigrina*[a]
		F. weidii[a]
		F. concolor[a]
		F. pardalis[a]
		F. onca[a]
		F. yagouaroundi[a]
	Sciuridae	*Symtheosciurus poasensis*
		Sciurus deppei
	Tapiridae	*Tapirus bairdii*[a]
	Trichechidae	*Trichechus manatus*[a]
	Cebidae	*Alouatta palliata*
		(= A. villosa)[a]
		Ateles geoffroyi[a]
		Cebus capucinus
		Saimiri oerstedii[a]
	Callithricidae	*Saguinus geoffroyi*
		(= S. oedipus)[a]
	Myrmecophagidae	*Myrmecophaga tridactyla*

II. Species with Reduced Populations

Class	Family	Species
Birds	Accipitridae	*Elanus leucurus*
		Elanoides forficatus
		Leptodon cayanensis
		Chondrohierax uncinatus
		Harpagus bidentatus
		Ictinia mississippiensis
		I. plumbea

Table 23. Vertebrates Protected by Costa Rican Law, cont.

Class	Family	Species
Birds	Accipitridae	*Rostrhamus sociabilis*
		Accipiter bicolor
		A. cooperi
		A. superciliosus
		A. striatus
		Buteo albicaudatus
		B. jamaicensis
		B. albonotatus
		B. swainsoni
		B. platypterus
		B. magnirostris
		B. brachyurus
		B. nitidus
		Parabuteo unicinctus
		Heterospizias meridionalis
		Leucopternis albicollis
		L. semiplumbea
		L. princeps
		Busarellus nigricollis
		Buteogallus anthracinus
		B. urubitinga
		Circus cyaneus
		Geranospiza nigra
		Pandionidae haliaetus
	Falconidae	*Herpetotheres cachinnans*
		Micrastur semitorquatus
		M. mirandollei
		M. ruficollis
		Daptrius americanus
		Polyborus plancus
		Milvago chimachima
		Falco peregrinus[a]
		F. deiroleucus
		F. rufigularis
		F. columbarius
		F. sparverius
	Psittacidae	*Ara ambigua*
Mammals	Dasypodidae	*Cabassous centralis*
	Mustelidae	*Gallictis allamandi*
	Procyonidae	*Bassaricyon gabbii*
		Bassariscus sumichrasti
	Brasypodidae	*Choloepus hoffmani*
		Bradypus griseus

[a]Species considered endangered by U.S. Fish and Wildlife Service (1980).

Source: Lopez Pizarro. 1978?

Only 17 of the 80 species on the Costa Rican list are classified as endangered or threatened by the U.S. Fish and Wildlife Service (Table 23). However, the USFWS lists 8 additional species not included on the Costa Rican list (USFWS 1980). Seven of these are marine species, including the Caribbean Monk Seal (*Monarchus tropicalis*) and six species of marine turtles: *Chelonia mydas, Eretmochelys imbricata, Lepidochelys kempii, L. olivacea, Dermochelys coriacea,* and *Caretta caretta*. The eighth is a shorebird, *Numenius borealis,* which is only a rare migrant in Costa Rica.

Carr and Stancyk (1975) comment particularly on the endangered status of the hawksbill or carey sea turtle (*E. imbricata*) in the Caribbean, saying that it has "...declined to endangered status before its ecology has been adequately investigated." Tagging of hawksbills at Tortugero beach over 20 years reveals a decline from 3.7 individuals per patrol-hour per mile in 1956-59 to just 0.97 today. Decline of the hawksbill is attributed to the value of its shell to the Japanese for ceremonial purposes, and the increase in numbers of spearfishermen (Carr and Stancyk 1975). Although the hawksbill and other marine turtles are not among the species protected by Costa Rican law, Costa Rica has been foremost among Central American nations in protecting sea turtle breeding beaches.

Costa Rica's Cocos Island, isolated in the Pacific (5^{o} 33' N, 87^{o} W) and about 7 km long, has a number of endemic forms. Four species and subspecies of birds found on Cocos Island are recognized by the IUCN (1971) as worthy of protection (Table 24). However, because Cocos Island is uninhabited and rarely visited, none of these are considered to be immediately endangered.

Table 24. Unique Forms of Birds on Cocos Island

Cocos Island Mangrove Cuckoo	*Coccyzus minor ferrugineus*
Cocos Island Flycatcher	*Nesotriccus ridgewayi*
Cocos Island Yellow Warbler	*Dendroica petechia aureola*
Cocos Island Finch	*Pinaroloxias inornata*

Source: IUCN. 1971.

The only species of plant currently recognized by any agency as endangered in Costa Rica is an orchid, *Notylia bicolor* (IUCN 1978). It is found only on tropical cedar, a tree valued for timber, and is scarce because cedar is so commonly cut. There are undoubtedly other plants endangered in Costa Rica, but the status of plants in the American tropics is generally poorly known.

3.5.4 National Park System[9/]

The Costa Rican national park system, administered by the Servicio de Parques Nacionales (SPN) of the Ministerio de Agricultura y Ganaderia, is the most extensive and well developed in Central America. All the major ecosystems are represented in national parks or biological reserves (Fig. 16). In the last few years the number of areas included in the park system has increased to 24, covering an impressive 3.9 percent of the total national area. A brief description of these areas follows.

National Parks

1. Santa Rosa. 10,700 ha. Pacfic dry tropical forest, gallery forest, savanna, estuaries, mangroves and beaches. Nesting grounds for over 100,000 Pacific Ridley turtles.

2. Rincón de la Vieja. 13,800 ha. Active volcano in the Guanacaste range (1898 m), origin of 32 rivers, contains four life zones.

3. Tortuguero. 21,000 ha. Most important breeding grounds for the green and carey sea turtles in the western Caribbean; coastal swamps and wetlands provide manatee habitat. Palm forests and lowland rainforest inland.

4. Barra Honda. 2295 ha. Cave system, bat populations.

5. Volcán Poás. 4000 ha. Active volcano with easy access from San José; much visited for scenic views.

6. Braulio Carillo. 32,000 ha. Includes Volcán Barba and Bajo La Hondura, with five forest types, abundant wildlife.

7. Volcán Irazú. 2210 ha. Inactive volcano with young plant communities, beautiful views.

8. Manuel Antonio. 280 ha. Three broad white beaches edged with tropical forest, abundant wildlife and seabirds.

9. Chirripó. 43,700 ha. Highest peak in southern Central America (3820 m) with glacial formations, cloud forest, paramo.

10. Cahuita. 1100 ha. Only significant formation of coral on the Atlantic coast of Costa Rica; palm-lined beaches

11. Corcovado. 36,000 ha. Major area of floral and faunal diversity on the Pacific coast, tropical wet forest.

12. Isla del Coco. 2400 ha. Unique wet forest on remote Pacific island with endemic species.

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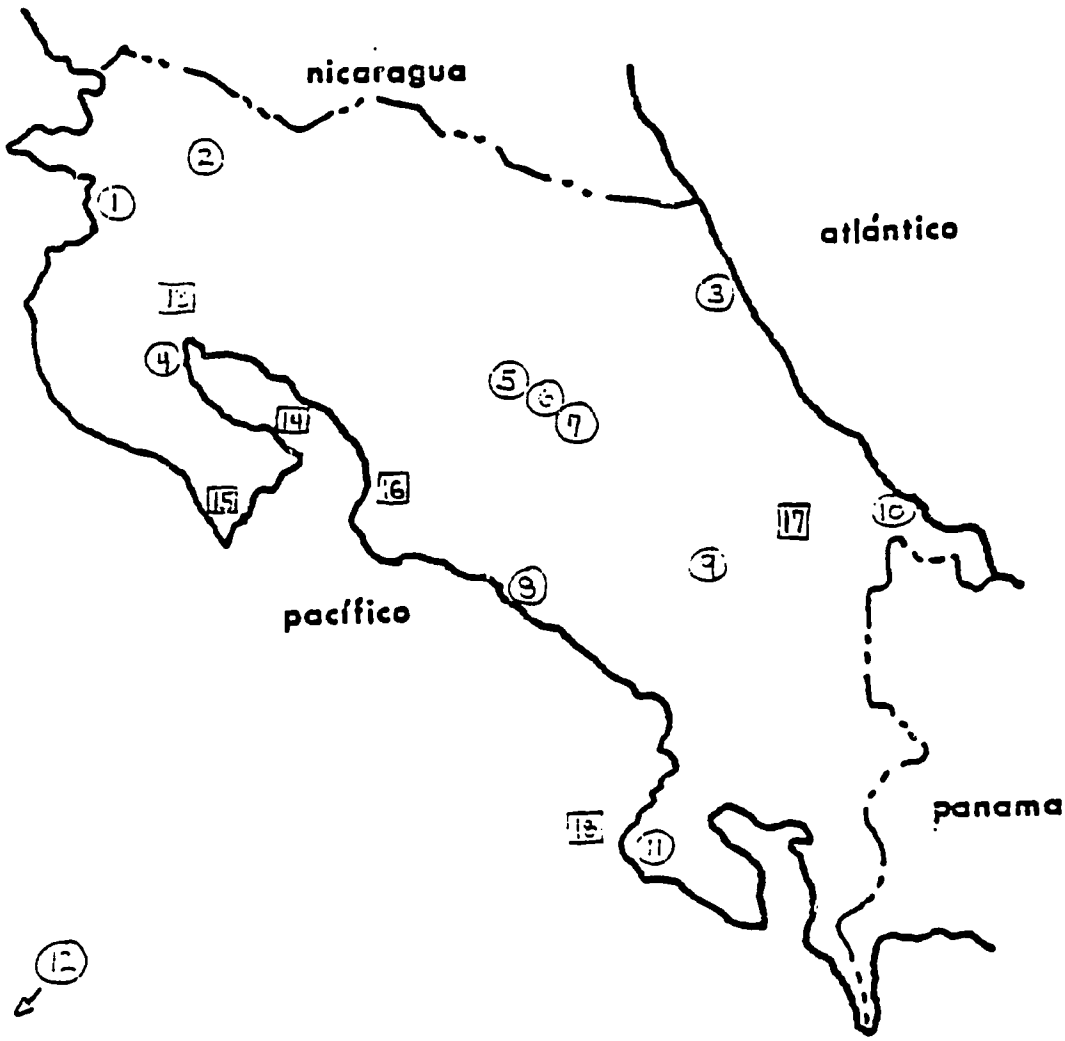
[9]Sources: La Bastille. 1978.
S.P.N. 1980a.
S.P.N. 1980b.

Figure 16. Location of National Parks and Biological Reserves



○ National Parks

1. Santa Rosa
2. Rincón de la Vieja
3. Tortugero
4. Barra Honda
5. Volcán Poás
6. Braulio Carillo
7. Volcán Irazú
8. Manuel Antonia
9. Chirripó
10. Cahuita
11. Corcovado
12. Isla del Golfo

□ Biological Reserves

13. Palo Verde
14. Islas del Golfo
15. Cabo Blanco
16. Carara
17. Hitoy-Cerere
18. Isla del Caño

Biological Reserves

13. Palo Verde. 4758 ha. Tropical dry forest, Tempisque river wetlands of great importance to migratory and resident waterfowl.

14. Islas del Golfo. 12 ha. Three small islands in the Gulf of Nicoya, nesting and roosting sites for frigatebirds, boobies, and pelicans.

15. Cabo Blanco. 1170 ha. Rocky coastline, seabirds and marine life, tropical dry forest.

16. Carara. 7600 ha. Last remnant of tropical dry forest in the area, abundant wildlife.

17. Hitoy - Cerere. 9044 ha. In valley of Rio La Estrella, Caribbean Foothills of Talamanea range; tropical wet forest with abundant avifauna.

18. Isla del Caño. 320 ha. 15 km offshore of Corcovado National Park on the Osa Peninsula; rich archaeological remains.

Other Parks

19. Guayabo National Monument. 65 ha. Most important archeological site in the country, with ancient paved roads, aqueducts, and monuments, on slopes of Turrialba volcano.

20. Santa Ana National Recreation Area. 42 ha. Outskirts of San José; site of future National Zoo, canyon of Río Uruca.

21. Prusia National Recreational Area. 583 ha. Upper watershed of Río Reventado; reforestation with native and exotic species.

22. Cariari National Recreational Area. 12.5 ha. Between Puerto Limón and Puerto de Moín; beaches.

23. Laguna de Fraijanes Recreational Park. 12.6 ha. Near Alajuela; cypress woods, lake, grassy field.

24. International Peace Park. By agreement with Panama, located in central border area.

One of the more remarkable features of Costa Rica's national park system is that most parks are protected by resident personnel, and many have information centers, guides, and interpretive signs. The recently prepared plan of operations for the system (SPN 1980a) divides the parks into three categories of priority for general management and planning purposes. High priority parks are those most frequently visited by the public, and include: Manuel Antonio, Volcán Poás, Volcán Irazú, Cahuita, Braulio Carillo, Santa Rosa, and the International Peace Park. The last of these is not heavily visited, but is threatened with destruction and is important for its international character. The remaining high priority parks all receive more than

25 thousand visitors per year. Parks of medium and low priority are those with few visitors or which are protected by their remote location.

3.5.5 Non-Governmental Conservation Efforts[10/]

Scientific and educational institutions independent of the national government have been instrumental in establishing conservation as a public issue in Costa Rica and in stimulating the government to protect the environment. The creation of Costa Rica's national parks, for example, is an achievement which can be credited as much to private action as to public policy. While much credit is due to the large international conservation organizations such as the World Wildlife Fund and the International Union for the Conservation of Nature, smaller, local agencies are equally important for their direct contact with the Costa Rican people and their special knowledge of national conditions. The following is a brief description of some of these important local agencies.

Associacíon Costarricense para la Naturaleza (ASCONA). A citizen's environmental group with headquarters in San José, ASCONA cosponsored (with the Centro Agronomico Tropical de Investigacion y Enseñaza and the Associacion Guatemalteca de Historia Natural) the First Regional Meeting of Non-Governmental Conservation Associations held in Guatemala City in December 1978 (AGHN et al 1978). At this meeting FEMAC (Federacion Mesoamericana de Asociaciones Conservacionistas No Gubernamentales) was formed, also currently headquartered in San José. Both agencies are concerned with environmental conservation and education in Central America, but ASCONA's activities are directed especially to Costa Rica. In 1978, ASCONA received a donation of U.S. $240,000. Current membership is about 300.

Centro Agronomico Tropical de Investigación y Ensenañza (CATIE). Located in Turrialba, CATIE is concerned with the study, application, and promotion of modern environmental principles to all aspects of land use in Central America. The Wildlands and Watershed Unit of CATIE has played a particularly important role in encouraging the development of national parks and reserves. Originally founded and funded by the Organization of American States, CATIE currently also receives private support from a number of international conservation and scientific foundations. CATIE's scope of operations is international, but its expertise and influence are particularly strong in Costa Rica.

Centro Cientifico Tropical. The Tropical Science Center is a private consulting organization located in San José. It provides a wide range of technical expertise in both pure and applied tropical studies,

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[10] Sources: AGHN et al. 1978?
CLADES. 1977; 1980.
La Bastille. 1978.
Lovejoy. 1978.
UNEP. 1976.

including agricultural methodology, climatology, ecology, surveys of soils, flora, fauna, and tourism. The Tropical Science Center also owns and operates the Monteverde Biological Reserve in the Cordillera de Tilarán, a montane wet forest locality.

Organization for Tropical Studies (OTS). OTS, based in the United States, sponsors a well-known tropical field studies course for graduate and undergraduate students in Costa Rica. For this purpose, they maintain four research stations in a diverse range of environmental communities (Fig. 14). Many young scientists have been first exposed to the problems of tropical ecology under the auspices of OTS. OTS owns and maintains an important 540 ha natural reserve at La Selva, a tropical wet forest locality on the Caribbean slope (Fig. 14).

National School of Environmental Sciences. The National School of Environmental Sciences, located in Heredia, is part of the National University of Costa Rica. It offers a Bachelor's Degree in Forestry Sciences, aimed at training students in the management of renewable natural resources in Costa Rica, as well as providing a global view of the problems of environmental change in the country and in the world (UNEP 1976).

Environmental Education Program. The Environmental Education Program, begun in 1977 by the State Extension University (Universidad Estatal a Distancia, San José) offers a correspondence course covering natural history, environmental pollution, watershed management, forest plantations, and management of natural areas. It also operates CIDA (Centro de Información y Documentatión Ambientales), an environmental information service, offers technical assistance in the field and provides speakers to address local environmental problems.

Other local environmental organizations mentioned by UNEP (1976) include the College of Biologists (Colegio de Biólogos de Costa Rica) of the Biology Department, University of Costa Rica, San Jośe, and the Friends of Nature, about which further details are not available.

4.0 Environmental Problems

4.1 Land Use

4.1.1 Deforestation and Progressive Land Degradation[11/]

With the exception of a few isolated areas of grassland in such special environments as high mountaintops or swamps, the natural vegetation of Costa Rica is forest. Ranging from the arid thorn forests of Guanacaste in the northwest to the luxuriant humid forests of the Caribbean slope and the Pacific southwest, Costa Rican forests are notable for the diversity of their flora and fauna (Sections 3.4, 3.5.1). Today, however, Costa Rican forests cover 30 percent of their original range, and they are disappearing at a rate of 55,000 hectares per year (Section 2.4.3). Much of the formerly forested area, originally cut to grow crops, is rapidly being converted to cattle pasture (Section 2.4.2). This massive change in the natural vegetation has created serious problems ranging from loss of native flora and fauna to economically damaging degradation of the land itself.

The deforestation of Costa Rica has cultural, technological, and economic causes. The original colonists from Spain regarded the tropical forest as a hostile environment, an attitude which persists to this day. Using metal blades and fire, they repeatedly cut and burned the natural vegetation until it did not return. Although these traditional methods are still in wide use, the advent of the chain saw has made the process of clearing forest even faster. The continuing hostile attitude towards natural forest is reflected in the vocabulary of the rural people, who refer to natural vegetation as "monte" (meaning untamed forest), while the term "bosque" (woodland) is reserved for tree plantations. This attitude is reinforced by current government laws which require colonists to clear the forest in order to establish their right of possession and which place higher taxes on naturally forested land than on "improved" land (Section 4.1.4).

The process of deforestation has been further accelerated by the increasing ease of access to forested areas. The rate of deforestation increased five-fold along the Pacific slope after completion of the Interamerican Highway. Atlantic slope deforestation, formerly limited to areas close to the railroad, rapidly expanded after construction of the San José - Limón highway. Forests of the Caribbean slope have recently been opened to cutting for timber and conversion to agriculture and cattle ranching by access from the

[11] Sources: D'Arcy. 1977.
Shane. 1978.
Tosi. 1978.
U.S. AID. 1979.

natural inland waterway along they coast. Yet, despite the rapidly dwindling forest reserves, a frontier attitude still persists among many Costa Ricans, who believe that large areas of forest remain to be cleared for farming.

Such extensive changes in the natural vegetation are not without broad environmental consequences. Erosion, falling river levels, flooding, and unproductive farm lands have already become serious problems in many areas of Costa Rica. Generally, the process begins with cutting and burning the forest to plant such annual crops as corn or beans. In some cases, the fields are later converted to perennial crops such as coffee or cacao, but most often, the land is converted to pasture after the soil becomes too impoverished to support annual crops. Those fields on the poorest soils are abandoned to revert to weedy second growth. Or, the conversion of forest to pasture may be direct in the case of lands controlled by speculators and absentee landlords. On all but the most carefully managed lands, undesirable weeds left by the cattle rapidly proliferate, eventually rendering the land marginal even for cattle production.

This process of progressive land deterioration often leads to even more serious consequences. A typical example is the Parrita watershed, just south of San José. Once a breadbasket zone of Costa Rica, it produced the majority of corn and beans in the country. Now it is entirely devoted to pasture, due to a decline in soil fertility. Landslides and road washouts are common in the entire zone. The force of tropical rainstorms, once dissipated by the natural forest canopy, now strikes the open ground directly, increasing erosion. Instead of percolating into the soil to be retained by the root structure of trees, rainwater now runs directly off the surface, causing floods in the banana plantations downslope. Large areas of soils have been so severely impoverished and eroded that they no longer even yield pasture, and some experts doubt that they can ever again support forests (U.S. AID 1979). This problem is now widespread along the entire central and south Pacific slope.

The degradation of the land is directly related to the economic well-being of the people who must live on the land. Costa Ricans living in degraded regions of the Pacific slope have lower incomes and higher rates of unemployment than those living in recently colonized areas. Unfortunately, the process of land degradation is now well under way on the Atlantic slope as well, where it will undoubtedly be even faster becasue of heavier rainfall and more fragile soils.

4.1.2 Inefficient Forest Management[12/]

Although Costa Rica's forests are being felled at a rapid rate,

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[12] Sources: Shane. 1978.
Tosi. 1978.
U.S. AID. 1979.

very little of the wood is put to use. Estimates of commercial use of wood range from 10 to 40 percent of that cut. The rest is burned or left to rot where it falls.

The reasons for this high rate of wastage appear to be both economic and political. The cost of transporting timber from remote areas where small farmers cut it to sawmills and markets is high. Many native trees have no known commercial value, or at least no present market in Costa Rica. In addition, the Forest Law of 1969 (Appendix III), designed to control forest exploitation, may have inadvertently encouraged waste. By requiring a permit to sell wood, but not to burn it or let it rot, it encourages waste by small farmers unwilling to obtain a permit. And, by prohibiting the export of unsawn trunks, it has discouraged a potential export trade which could increase the value of timber to the woodcutter (U.S. AID 1979).

Costa Rica, like many tropical countries, has struggled with reforestation efforts. Part of the problem is the difficulty of selecting suitable species for reforestation, since native tropical hardwoods are generally the most difficult to manage. Exotic cypress has been the most successful species used to date, but plantations of exotics are not attractive to the native fauna.

A more critical problem with reforestation is the lack of manpower and financial incentives. The Office of Forestry says that it lacks funds and personnel to undertake effective reforestation, while the lumber industry continues to ask for more concessions to keep its 35,000 workers employed (Shane 1978). Private landholders find it more profitable to keep land in pasture than to grow trees (U.S. AID 1979). Unfortunately the progressive degradation of pasture soils may soon make many of them difficult, if not impossible, to reforest.

4.1.3 Loss of Native Flora and Fauna[13/]

The diversity of Costa Rica's native flora and fauna is discussed in Sections 3.4 and 3.5, as are the various species, mostly vertebrates, officially considered to be endangered. Clearly, the widespread destruction of natural habitat, i.e. deforestation, is the principal cause of loss of native flora and fauna.

However, some of the effects of deforestation on the abundance and diversity of native plants and animals are subtle, and deserve careful consideration. Biological reserves and natural parks, particularly the smaller ones, may not be adequate to preserve some forest plants and animals. When reserves are only small "islands"

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[13] Sources: D'Arcy. 1977.
OTS. 1980?
Shane. 1978.

in a sea of deforested country, the small populations of animals they support may soon decline to extinction, with little chance of recolonization from other patches of forest. The Organization for Tropical Studies is currently deeply concerned that its 540 ha reserve at La Selva will become isolated from the surrounding forest (OTS 1979). Costa Rican ornithologist Dr. Gary Stiles estimates that 100 of the 120 interior forest bird species at La Selva will be lost if La Selva becomes an island.

The loss of animals by extinction in isolated forests or by hunting pressure can in turn threaten the plants (D'Arcy 1980?). Many tropical plants rely on animals for pollination and for spreading their seeds by eating fruit. Many species have particularly large seeds and fruits which are consumed and dispersed by the larger birds and mammals. These species are often the first to go in areas disturbed by man. Much remains to be learned about the inter-relationships of tropical plants and animals, information which may forever be lost unless suitably-sized areas are preserved.

4.1.4 Administrative Planning and Policy Problems

Administrative problems with land use management in Costa Rica are of two basic kinds: lack of background data and trained personnel, and lack of consistency and coordination in management planning and policy. Tosi (1978) comments that existing surveys of natural resources, soils, climate, natural vegetation, and other technical studies are very uneven in level of competence and detail, and have not been synthesized in ecological terms. UNEP (1976) also mentions the lack of knowledge on the quantity and quality of existing resources, and points out that much useful information generated by foreign scientists has been lost because they have worked in isolation from their Costa Rican counterparts.

UNEP (op. cit) cites a lack of overall planning policy for the environment and natural resource use as a critical problem at the national level. Contributing factors are poor inter-agency cooperation and consequent duplication of efforts. Another aspect of lack of cooperation is the failure of the government to make use of local university scientists. For example, scientists at the School of Biology, National University of Costa Rica were concerned about the potential environmental impact of the large Arenales hydroelectric project (Appendix II), but government support for such research is not available, and university scientists often feel that their advice is generally ignored by government agencies (UNEP 1976).

Examples of national law and policy being at odds with resource conservation include benefits for clearing land under the laws of colonization and land tenure (Ley de Tierras y Colonización; Ley de Posesoria) as discussed in Section 4.1.1, and forest management laws which discourage the commercial sale of cleared timber (Section 4.1.2).

4.1.5 Positive Steps and Corrective Measures

Costa Rica has made encouraging progress towards correcting the causes of land degradation and arriving at a policy of rational land use. One of the most important steps has been the successful reduction of population growth from 3.1 percent to 2.2 percent over the last three decades (Section 2.3.2). Another positive sign is the growth of private conservation groups (Section 3.5.5), which reflects a growing public awareness of conservation problems. The Costa Rican national park system (Section 3.5.4), one of the most extensive in Latin America, also plays an important role in developing public awareness of conservation as well as protecting representative areas of Costa Rican ecosystems.

The national government took an important step towards rational management of forest resources with the passage of the Forest Law of 1969 (Appendix III), which gave the Ministry of Agriculture (MAG) the following responsibilities:

1. Conserve forest resources by means of establishing protected zones, forest reserves, national parks, and biological reserves.

2. Prevent and combat erosion in upper watersheds.

3. Establish rational systems for the exploitation and renewal of forest resources.

4. Identify areas inappropriate for agriculture or grazing which should be in forest.

5. Encourage colonies which usefully exploit forest resources.

6. Promote forestry research.

7. Educate the public as to the importance of the nation's forest reserves.

For the first six years, however, forest management was not considered a priority by the MAG, and the General Forest Office (DGF) was too underfunded to accomplish much. Not until 1974 was the DGF given significant funding, but it still lacked effective planning to make efficient use of its funds. Recently, a National Forest Development Plan has been written which establishes priorities both for general goals and for specific watersheds requiring attention (Table 25). Further descriptions of the priority watersheds are found in U.S. AID (1979).

Table 25. Priority Watersheds Established by the National Forest Development Plan

A. Multiple Use	Locality Number[a]
1. Río San Carlos	14
2. Ríos Tempisque and Bebedero	19 + 20
3. Río Parrita	26
4. Río Térraba	31
5. Río Tarcoles	24
6. Río Barranca	22

B. Protection of Water Sources	Locality Number
1. Río Sixaola	1
2. Río Banano	30
3. Río Matina	6
4. Río Pacuare	8
5. Río Reventazón	9
6. Río Sarapiqui	12
7. Nicoya Peninsula Rivers	18
8. Río Damas	27
9. Río Naranjo	28
10. Río Savegre	29

[a]Numbered localities shown on Fig. 11 and described in Table 18.

Source: U.S. AID. 1979.

The National Development Plan for 1979-82 made further progress by incorporating management and conservation of natural resources as an instrumental part of the development strategy (U.S. AID 1979). A current agricultural development plan is designed to make more intensive use of land in Guanacaste, now devoted almost exclusively to cattle pasture. Irrigation water will be diverted from the Atlantic region to Guanacaste for intensive crop production, and cattle ranching will be halted. As the government buys ranch land and moves farmers out of forested frontier areas and into Guanacaste, the population is projected to increase from the present level of 7000 to over 100,000 (Shane 1978). The Arenal hydroelectric project (Appendix II), part of the overall irrigation project, will provide power. This project, designed to make better use of land already cleared and remove settlement pressure from land still in forest, represents the kind of integrated agricultural development that Costa Rica needs in order to achieve efficient use of its natural resources.

There is considerable hope that new agricultural methods developed specifically for tropical forest environments may be able to solve some of the problems associated with traditional methods imported from north temperate zones. For example, CATIE (Section 3.5.5) is experimenting with multiple cropping systems designed to mimic natural forest structure (Shane 1978). One such system, described by Hart (1980), begins with corn, beans, and cassava grown together. Banana trees are planted to mature in the shade of these annual crops, followed by coconut palms, cacao trees, and rubber trees, which reach maturity in 10 to 50 years. The natural canopy provided by this system not only protects the soil from rain erosion, but also inhibits the growth of weeds by cutting out light penetration. Another system suggested is a three-tiered coffee plantation with laurel trees (*Cerdia alliodora*) highest, *Erythrina poeppigina* in the middle, and coffee lowest. Decayed laurel leaves replenish soil nutrients, while *Erythrina* is a valuable cabinet wood. These systems have the further advantages of both structural and species variety, which tend to encourage native wildlife.

Foreign aid programs have also begun to recognize the critical importance of natural resources conservation. A major example is the U.S. AID Natural Resources Conservation Project (Appendix IV), which is designed to stimulate effective use of forest, water, and soil resources. FAO has also been actively working to support conservation in Costa Rica (U.S. AID 1979).

4.2 Environmental Pollution

4.2.1 Urban Pollution

Only very sketchy information is available about the nature and extent of urban water, air, and noise pollution in Costa Rican cities. Kolbusch and Orlich (1978) and ROCAP (1978) deal only with pollution problems in San José. Even in the capital city, however, information is limited because pollution is rarely, if ever, measured.

According to Kolbusch and Orlich (1978), the water quality in San José is better than that of other Central American capitals, specifically Guatemala City, Tegucigalpa, and San Salvador. Chlorination in San José is adequate at normal rates (0.3 ppm), as opposed to 1.5 ppm used in Tegucigalpa. Nonetheless, infection by intestinal parasites is a widespread health problem in Costa Rica (Section 2.7.3), undoubtedly spread by contaminated water supplies. Urban areas are known to have a high incidence of gastro-intestinal diseases, principally affecting infants and children (UNEP 1976). Certainly there is a considerable portion of the population of San José which does not have access to the treated municipal water supply (Appendix I).

As of 1978, a new collector system for domestic wastewater in San José was 60 percent constructed. Wastewater is currently

drained to the eastern part of the city where both waste and surface water drain into the Río Grande. A small treatment plant is planned for construction in this area in 1984.

Collection, transport and street cleaning of solid refuse is the responsibility of the city of San José. The principal landfill, located 5 km from San José, has neither basic sealing nor drainage water control. The municipality plans to close the landfill in five years, and is considering alternative waste treatment systems, such as composting and recycling. Besides the primary landfill now in use, Kolbusch and Orlich (1978) also observed "plenty" of open uncontrolled dumps, often burning. There are no provisions for recycling reusable industrial wastes.

San José has the potential for a significant air pollution problem, due primarily to vehicle emissions (ROCAP 1978). The most significant industrial air pollution sources are the coffee processing plants and the margarine plant. In addition, meterological conditions in the San José area are favorable to the build-up of air pollution; temperature inversions occur about 50 days a year. However, no meaningful data on ambient air quality were available at the time of the ROCAP Survey (1978).

ROCAP (op. cit.) also reports very high noise levels throughout the San José metropolitan area. Once again, there is very little ambient data available, but health authorities are concerned about increasing evidence of hearing impairment caused by noise in the streets, schools, and industries. In particular, the Health Department has found strong indications of acute hearing problems developing in school children. Auto traffic is the predominant source of noise in the urban center of San José.

Aquatic pollution near port cities has been cited as a problem by UNEP (1976). Particular problem areas mentioned include pollution from oil residues at Puerto Limón, and general environmental degradation caused by port development at Caldera.

The General Health Law of 1973 (Appendix III) gives the Ministry of Health broad powers for enforcing pollution control, and the Ministry has developed a basic environmental action plan for 1976-82 (ROCAP 1978). To help solve the fundamental problem of lack of ambient data, the Ministry has ordered some $76,000 worth of monitoring equipment. However, the primary problem with implementing a monitoring program is the lack of trained technical help to operate the equipment. Similar problems of lack of equipment and trained technicians also plague the current vehicular emission control inspection program (ROCAP 1978). Manpower limitations have also prevented the Division of Environmental Health from establishing standards for air and water quality for fear of lacking credibility without the technical ability to monitor and enforce such standards (Appendix III, Section 6.0).

4.2.2 Rural Pollution

According to UNEP (1976) the greatest rural pollution problem is the contamination of soil by pesticides, which eventually leach into the water supply. Costa Rica is not a major cotton producer, and is therefore exempt from the severe cotton pesticide pollution problems which affect other Central American nations, but pesticides are widely used on such Costa Rican cash crops as bananas, sugar cane, and coffee. As with urban pollution, the severity of the problem is not well known, due to lack of adequate monitoring.

4.2.3 Pollution and Development Policy

In an effort to stimulate and diversify the national economy, the Costa Rican government has also created opportunities for new sources of environmental pollution. The National Development Plan for 1974-78 emphasized sugar, meat, fish, and agricultural products requiring processing before exportation. This policy of creating new rural industry (or "agro-industry") could have negative environmental effects, particularly by increasing sources of water pollution (UNEP 1976). The same development plan also refers to expanding the aluminum, cement, and mining industries, all of which are potential sources of environmental degradation. In Talamanca, prospects of extensive copper deposits have interested mining companies, but operations are still in the exploratory stage (Shane 1978). Many other mining possibilities in Costa Rica remain unexplored or underdeveloped, including gold, manganese, chromite, nickel, magnetic and titaniferous sands, lead, zinc, sulfur, bauxite, and carbon (UNEP 1976). Although the National Development Plan for 1974-78 mentioned more than 170 investment projects and opportunities in the industrial sector, none were evaluated on the basis of their potential environmental impact. No environmental consideration is given to the location of new industry (UNEP 1976). Like many other developing countries, Costa Rica is more anxious to stimulate industrial development than it is to consider the environmental consequences of that development. For example, the faculty at the University of Costa Rica in San José is interested in investigating environmental pollution problems, but they lack the financial support to do so (ROCAP 1978).

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Appendix I. Water Supply and Sanitary Facilities of Major Cities (1965)

City	Water Supply	Sewage, Sanitary Service
Alajuela	a. Derived from springs. b. Treated by chlorination. c. Distributed from tanks located in the northern part of the city; quality is good. d. Service connections (dwellings): 9,67[illegible]: 340 have own wells, and 855 have no water service (Cantón Central, 1963) e. Water mains and distribution lines range between 10" and 1" in diameter. f. Pressure: maximum 150 lbs./sq. in.; 20 to 40 lbs./sq. in. in the distribution net. g. Requirements: 120 liters/sec.; 145 liters/sec. available.	a. Sewage collected by one main trunk line. b. A primary sewage treatment plant exists in the southern part of the city; from there discharge of effluent drains directly into Quebrada El Barro. c. Number of homes with baths: 7,917; other: 165; none: 3,284 (Cantón Central, 1963). d. Homes served by sewers: 2,926; septic tanks: 1,055; "pozo negro planchet": 3,201; "pozo negro madera": 2,551; other: 29; none: 1,604 (Cantón Central, 1963).
Cartago	a. Mainly from springs and artesian wells. b. Not treated. c. Distributed from reservoirs located in the northern part of the city. Quality - good. d. Service connections (dwellings): 6,886; 330 have own wells, and 410 have no water service in Cantón Central (1963). e. Water mains and distribution lines range between 10" and 1" in diameter. f. Pressure: maximum 150 lbs./sq. in.; normally 20 to 40 lbs./sq. in. in the distribution net. g. Requirements: 110 liters/sec.; 220 liters/sec. available.	a. Sewage collected by 2 main trunks. b. Primary sewage treatment plant located in area just south of city limits; discharge of effluent drains to Quebrada El Molino. c. Number of homes with baths: 5,157; other: 45; none: 2,427 (1963, Cantón Central). d. Homes served by sewers: 1,752; septic tanks: 805; "pozo negro planchet": 1,217; "pozo negro madera": 2,819; other: 11; none: 1,025 (1963, Cantón Central).
Golfito	a. Derived from springs and wells. b. Not treated. c. Distributed by the municipality. d. Service connections (dwellings): unknown. e. Water mains and distribution lines range between 6" and 1" diameter. f. Maximum pressure: 150 lbs./sq. in.; normally 20 to 40 lbs./sq. in. in distribution net. g. Requirements: 10 liters/sec.; available: 35 liters/sec.	a. No collection of sewage. b. No treatment. Drains to the sea. c. Number of homes with baths: 3,275; other: 180; none: 676 (1963, Golfito District). d. Homes served by sewers: 1,505; septic tanks: 1,298; "pozo negro planchet": 145; "pozo negro madera": 388; other 79; none: 716 (1963 Golfito District).
Heredia	a. From springs. b. Not treated. c. Distributed by the municipality from tanks situated in the northern part of the city; its quality is good. d. Service connections (dwellings): 4,411; other: 565 have own wells or other sources; 254 have no water service in Canton Central (1963). e. Water mains and distribution lines range between 10" and 1" in diameter. f. Pressure: maximum 150 lbs./sq. in.; 20 to 40 lbs./sq. in. in the distribution net. g. Requirements unknown.	a. Sewage collected by 1 main trunk. b. Treatment of primary nature made at a plant located in the southern part of the city; effluent discharged into Río Pirro. c. Number of homes with baths: 4,114; other: 60; none: 1,056 (Cantón Central, 1963). d. Homes served by sewers: 2,070; septic tanks: 575; "pozo negro planchet": 1,191; "pozo negro madera": 800; other: 8; none: 581.
Liberia	a. Derived principally from springs. b. Untreated. c. Distributed by municipality from tanks in the northern part of the city; quality is good. d. Service connections (dwellings): 1,165; 194 have own wells or other source; 244 have no water service (1963). e. Water mains and distribution lines range between 10" and 1" in diameter. f. Pressure: maximum 40 lbs./sq. in.; 20 lbs./sq. in. in the distribution net. g. Requirements 25 liters/sec.; 50 liters/sec. available.	a. Municipal sewage system lacking. b. No sewage treatment exists. c. Number of dwellings with baths: 1,098; other: 16; none: 489. d. Dwellings served by septic tanks: 240; "pozo negro planchet": 700; "pozo negro madera": 524; other: 3; none: 152.

City	Water Supply	Sewage, Sanitary Service
Limón	a. From 2 wells located south of the city. b. Treated at filtration plant in northwest part of central city area. c. Distributed from reservoirs located at several points in the city. d. Service connections (dwellings): 2,729; wells or other: 1,613; no water service: 529 (1963). e. Water mains and distribution lines range between 10" and 1" in diameter. f. Pressure: maximum 150 lbs./sq. in.: 20 to 40 lbs./sq. in. in the distribution net. g. Requirements unknown; 70 liters/sec. available.	a. Sewage collected by several lines and discharged into the sea. b. Treatment: None. c. Number of dwellings with baths: 4,341; other: 644; none: 1,659 (1963). d. Dwellings served by sewers: 2,659; septic tanks: 1,303; "pozo negro planchet": 259; "pozo negro madera": 1,876; other: 54; none: 793.
Puntarenas	a. From artesian springs known as Ojo de Agua, near Alajuela. b. Treatment by chlorination. c. Distribution by Ferrocarril Eléctrico al Pacífico. d. Service connections (dwellings): 3,835; wells or other: 523; no water service: 306 (1963). e. Water main diameters are 16"; the distribution lines are 2" in diameter. f. Pressure: 150 lbs./sq. in. in the mains, but 20 to 40 lbs./sq. in. in the distribution net. g. Requirements: 80 liters/sec.; 70 liters/sec. available.	a. Sewage disposal in septic tanks and drainage directly into the sea. b. Number of dwellings with baths: 3,733; other: 311; none: 620 (1963). c. Dwellings served by sewers: 1,519; septic tanks: 1,073: "pozo negro planchet": 85; "pozo negro madera": 617; other: 715; none: 655.
San José	a. From wells and the Río Tiribí. b. Chlorinated at water treatment plants located near Dulce Nombre and Tres Ríos. Filtration systems are greatly hampered by the accumulation of volcanic ash from Volcán Irazú. Major reservoirs at Curridabat, east of the city. c. Distributed through system of water mains from reservoir tanks located in the city. System has much loss by leakage. Quality, good. d. Service connections: Unknown. e. Water mains range from about 16", as feeders to the reservoirs, to about 4" in residential areas. f. Pressure low due to leakage and age (up to 60 years) of parts of system. g. Requirements are about 1,000 liters per second; the Tres Ríos filtration plant is operating 24 hours per day, but supplies are less than required.	a. Sewage collected by 3 main trunk lines. b. Sewage treatment plant located to the south of the central part of city, discharges into Río María Aguilar. c. Number of homes with baths: 31,179; other: 41; none: 1,113 (Cantón Central). d. Homes served by sewers: 16,804; septic tanks: 6,385; "pozo negro planchet": 4,235; "pozo negro madera": 3,623; other: 214; none: 472 (Cantón Central).
Turrialba	a. From springs located north of the city. b. Untreated. c. Distribution: by the municipality. d. Service connections (dwellings): 2,729; 425 have own wells or other sources; 259 have no water service (1963). e. Water mains are 8" in diameter; distribution lines are 2" in diameter. f. Pressure: Maximum 150 lbs./sq. in. in mains, but 20 to 40 lbs./sq. in. in the distribution lines. g. Requirements: 45 liters/sec.; 200 liters/sec. available.	a. Sewage collected by 1 main trunk. b. Treatment: None. c. Number of dwellings with baths: 2,226; Other: 71; none: 1,106; (1963). d. Dwellings served by sewers: 192; septic tanks: 1,304; "pozo negro planchet": 357; "pozo negro madera": 1,227; other: 74; none: 259 (1963).

Source: U.S. Army Corps of Engineers. 1965.

APPENDIX II

Energy Resources

Table 1. Energy Resource Summary, 1979

Hydroelectric Potential Theoretical Potential: 9,000 MW[1] Installed Capacity: 290 MW[2] (65% of total installed capacity.
Geothermal Forty MW are now scheduled at Las Hornillas de Miravalles.[3] The potential is estimated to be 720 MW.[4]
Oil Reserves Proven: None. Estimated: 50,000 barrels/day for 10 years.[5] Refining Capacity: 10,000 barrels/day.[5]
Gas Reserves Proven: None.
Coal There are 100 million tons of high quality coal in Bolia.[5]
Wind There are areas of strong wind potential. Average midday wind speeds are 13 to 33 km/hour.[1]
Solar The average is 0.38 to 0.54 kw/square meter.[1]
Biomass Forests: Forest and woodlands cover 2.5 million hectares.[6] Sugar: Sugarcane harvested in 1978 amounted to 44 thousand hectares.

[1] Fuentes de Energia No Convencionales, ICE.
[2] Politicas sobre el Desarrollo Electrico de Costa Rica, ICE.
[3] Geothermal Power Plants of Mexico and Central America: A Technical Survey of Existing and Planned Installation.
[4] Obiols, The Situation in the Energy Sector in Member Countries of the Central American Common Market, 1979.
[5] Personal communication with Direccion de Geologia y Minas.
[6] FAO Production Yearbook, 1978, Vol. 32.

Source: MITRE, 1980.

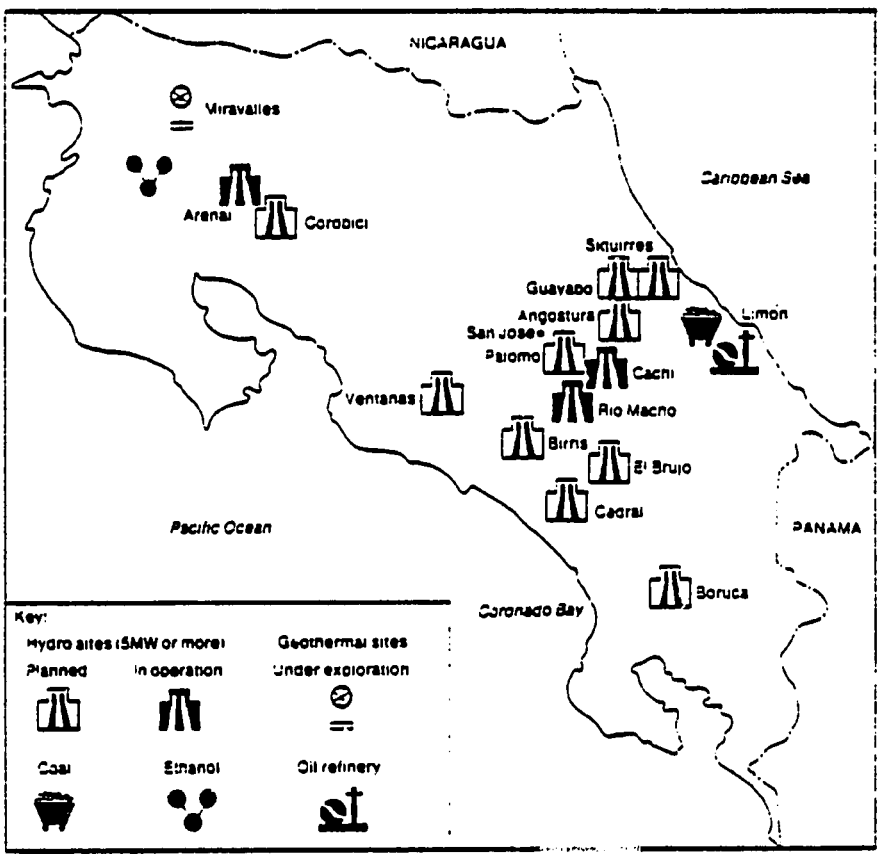

Figure 1. Energy Resource Distribution

Source: MITRE. 1980.

Table 2. Petroleum Consumption, 1978

	Refinery Production		Direct Imports		Total Consumption [1]	
	10^3 bbls	TJ	10^3 bbls	TJ	10^3 bbls	TJ
LPG	98.6	406	101.3	429	193.1	817
Aviation Gasoline	-	-	51.0	283	51.0	283
Gasoline	632.1	3,502	656.1	3,635	1,272.3	7,049
Kerosene	189.8	1,135	-	-	201.8	1,207
Jet Fuel	159.0	951	-	-	159.0	951
Diesel	703.7	4,324	2,286.5	14,051	2,971.0	18,256
Residual	1,140.3	7,360	-	-	1,060.5	7,031
Other	12.0	73	18.0	110	30.0	183
Total	2,935.5	17,951	3,112.9	18,508	5,938.7	35,777

[1] The figures for total consumption do not always equal the total because of changes in stocks.

Source: MITRE. 1980.

Table 3. Total Resource Use (terajoules)

	1978		Year 2000 [1]			
	TJ	(%)	Case I	(%)	Case II	(%)
Hydro	20,924	27	110,692	41	110,692	48
Geothermal	0		9,336	3.6	9,336	4
Petroleum	36,459	46	114,390	43	74,132	32
Direct Uses	28,747		114,390		74,132	
Electric Generation	5,468		0		0	
Losses, Unaccounted	2,244		NA		NA	
Non-Commercial	21,488	27	34,386	13	34,386	15
Total Resources	78,931		169,304		229,046	

[1] Case I assumes 6.5% demand increase; Case II assumes 4.4%.

Source: MITRE. 1980.

Table 4. Energy Research and Development

Technology/Resource	Institution	Product or Activity
ALCOHOL	Corporacion Costarricense de Desarrollo	Constructing alcohol distillery in Guardia-Liberia, Guanacaste. Projected production in 1981: 240,000 liters/day. Brazilian technology and equipment.
	University of Costa Rica	Carrying out project to develop small-scale domestic distillation using sugarcane.
BIOGAS	Universidad de Costa Rica	Conducting preliminary investiagtions in biogas utilization.
	Instituto Tecnologico de Costa Rica	Performing research on biogas production from animal wastes.
	Instituto Costarricense de Electricidad	Proposed a 6-stage program for evaluation of national biogas potential
COAL	Instituto Costarricense de Electricidad	Identified 5 geographic areas suitable for coal explorations--3 areas nominated as high priority. Proposed 3-year study to include topographic, photogeoloc, geophysical and geochemical research, plus 600-meter drilling activities in key areas. Recently discovered high-quality coal in South Atlantic region.
	Ministerio de Economia, Direccion de Geologia y Minas	Sampled coal and oil shale deposits on a limited basis.
GEOTHERMAL	Instituto Costarricense de Electricidad	Carrying out the Miravalles Geothermal Project. After completion of first phase, (1977) obtained 4.1 million dollar loan for IDB to continue exploration activities until 1980.
MINI-HYDRO	Instituto Costarricense de Electricidad	Identified 75 potential sites adding 40+ MW.
	Universidad de Costa Rica	Prepared master plan for energy-related research, including plans for indigenously-designed and built turbines. Completing feasibility study of 30-KW project in San Carlos.
PETROLEUM	Instituto Costarricense de Electricidad, Oficina de Geofisica	Conducts on-going program for data collection on fossil fuels.
SOLAR	Universidad Nacional	Developed solar flat-plate collectors, performed research on solar dryers for grains and conducted evaluation of potential solar technologies for Costa Rica.
	Instituto Tecnologico de Costa Rica	Performed research on solar water heaters, solar grain and wood dryers.
	Instituto Costarricense de Electricidad	Maintains 26 solar measurement stations, covering 50% of national territory. Plans to install 250 photovoltaic telephones in isolated areas by 1985.
	Instituto Meteorologico	Operates 16 solar measurement stations.
WIND	Instituto Costarricense de Electricidad	Completed preliminary study of wind potential in Costa Rica. Installed 14 monitors nationwide. Selected 5 geographic areas for further study.
	Instituto Tecnologico de Costa Rica	Collaborating with West Texas St. University to design and build prototype windmill.
WOOD	Instituto Costarricense de Electricidad	Completed firewood survey in collaboration with UNDP.
	Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE)	Performed extensive research in forest utilization and management.

Source: MITRE. 1980.

APPENDIX III

Environmental Law

1.0 Introduction

2.0 General Health Law

- 2.1 Background Information
- 2.2 General Policy
- 2.3 Water Quality
- 2.4 Solid Wastes
- 2.5 Air, Odors, and Noise
- 2.6 Land Use Controls

3.0 Summary of Forest Law

4.0 Reforestation Law

5.0 Existing Legal Process

6.0 Enforcement and Implementation

Sources: ROCAP. 1978.
U.S. AID. 1979.

1.0 Introduction

This review treats three important environmental laws: the General Health Law of 1973, the Forest Law of 1969, and the Reforestation Law of 1977. Discussions of the General Health Law (Section 2.0) existing legal processes (Section 5.0), and enforcement and implementation (Section 6.0) are directly from ROCAP (1978), while the sections on the Forest Law (3.0) and Reforestation Law (4.0) are from U.S. AID (1979). Comments on processes and enforcement by ROCAP are meant to apply to the General Health Law, but have some relevance to forest laws as well. Some important aspects of environmental law not covered in this appendix include fish and game regulations (but see Section 3.5.3), commercial fisheries law, and laws governing water rights, land colonization rights, and tenure.

2.0 General Health Law

2.1 Background Information

Costa Rica's General Health Law (Ley General de Salud No. 5395, October 30, 1973) provides a detailed and comprehensive statutory basis for regulating air, noise and water pollution, solid wastes, toxic and hazardous substances, urban development (concurrently with other agencies), food and drugs and other health matters.

The Ministry of Health (División de Saneamiento Ambiental - DSA) through the Office of the President, is responsible for issuing and implementing regulations, standards and limitations. Relevant pollution control provisions are detailed but lack specific criteria or standards. To date no implementing regulations establishing emission/effluent limitations or standards have been promulgated. (Note: Article 58 of the Ley Organica del Ministerio de Salud requires the Executive Branch (Poder Ejecutive) to promulgate implementing regulations within 12 months following enactment of the General Health Law). The Health Law gives the Minister of Health very broad discretion in implementing and enforcing the law.

2.2 General Policy

Articles 262 and 263 contain a general statement of national environmental policy and prohibit, in general terms, actions which cause deterioration of environmental quality.

2.3 Water Quality

Articles 264 - 277 govern water supply. The Ministry of Health has overall regulatory authority over domestic and industrial water supply standards. Wastewater or solid waste discharges into surface or subsurface waters (including oceans) are prohibited without approval of the Ministry of Health (in accordance with appropriate treatment requirements). Activities which may contaminate or deteriorate aquifers or other sources of water for human use, are prohibited.

The Ministry of Health has specific regulatory authority over non-biodegradable wastewater discharges (Art. 292), and approval authority over domestic sewage disposal (Art. 287). The Ministry of Health concurrently with the National Water and Sewage Agency (Acueductos y Alcantarillado A y A) have authority to prescribe technical requirements for existing wastewater disposal systems operated by municipalities or private entities. The Executive Branch (Poder Ejecutivo) in consultation with A y A has regulatory authority over construction and operation of new wastewater disposal systems (Art. 289).

2.4 Solid Wastes

The Ministry of Health has approval authority over systems of solid wastes (Article 279). Municipalities have legal responsibility and authority for collection and disposition of domestic solid wastes (Art. 280). Industrial, commercial and agricultural enterprises generating solid wastes are required to develop separate systems for separating, collecting and disposing their solid wastes, subject to the Ministry of Helath's approval, where such wastes cannot be processed through municipal systems. (Art. 281). Local municipal health authorities must approve all re-use or recycling activities (Art. 283).

2.5 Air, Odors and Noise

The Ministry of Health has regulatory authority to prescribe ambient air quality standards and to define air contaminants, including odors, that will be subject to the Ministry of Health's regulatory authority (Art. 294).

The Ministry of Health has regulatory authority to prescribe emission limitations for all vehicles assembled in or imported into Costa Rica (Art. 296). This authority includes regulatory authority over vehicle fuels and additives. (NOTE: The Director of DSA does not recognize these provisions as adequate authority to regulate vehicle emissions. The Ministry of Transportation has jurisdictional authority over motor vehicles).

The Ministry of Health has apparent or implicit regulatory authority to prescribe emission standards or limitations for industrial and commercial sources of air pollution (Arts. 296, 297).

The Ministry of Health has regulatory authority to prescribe ambient noise standards (Art. 294).

2.6 Land Use Controls

The location and construction of new industry is subject to approval by the Ministry of Health (Arts. 298 - 300). The Ministry also has authority to close down industries that constitute nuisances (Art. 304).

3.0 Summary of Forest Law

RESUMEN DE LA LEY FORESTAL N° 4465, DEL 17 DE NOVIEMBRE DE 1969.

CAPITULO I - Disposiciones Generales

La ley establece como función esencial del estado la protección, utilización, conservación y promoción de sus recursos forestales de acuerdo con el principio de uso múltiple de los recursos naturales renovables.

Esta función es responsabilidad del Ministerio de Agricultura y Ganadería (MAG) el cual:

a. Conservará por medio de sistemas técnicos de ordenación forestal los recursos forestales renovables del país y los aumentará al máximo posible por medio de técnicas modernas aplicables.

b. Establecerá zonas de protección, reservas forestales, parques nacionales y reservas biológicas.

c. Combatirá la degradación y erosión del suelo en las cuencas superiores de los ríos y en las fuentes de agua.

d. Orientará y controlará el uso racional de recursos forestales por medio de la implementación de sistemas adecuados para la explotación y renovación de estos recursos.

e. Incorporará gradualmente a la economía nacional, por medio de una planificación adecuada, las tierras no aptas para la agricultura o la ganadería que podrían dedicarse a bosques.

f. Estimulará el establecimiento de colonias para la explotación de recursos forestales y promoverá industrias estables basadas en estos recursos.

g. Promoverá programas de investigación científica y técnica que lleven a una política responsable de ordenación forestal.

h. Conservará y aumentará la vida silvestre.

i. Seleccionará, adiestrará y promoverá un cuerpo de profesionales competentes para llevar a cabo la administración de las reservas forestales.

j. Establecerá por medio de un proceso continuo de educación y publicidad una comprensión clara de la importancia y significado de los bosques.

Las tierras forestales que se necesitan para alcanzar estos objetivos pueden ser expropiadas por el estado.

CAPITULO II - Administración Forestal

La entidad ejecutora será la Dirección General Forestal (DGF) del MAG la cual establecerá un cuerpo de guardas para bosques y parques. Las funciones de la DGF serán administrar el Patrimonio Forestal del Estado; hacer inventarios de tierras forestales; designar Zonas de Protección, Parques Nacionales; Reservas Forestales y Reservas Biológicas; negociar convenios cooperativos con propietarios de tierras forestales; dar asesoría técnica a propietarios de tierras forestales y llevar a cabo estudios científicos de los recursos y usos forestales.

En el MAG funcionará un Consejo Forestal Nacional como organismo consultor del Poder Ejecutivo.

CAPITULO III - El Patrimonio Forestal del Estado

El Patrimonio Forestal del Estado está formado por las Reservas Nacionales, las Reservas Forestales, los Parques Nacionales, los Viveros Forestales del Estado, las Zonas de Protección de Cuencas Hidrográficas y los Jardines Naturales Botánicos y Zoológicos. La administración de la zona marítima terrestre, que es de 200 metros de ancho a lo largo de ambas costas, permanecerá bajo jurisdicción del ITCO.

El Poder Ejecutivo transferirá al ITCO aquellas tierras declaradas por el MAG como no aptas para la agricultura. Las tierras apropiadas para bosques bajo el estudio de clasificación de tierras, serán conservados por el Estado como parte del patrimonio forestal, pero pueden transferirse al ITCO u otras entidades con el fin de establecer colonias de explotación forestal.

El Poder Ejecutivo decretará toda la tierra que sea necesaria como reservas nacionales, estatales, municipales o privadas, reservas forestales, parques nacionales y reservas biológicas con el fin de lograr el objetivo de esta ley. Cuando se trate de propiedad privada para el establecimiento de reservas o parques nacionales, dichas tierras serán adquiridas por medio de compra o expropiación. La posesión de tierras ubicadas en el patrimonio nacional no constituye derecho legal a dichas tierras y el derecho del estado a reivindicar es inalienable. La DGF procederá a desalojar las personas que ocupen dichas tierras parcial o totalmente. Cuando así se autorice, el ITCO tiene la obligación de reubicar a las personas afectadas por esta disposición.

Todo proyecto de colonización, parcelamiento o cualquier empresa agrícola o ganadera cuyos planes de trabajo impliquen una eliminación de bosques deben obtener aprobación de la DGF.

Un impuesto de explotación será gravado sobre la madera extraída de tierras debidamente inscritas, pero los cargos de explotación no los pagarán los campesinos que produzcan carbón como industria casera o que utilicen la madera en la producción de pequeñas cantidades de leña. La explotación de madera extraída por propietarios de fincas con el fin de mejorarlas también está exenta.

CAPITULO IV - Utilización de Bosques del Patrimonio Estatal

La utilización de productos forestales provenientes del patrimonio forestal del estado puede hacerse únicamente con permisos concedidos por la DGF. Dichos permisos serán anuales, para áreas de hasta 100 hectáreas y no podrán exceder los 500 metros cúbicos de troncos. Las concesiones serán dadas por un máximo de 50 años y ninguna persona podrá tener más de una concesión para el mismo tipo de producto. Los caminos o cualquier otra obra de infraestructura necesaria para la extracción de productos forestales de reservas nacionales se convertirá en parte del patrimonio forestal del estado cuando la concesión expire. La posesión de tierras donadas por medio de permiso o concesión para la utilización de productos forestales no constituye ningún derecho real a esa propiedad.

Para la explotación de productos forestales en reservas nacionales los beneficiarios pagarán al Fondo Forestal de la DGF una tarifa anual por área por cada hectárea donada y una tarifa basada en el volúmen, peso y clase de producto explotado. Las tarifas serán exoneradas en casos donde la población rural utilice el bosque para fines domésticos o consumo en el hogar, o donde los productos de madera se utilicen para servicios de interés público.

3.0 Forest Law, Continued

CAPITULO V - Utilización de Bosques de Propiedad Privada

Los bosques y tierras colocadas voluntariamente bajo el Régimen Forestal estarán exentos del pago de impuestos por tierras incultas establecido por el ITCO. Inversiones hechas en la forestación y reforestación de tierras bajo un plan de ordenación aprobado por la DGF serán gastos deducibles para fines del impuesto sobre la renta.

El Sistema Bancario Nacional, hasta donde pueda, dará ayuda crediticia adecuada a los propietarios de bosques que se coloquen voluntariamente bajo el Régimen Forestal, facilitando la ejecución de planes de ordenación forestales.

Los propietarios de tierras agrícolas de más de cinco hectáreas deberán dedicar por lo menos un 5% a reforestación.

CAPITULO VI - Parques Nacionales

Los parques nacionales son aquellas áreas de significado histórico que, por su belleza escénica natural o por la flora y fauna de importancia nacional o internacional que en ellas se encuentre, están dedicadas a recreación y educación del público, turismo o investigaciones científicas.

CAPITULO VII - Protección Forestal

El asentamiento de tierras en los parques nacionales, reservas forestales o zonas de protección está prohibido.

No se permitirá el pastoreo en tierras del patrimonio forestal del estado sin autorización de la DGF.

La DGF colaborará en la defensa de tierras forestales de propiedad privada que se hayan sometido voluntariamente al régimen forestal, con el fin de mantenerlas libres de precaristas.

Las zonas de protección son aquellas áreas de tierras forestales que están dedicadas a la protección de suelos y mantenimiento de cuencas hidrográficas. Las zonas de protección declaradas incluyen áreas que rodean manantiales que se originan en las colinas por un radio de 60 metros; o 50 metros para manantiales ubicados en tierras planas; una zona de cinco metros bordeando los ríos, riachuelos, lagos, lagunas y represas naturales. Dentro de una reserva nacional, las zonas de protección incluyen: una zona de 50 metros de ancho bordeando los ríos; y en cuencas hidrográficas, una franja de 300 metros desde un lado de la depresión máxima al otro.

CAPITULO VIII - Transporte y Mercadeo de Productos Forestales

El Poder Ejecutivo controlará y regulará la exportación e importación de productos madereros por medio de permisos aprobados por la DGF.

CAPITULO IX - Infracciones, Sanciones y Procedimientos

Las actividades que destruyan la vegetación en tierras protegidas serán castigadas con prisión de uno a seis meses. Se fijarán multas de $23 a $585 a: aquellos que exploten productos forestales en tierras dentro del Patrimonio Forestal del Estado (los productos forestales explotados ilícitamente serán confiscados por la DGF); aquellos que no manejen los productos forestales de conformidad con esta ley; aquellos que establezca aserraderos u otro tipo de industria de transformación de productos forestales sin autorización; aquellos que invadan reservas nacionales; reservas forestales o parques nacionales sin permiso; y aquellos que sometan tierras forestales dentro del Patrimonio Forestal del Estado a pastoreo sin autorización apropiada.

4.0 Reforestation Law

LEY DE REFORESTACION N° 6184, DEL 18 DE NOVIEMBRE DE 1977

ARTICULO 1

La producción, siembra y cuidado de cualquier tipo de árboles es de interés público y obligación gubernamental.

ARTICULO 2

Cualquier préstamo comercial concedido por el Sistema Bancario para actividades agrícolas deberá utilizar un 2% para actividades de silvicultura y conservación de suelos. El Departamento Agrícola es responsable de la planificación y coordinación de la conservación de suelos y reforestación de cuencas hidrográficas. No menos del 1% del Presupuesto Ordinario Nacional del año pasado será agregado al presupuesto de la DGF para tales propósitos.

ARTICULO 3

El Banco Central de Costa Rica dará a cualquier persona o empresa no más del 1% de la suma total del préstamo asignado para fines de esta ley. Una hectárea es el área mínima que se considera para dicho préstamo.

ARTICULO 4

Los préstamos están divididos en: (a) pago inicial para el establecimiento de vivero forestal o adquisición de plantas; (b) pagos anuales para actividades de silvicultura; y (c) pagos periódicos para la subsistencia de los agricultores dedicados a dicha actividad.

ARTICULO 5

El interés anual del préstamo no será mayor del 8%; cinco años de gracia; 15 años o más para su amortización.

ARTICULO 6

Los árboles y cualquier otra garantía para satisfacción del banco y una póliza especial del Instituto Nacional de Seguros serán requisitos del banco para la concesión del préstamo.

ARTICULO 7

Los agricultores dedicados a la siembra de bosques o árboles frutales estarán exentos del pago de impuesto territorial. Los ingresos obtenidos de la venta de productos de siembras de maderas y frutas están exentos del impuesto sobre la renta.

ARTICULO 8

Los fondos para programas de silvicultura y pagos para tierras compradas o expropiadas para reservas forestales se obtendrán por medio de la emisión de bonos forestales por una suma total de ¢40 millones, con vencimiento a los 20 años y el 8% de interés anual.

ARTICULO 9

El MAG dará la asesoría técnica necesaria; colaborará con las municipalidades, los centros agrícolas y cualquier entidad interesada en este programa.

4.0 Reforestation Law, cont.

ARTICULO 10

El Estado podrá establecer entidades con capital mixto para llevar a cabo el cultivo, mercadeo e industrialización de productos forestales. El estado y todas las demás entidades públicas están autorizadas para invertir recursos propios en dichas entidades de capital mixto.

ARTICULO 11

Todos los estudiantes de escuela primaria deberán preparar un proyecto acerca de la reforestación o analizar los beneficios de los bosques. En las escuelas rurales los niños deberán hacer un proyecto práctico, como por ejemplo la siembra y cuidado de una plantación trabajando en grupo, o sembrar y cuidar 10 árboles por cada persona durante un período de seis años. El MAG y el Ministerio de Educación darán asesoría conjunta.

ARTICULO 12

El ITCO deberá examinar, en colaboración con la DGF, la aptitud forestal de todos los agricultores. El propósito de esta encuesta es obtener la información posesoria necesaria para acciones legales o administrativas. La información obtenida sin los requisitos mencionados anteriormente es totalmente ilegal.

ARTICULO 13

Las áreas calificadas como reservas forestales absolutas, deberán ser mantenidas por el Estado. Tierras de propiedad privada, que sean absolutamente necesarias para la protección de recursos hidráulicos se declaran de beneficio público y pueden ser expropiadas. La expropiación se hará según lo establece el código municipal y la acción no podrá ser objetada.

ARTICULO 14

Las entidades públicas correspondientes colaborarán con los propietarios de plantaciones forestales a fin de mantenerlas libres de precaristas.

ARTICULO 15

El ITCO, en coordinación con la DGF, promoverá el cultivo y conservación de bosques dentro de su jurisdicción.

ARTICULO 16

El cultivo de bosques recibirá reconocimiento público y se dará un premio anualmente al mejor cultivo forestal.

ARTICULO 17

El MAG establecerá una campaña cívica permanente para promover la reforestación.

ARTICULO 18

Se agrega una nueva cláusula al Artículo 19 de la Ley de Informaciones Posesorias N° 139 del 14 de julio de 1941 y sus reformas:

En una finca declarada apta para bosques por la DGF, se prohíbe la tala de árboles en el 25% de su área, excepto aquellos que la DGF marque para renovación forestal y se sembrarán cinco o más árboles de la misma especie por cada árbol cuya tala sea autorizada.

5.0 Existing Legal Process

Costa Rica has adopted an administrative procedure law (contencioso administrativo). Agency decisions are reviewable within the agency, up to the level of the Ministers. Thereafter, appeals may be taken to special administrative courts.

Environmental regulations and standards are thus administratively and judicially reviewable by persons or entities directly affected. It is unclear under Costa Rican law the extent to which the general public (not directly affected by an environmental regulation or standard) has standing to petition for administrative and judicial review.

6.0 Enforcement and Implementation

No specific standards have been promulgated by the Minister of Health implementing the general Health Law with respect to air, water and noise pollution and solid waste.

With respect to industrial sources of air and water pollution, DSA implements and enforces the Health Law provisions through a permit system. A proponent of new construction must first submit preliminary plans (indicating type of industrial process, emissions anticipated etc.) to DSA for approval. After DSA approves the preliminary plans (including site), the applicant must submit final plans detailing wastewater disposal, emission controls (if any) and other mitigation measures. After final plan review DSA either approves or disapproves construction of the project. After construction, DSA issues an operating permit.

DSA lacks a trained technical staff capable of undertaking careful analysis of potential pollution problems generated by proposed projects subject to DSA's approval authority. In the few complex cases that have been presented DSA has called on PAHO/CEPIS to provide technical assistance. In addition, DSA's lack of specific regulatory criteria makes it difficult for DSA to implement the Health Law systematically. As a result the Health Law's pollution control provisions are being implemented cautiously in an effort to avoid potential unfairness.

Costa Rica's largest industrial sources of pollution were constructed before the Ministry of Health's permit authority was established in 1973. Prior to that time the Health Code required Ministry approval but this was circumvented by obtaining special legislative concessions for construction and operation of the industry. It is possible that in the future, avoidance of Ministry permit requirements for new industrial projects (or expansion of existing facilities), will occur through the legislative concession device.

Vehicle pollution controls are under the implementation and enforcement jurisdiction of the Ministry of Transportation. (NOTE: Decreto Ejecutivo No. 1118 SPPS August 2, 1970 limits smoke emissions from vehicles to less

than 10 units on the HARPRIDGE scale). In August, 1978, the Minister of Transportation ordered the testing of all vehicles for excessive smoke during the required annual safety inspection. It was apparent from a visual inspection of the testing equipment in operation (which measures CO) that the Ministry lacks technicians and equipment capable of carrying out even a modest vehicle emission testing program.

Enforcement of the vehicle smoke emission limits is also hampered by: 1) strong political resistance from bus operators who have threatened to strike if enforcement action is taken; 2) lack of trained diesel engine mechanics; and 3) lack of diesel engine tuning equipment (apparently only 6 units exist in Costa Rica).

The difficulty in implementing and enforcing environmental standards that affect industry is illustrated in the case of the coffee processing industry. Coffee processors (beneficios) discharge large quantities of organic wastes into rivers and streams in the Central Valley. The organic wastes ferment creating high BOD, significant odor problems and discoloration of water. In 1972 the Congress enacted a law requiring beneficios to reduce within 5 years their organic waste discharges by 95%. This standard required the beneficios to install treatment processes that were technologically available (line process), but which most beneficios considered too expensive. None of Costa Rica's beneficios made efforts to comply and as the 1977 deadline approached, the beneficios petitioned the Ministry of Health (having implementation and enforcement authority) to suspend application of the law on the grounds that treatment processes were unavailable and because of economic "impossibility" of compliance. The Ministry of Health granted the petition and suspended application of the law.

Public concern over air, noise and water pollution and environmental deterioration (e.g. deforestation) is significantly higher in Costa Rica than in other Central American countries. The individuals interviewed who have technical or administrative background in environmental problems, generally expressed the view that the current government (despite pledges to take dramatic action) has not made a real commitment to curb pollution. The concensus of these individuals is that environmental protection actions will be taken in the area of creating new parks and in increasing resource management, but that strong action to implement existing pollution control authority is not to be anticipated.

APPENDIX IV

U.S. AID Programs of Environmental Significance

1.0 The Natural Resources Conservation Project

2.0 Other U.S. AID Programs of Environmental Significance

- 2.1 Health
- 2.2 Rural Development
- 2.3 Resources Planning
- 2.4 Conservation

Sources: U.S. AID. 1979.
U.S. AID Library Information Service, Washington, D.C.

1.0 The Natural Resources Conservation Project

Although U.S. AID participates in a number of projects of environmental consequence, perhaps the most important and ambitious of these is the Natural Resources Conservation Project, No. 5150145, 1979-85 (also see part 2.4 of this Appendix). Because this project has the potential for making major strides in the improvement of land use standards in Costa Rica, and because it is in many ways a model project for tropical natural resources management in general, it is discussed in some detail here. The project is divided into six major sections:

Analysis of Policy and Research. The goals of this section are first to examine the effects of administrative, legal, financial, and socio-economic policies on natural resources management, and second, to supply technical and silvicultural research needs. Findings are to be made available to the government of Costa Rica for use in improving the administration of natural resources.

Pilot Project in Microwatershed Management. To take place in the upper Río Nosara watershed (Fig. 1), this project will concentrate on pasture and livestock improvement on small and medium-sized farms, together with reforestation. It will also include a demonstration program in soil conservation practices and extension help in fruit tree cultivation. The project is designed to explore and perfect techniques of land use management which can be applied on a wider scale in the future.

Reforestation and Range Management. This project is designed to test the effects of financial subsidies for reforestation and supervised credit for improving cattle and pastureland. It is to be carried out in five areas in Guanacaste, including four beef cattle areas and one dairy cattle area, centered around Santa Cruz, Nicoya, Colonia Carmon, and Tilarán (Fig. 1).

Pilot Project in Forest Production. This project will establish methods for forest management and forest resources production to be used in a forest production colonization project being carriet out by ITCO in the Carribean slope forest just south of Puerto Viejo (Fig. 1). A major benefit of the project is to provide DGF with field experience and training in forest management.

Watershed and Natural Resources Management Projects. To be carried out in five areas of high priority (Fig. 1), the goal of these projects is to gather basic data necessary to formulate land use plans for each area. Information is to be gathered on climate, topography, vegetation, soils, hydrologic and energy resources, land tenure, population, current land use and agricultural practices, and available public services.

Environmental Education and Conservation in Braulio Carillo National Park. The goal of this project is to stimulate public interest in conservation through the construction of educational and research facilities in Braulio Carillo National Park (Fig. 1), as well as to

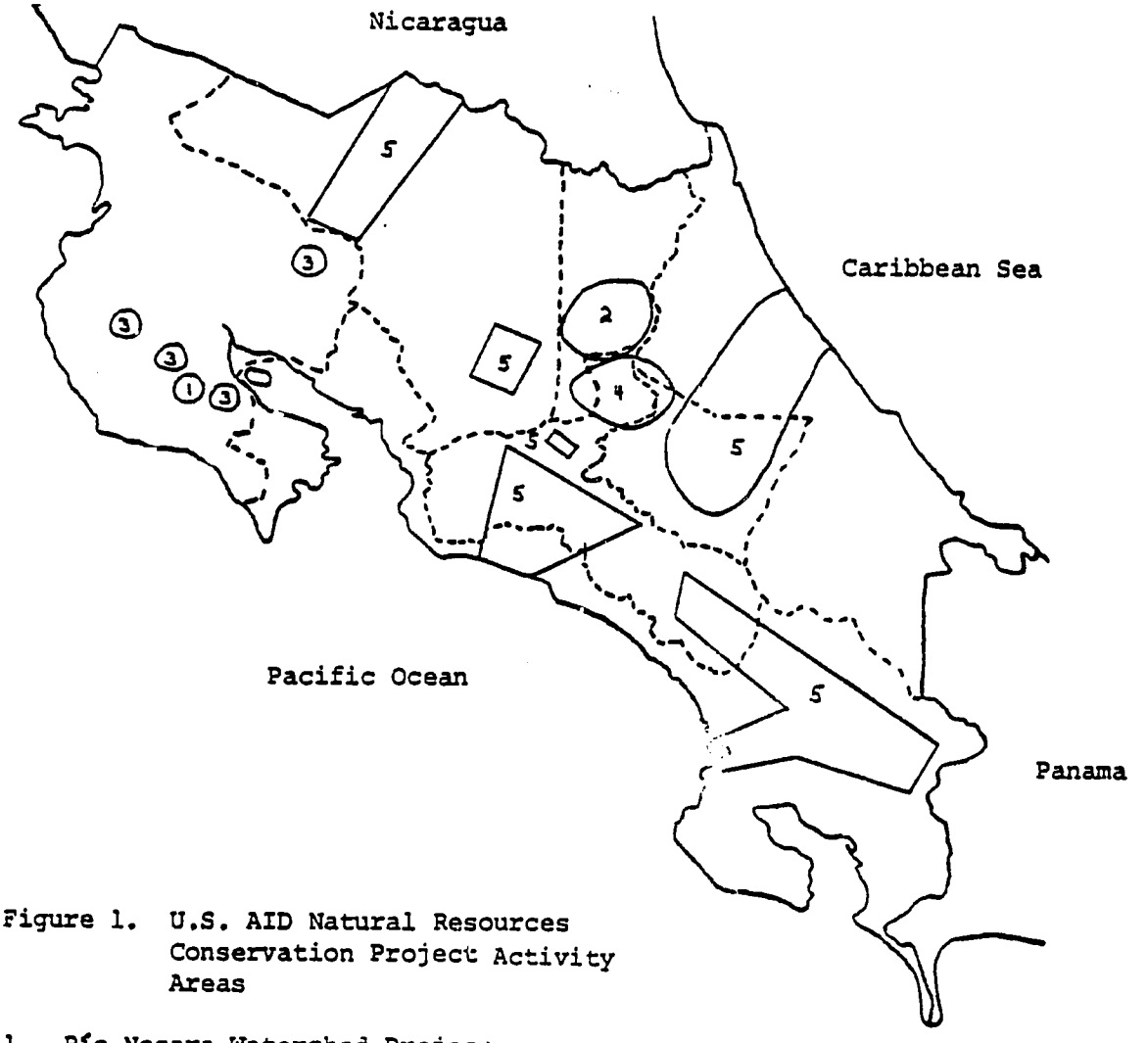

Figure 1. U.S. AID Natural Resources Conservation Project Activity Areas

1. Río Nosara Watershed Project
2. Forest Production Project
3. Reforestation/Range Management Projects
4. Braulio Carillo National Park Project
5. Watershed and Natural Resources Management Projects

----Provincial Boundaries

Source: U.S. AID. 1979.

insure adequate protection of the park after the construction of the new San José - Limón highway.

2.0 Other U.S. AID Programs of Environmental Significance

2.1 Health

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150105 SUB-PROJECT: 00
PROJECT TITLE: FAMILY PLANNING — INITIAL FY: 68 FINAL FY: 70

PROBLEM: SEVERAL FACTORS CONTRIB TO COSTA RICA'S INORDINATELY HIGH POPULATION GROWTH. 1. RURAL, LOW-INCOME POPULATIONS HAVE LIMITED ACCESS TO FAMILY PLANNING EDUCATION & SERVICES; 2. THERE ARE PREVAILING SOCIAL ATTITUDES AGAINST CONTRACEPTION WITHOUT COUNTERBALANCING KNOWLEDGE OF ITS SOCIO-ECONOMIC BENEFITS; 3. THERE IS A SHORTAGE OF TRAINED FAMILY PLANNING PERSONNEL IN COSTA RICA. ALL OF THESE FACTORS INHIBIT THE GOCR IN ITS EFFORTS TO INITIATE AN EFFECTIVE, MULTI-FACTED PROGRAM TO REDUCE POP GROWTH TO A LEVEL CONTRIBUTORY TO NATL DEVELOPME

STRATEGY: SIX-YEAR PROJECT CONSISTING OF A GRANT PROVIDING TECH ADVISORY ASSISTANCE TEMPORARY STAFF TO REPLACE INDIG TRAINEES,GYNECOLOGICAL & CYTOLOGICAL LAB EQUIPMENT,PER DIEM SUPPLMT OF STAFF & SALARY SUBSIDIES TO ASSIST IN A NATL MULTI-INST POPULATION CONTROL PROGRAM. HOST COUNTRY PROVIDES BUDGETING SUPPORT TO COVER SUPERVISORY PERSONNEL ADDITL CLINIC EQPMNT PARTIC & IN-COUNTRY TRNG OPER COSTS & LNG-TRM MAINT. SWEDEN,UN,FORD FNDTN PROVIDE ADDTNL BUDGET SUPPORT COMMODS & TECH ASSIST.

SUMMARY:

GRANT TO THE GOVT OF COSTA RICA TO SUPPORT A MULTI-AGENCY POPULATION CONTROL/FAMILY PLANNING(FP)PROGRAM. THE SPECIFIC AGENCIES & THEIR RESPECTIVE ACTIVITIES FUNDED ARE: 1.COSTA RICAN DEMOGRAPHIC ASSOC(CRDA)--A.BACKSTOPPING OVER 70 PRIVATE PHYSICIANS B.SUPPLYING PHARMACIES WITH FP SUPPLIES AT NET COST C.MAKING REDUCED-COST FP POLICIES AVAILABLE TO EMPLOYERS(POLICIES PROVIDE MED EXAMS,FP SVCS) D.FP PUBLICITY PROG(PUBLICATIONS,PRESS,TV,RADIO) E.TRAINING PROG FOR NON-MED OFFICIALS. 2.UNIV OF COSTA RICA--A.FP TRNG FOR KEY MED & PARAMED PGM STAFF(DEMOGRAPHIC/FP TRNG FOR MED & NURSING STDNTS B.(ANTICIPATED)SENSITIVITY & DRUG COURSES FOR COMMUNITY LEADERS. B.LATIN AMER CNTR FOR DRUG STUDIES--A.DRUG RESEARCH & TRNG B.PARTIC TRNG FOR ABORTION STUDIES. C.MCH--A.OPENING OF AN ADDIT 3-4 FP CLINICS(AID PROVIDES EQPMNT & COMMODS,SUPPORTS TRNG,PAYS SALARIES OF SUBSTIT PRSNNL UNTIL PERMANENT STAFF CAN COMPLETE TRNG AND PER DIEM OF NURSE EDUCATORS,AND TOPS SALARIES FOR MED & POPULATION DIRECTORS). 5.TROPICAL SCIENCE CENTER--A 1-YR AERIAL GROUND RESEARCH SURVEY OF POPULATION DISTRIBUTION.
AFTER 2 YRS,FP SVCS WILL BE INTEGRATED INTO THE TOTALITY OF HEALTH SVCS OFFERED BY ALL MOH CLINICS.THIS WILL REQUIRE THE EQUIPPING OF 30 CLINICS BY AID.
PROP(6/17/70)ASSURES CONTINUING ADVISORY,TRNG & COMMOD SUPPORT FOR ORIGINAL IMPLEMENTING AGENCIES PLUS SUPPORT FOR THE CENTER FOR SOCIAL & POPULATION STUDIES(CESPO).CESPO WILL INTRODUCE SEX EDUC PROGS INTO THE SECONDARY SCHL CURRIC,COORDINATE THE RESEARCH & TRNG PROGS UNDERWAY,AND CONDUCT EVAL STUDIES.
PROP(10/25/73)EXTENDS PROJ THRU FY76 AND INITIATES A REORGNTN OF THE FP PROG INTO A JOINT EFFORT BY THE MOH AND THE NATL COORDINATING COMMITTEE FOR POP & SEX EDUC(CONAPO).CONAPO MEMBERS(CRDA,CESPO,CNTR FOR FAMILY INFORMATION,CNTR FOR PAR ORIENTATN,SOCIAL SECURITY INST(CCSS),MOE,AND MIN OF PUBLIC HLTH.PROJ AT THIS POINT BECOMES A BROADER-BASED RUR HLTH PROG WITH FP BEING A MAJOR ELEMENT.AID CONCENTRATES SUPPORT ON EFFORTS TO UTILIZE PARAMEDS MORE EXTENSIVELY IN RUR HLTH DELIV SVCS & ADMIN TRNG. PROP(3/13/74)AUTHORIZES ASSISTANCE TO THE CCSS FOR THE TRNG OF WOMEN'S HLTH CARE SPECIALISTS(PARAMEDS).

GOAL: COSTA RICA'S BIRTH RATE IS REDUCED TO A LEVEL CONDUCTIVE TO SUSTAINED SOCIO-ECONOMIC DEVELOPMENT. 1

PURPOSE:

OUTPUTS: ESTABLISH A VIABLE, MULTI-AGENCY, GOVERNMENT OPERATED PUPULATION CONTROL/FAMILY PLANNING PROGRAM.1

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	OIC CALL NO	PUB NO
PROJECT APPRAISAL REPORT					
PROJECT APPRAISAL REPORT	08/ /0/71	FAMILY PLANNING			
ANNUAL REPORT	06/13/73	HEALTH/FAMILY PLANNING PROJECT			
ANNUAL REPORT	05/23/74	ANNUAL REVIEW: HEALTH/FAMILY PLANNING PROJECT			

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150121 SUB-PROJECT: 00
PROJECT TITLE: NUTRITION PROGRAM — INITIAL FY: 76 FINAL FY: 80

PROBLEM: GOVERNMENT OF COSTA RICA REQUIRES ASSISTANCE IN FUNDING A MULTIFACETED NATIONAL NUTRITION PROGRAM.

STRATEGY: LONG-TERM (40 YEAR) LOAN TO GOVERNMENT OF COSTA RICA PROVIDES CAPITAL INTENSIVE SUPPORT TO CENTRALIZED PUBLIC SECTOR NUTRITION PROGRAM.

SUMMARY: PROJECT IS 5 PART EFFORT TO (1)ESTABLISH NATIONAL NUTRITIONAL INFORMATION SYSTEM; (2)CONDUCT RESEARCH IN OPERATIONAL METHODOLOGY, APPLIED NUTRITIONAL RESEARCH, & FOOD TECHNOLOGY; (3)IMPROVE NUTRITION FIELD SERVICES THROUGH TRAINING OF NURSES, EXTENSION WORKERS, NUTRITION ASSISTANTS, & RURAL HEALTH INSPECTORS; (4)EDUCATE TARGET POPULATION IN NUTRITION, SANITATION, AND BASIC HEALTH PRACTICES THROUGH THE USE OF RADIO, RADIO STUDY GROUPS, SCHOOL GARDENS, & MATERNITY CLINIC PROGRAMS; INSTALL SOME 600 RURAL WELLS/HANDPUMPS/MOLDING TANKS.

GOAL: TO IMPROVE THE OVERALL NUTRITIONAL LEVEL OF THE RURAL AND URBAN POOR IN COSTA RICA. 1

PURPOSE: DEVELOP AND APPLY SYSTEMATIC, INTEGRATED, AND MULTI-SECTORAL APPROACH IN PLANNING, IMPLEMENTING, AND EVALUATING COSTA RICAN NATIONAL NUTRITION PROGRAM. 1

OUTPUTS: 1.NUTRITION INFORMATION SYSTEM DESIGNED AND IMPLEMENTED. 2.RESEARCH RESULTS DETERMINED FOR OPERATIONAL METHODOLOGY OF PROGRAM, APPLIED NUTRITION RESEARCH, AND FOOD TECHNOLOGY. 3.FIELD SERVICE FOR NUTRITION, SANITATION, HEALTH, COMMUNITY ORGANIZATION, AND LOCAL FOOD PRODUCTION BEGUN. 4.IMPROVED COMMUNITY BEHAVIOR RELATIVE TO NUTRITION, SANITATION, AND BASIC HEALTH HABITS PROVIDED. 5.IMPROVED ENVIRONMENTAL SANITATION FOR SMALL COMMUNITIES OF RURAL TARGET GROUP ESTABLISHED. 1

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	OIC CALL NO	PUB NO
PROJECT EVALUATION SUMMARY	12/21/77	NUTRITION PROGRAM	12P		
PROJECT EVALUATION SUMMARY	09/26/74	NUTRITION PROGRAM (LOSTA RICA)	4P		
SECTOR ASSESSMENT	10/21/75	NUTRITION ASSESSMENT FOR COSTA RICA		C5a+1.1050	
SPECIAL EVALUATION REPORT	04/20/79	A QUICK REVIEW OF THE COSTA RICA NUTRITION LOAN	18P		
LOAN PAPER/CAPITAL ASSISTANCE PAPER	12/17/75	COSTA RICA --NUTRITION PROGRAM		C5a+1.1420	

Health Continued

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA
PROJECT TITLE: FAMILY PLANNING SERVICES

PROJECT: 515U832 SUB-PROJECT: 00
INITIAL FY: 79 FINAL FY: 81

PROBLEM: THE HIGH NATIONAL FERTILITY RATE OF COSTA RICA HINDERS THE POSSIBILITY FOR SUCCESS OF OTHER DEVELOPMENT STRATEGIES AND PROGRAMS AIMED AT LOWER-INCOME FARMERS.

STRATEGY: CAPITAL INTENSIVE, LONG TERM, PUBLIC SECTOR, PRIVATE SECTOR, CENTRALIZED APPROACH.

SUMMARY: ASSISTANCE PROVIDED TO THE GOCR AND PRIVATE FAMILY PLANNING (FP) ORGS TO EXPAND FP SERVICES AND SEX EDUCATION TO RURAL POOR. EMPHASIS PLACED ON UTILIZING WOMEN'S HEALTH CARE SPECIALISTS AND AUXILIARY NURSES AS PRIMARY AGENTS AT 240 HEALTH POSTS. WORKS THRU MOBILE RURAL HLTH PROGRAM ADDITIONALLY TO REACH REMOTE AREAS. VOLUNTEER MALARIA WORKERS, AGR EXTENSION AGENTS, RURAL PROMOTERS AND COMMUNITY MIDWIVES TRAINED AND EMPLOYED TO DELIVER FP COUNSELING AND SERVICES. THREE MAJOR CONTRIBUTIONS TO RURAL IMPROVED HLTH THRU SPACED PREG; GREATER PARTICIPATION IN LABOR FORCE; AND PROJECT EDUCATES AND EMPLOYS WOMEN PROFESSIONALLY. PROJECT ADDITIONALLY GENERATES EDUCATIONAL MATERIALS INCLUDING AUDIO-VISUAL AIDS.

GOAL: TO REDUCE NATL FERTILITY RATE WHICH WILL ENHANCE AND SUPPORT THE POSSIBILITIES FOR SUCCESS OF OTHER DEVELOPMENT STRATEGIES AND PROGRAMS AIMED AT THE LOWER-INCOME FARMERS.

PURPOSE: TO CONSOLIDATE THE INSTITUTIONAL CAPABILITY AND CAPABILITY TO PROTECT 130,000 WOMEN IN FERTILE AGE WITH EFFECTIVE METHODS OF CONTRACEPTION BY END OF FY'79.

OUTPUTS: 1. TWO WOMEN HEALTH CARE SPECIALISTS (WHCS) TRAINING CENTERS ESTABLISHED 2. FAMILY PLANNING INFORMATION AND DISTRIBUTION SYSTEM BY NON-MEDICAL REFERRAL AGENTS ESTABLISHED 3. FAMILY PLANNING PROGRAM IN RURAL AREAS EXPANDED 4. PROMOTIONAL MECHANISM TO ENCOURAGE USE OF FAMILY PLANNING SERVICES IN RURAL AREAS ESTABLISHED.

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
PROJECT EVALUATION SUMMARY	01/15/79	PES-USAID/COSTA RICA-FAMILY PLANNING SERVICES.	16P		

2.2 Rural Development

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU COSTA RICA
PROJECT TITLE: COSTA RICA-AGRICULTURAL DEVELOPMENT

PROJECT: 515-0838 SUB-PROJECT: 00
INITIAL FY: 83 FINAL FY: 88

PROBLEM: SMALL FARMERS LACK TECHNICAL EXPERTISE; ACCESS TO CREDIT AND COMPETITIVE MARKETS WITH WHICH TO INCREASE THEIR AGRICULTURAL PRODUCTION.

STRATEGY: EDUCATE SMALL FARMER IN PRODUCTION PRACTICES, MANAGEMENT, MARKETING, AND ORGANIZATIONAL TECHNIQUES TO INCREASE CREDIT USE BY FARMERS AND ASSURE FARMERS OF GOOD CLIENT RELATIONS WITH CREDIT BANK.

SUMMARY: SPECIALIST TRAINING IN FARMING AND MARKETING AT SECONDARY SCHOOL LEVELS IN COSTA RICA EMPHASIZING RESEARCH COORDINATION. COST ANALYSIS TO DETERMINE HIGHEST SOCIAL-ECONOMIC BENEFITS. RURAL COOPS AND CREDIT UNIONS STRENGTHENED WITH PRIORITIES FOR BASIC FOOD AND NONTRADITIONAL EXPORT CROPS. INFORMATION CENTER. PRICE STABILIZATION SYSTEM, AND LAND TENURE DEVELOPED. ASSISTANCE TO MAG IN INCREASING PRODUCTIVITY BY ADOPTING MODERN PRACTICES AND USING TOOLS DEVELOPED BY OTHER PROJECT ACTIVITIES.

GOAL: INCREASE AGRICULTURAL POTENTIAL OF THE SMALL FARM OPERATOR. I

PURPOSE: BETTER ACCESS TO CREDIT, TECHNICAL ASSISTANCE, AND EFFICIENT COMPETITIVE MARKETS FOR SMALL FARMERS. I

OUTPUTS: ALL AGRICULTURAL SECTOR AGENCIES HAVE MADE AN EFFECTIVE DELEGATION OF AUTHORITY AND DISPERSION OF SERVICES TO THE 6 REGIONAL CENTERS. THE NATL AGRICULTURAL COUNCIL AND ITS REGIONAL CENTERS ACCEPTING COORDINATED RURAL PLANS AND INTEGRATED STRATEGY. NEW LENDING PROPOSALS DEVELOPED AND IMPLEMENTED. MINISTRY OF AG TECHNICIANS REACHING RURAL TARGET FARM IN GROUPS WITH VALID SUITABLE INFORMATION. SEEDS OF GOOD QUALITY AVAILABLE FOR THE GENERAL AG PRODUCERS. I

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
SPECIAL EVALUATION REPORT	06/01/76	INTERCOUNTRY EVALUATION OF AGRICULTURE SECTOR PROGRAMS: COLOMBIA; COSTA RICA; GUATEMALA (VOLUMES)	110	[illegible]	PN-AAU-[illegible]
LOAN PAPER/CAPITAL ASSISTANCE PAPER	06/18/70	AGRICULTURAL SECTOR LOAN STUDY (515-L-022)			
END-OF-TOUR REPORT	07/14/65	END OF TOUR REPORT - RUSSELL DESROSIERS, TROPICAL CROPS ADVISOR		C16J0.972[illegible]37A	
END-OF-TOUR REPORT	01/00/67	END OF TOUR REPORT - [illegible]		C16J0.972[illegible]37A	

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150117 SUB-PROJECT: 00
PROJECT TITLE: AGRICULTURAL DEVELOPMENT PROGRAM — INITIAL FY: 70 FINAL FY: 78

PROBLEM: SMALL FARMERS IN COSTA RICA, USING TRADITIONAL AGRICULTURAL METHODS ARE CONFINED WITHIN LIMITS OF LOW PRODUCTIVITY.

STRATEGY: LOAN IS GRANTED TO COSTA RICAN GOVERNMENT TO FINANCE AGRICULTURAL DEVELOPMENT PROGRAM.

SUMMARY: COSTA RICA RECEIVES LOAN TO FINANCE AGRICULTURAL DEVELOPMENT PROGRAM. PROGRAM CONSISTS OF SEVEN PROJECTS WHICH WILL BE IMPLEMENTED SIMULTANEOUSLY, PRESENTING A MULTI-FACETED APPROACH TO THE INTERRELATED PROBLEMS OF THE SMALL FARMER. PROJECTS FOCUS ON THE FOLLOWING AREAS: (1)AGRICULTURAL SERVICES (2)AGRICULTURAL EDUCATION (3)CREDIT (4)COOPERATIVES (5)MARKETING (6)LAND TENURE (7)COMMUNITY/MUNICIPAL DEVELOPMENT.

GOAL: INCREASE SMALL FARMER'S INCOME AND IMPROVE ECONOMIC AND SOCIAL DEVELOPMENT IN COSTA RICA. I

PURPOSE: INCREASE CROP PRODUCTION OF COSTA RICAN SMALL FARMERS BY INTRODUCING MODERN FARMING PRACTICES. I

OUTPUTS: SMALL FARMERS ARE TRAINED IN MODERN PRODUCTION AND MANAGEMENT PRACTICES. AMOUNT OF CREDIT AVAILABLE TO SMALL FARMERS INCREASED. COOPERATIVES AND NEW MARKET FACILITIES ARE ESTABLISHED. LAND TITLING PROGRAM IS ESTABLISHED. COMMUNITY LEADERS ARE TRAINED IN COMMUNITY MANAGEMENT PRACTICES. I

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
SPECIAL EVALUATION REPORT	06/01/74	INTERCOUNTRY EVALUATION OF AGRICULTURE SECTOR PROGRAMS: COLOMBIA; COSTA RICA; GUATEMALA (VOLUMES)	73P	LA[0]U.V8M751(V3)	PNAAD110-A1
SPECIAL EVALUATION REPORT	07/01/75	INTERCOUNTRY EVALUATION OF A.I.D. LAND SALE GUARANTY PROGRAMS: ECUADOR; COSTA RICA	65P	EC333.326044	PNAAD112
SPECIAL EVALUATION REPORT	12/26/75	EVALUACION FINAL DEL PROGRAMA DE DESARROLLO AGROPECUARIO: 1971-1974 (FINAL EVALUATION OF THE FARM DEVELOPMENT PROGRAM: 1971-1974)	105P	630.97295A188	PDAAA442-A1
AUDIT REPORT	05/01/74	AUDIT REPORT: USAID/COSTA RICA AGRICULTURAL SECTOR LOAN PROJECT 515-26-190-117, LOAN NO. 515-L-022	100P		
LOAN PAPER/CAPITAL ASSISTANCE PAPER	06/10/76			LS63U.977D0A265	

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150120 SUB-PROJECT: 00
PROJECT TITLE: RURAL DEVELOPMENT PROGRAM — INITIAL FY: 79 FINAL FY: 80

PROBLEM: SMALL FARMER PARTICIPATION IN THE GROWTH OF THE AGRICULTURAL SECTOR REQUIRES MORE EFFECTIVE GUIDANCE CONCERNING MODERN TECHNOLOGY AND MANAGEMENT METHODS, BETTER ACCESS TO CREDIT, PRODUCTIVE INPUTS, PROBLEM SOLVING SERVICES AND RAIG INPUT TO ACCOMPLISH THIS. PUBLIC INSTITUTIONS MUST BE RESTRUCTURED AND DECENTRALIZED MAKING THEM MORE RESPONSIVE IN DELIVERING THEIR SERVICES TO THE SMALL FARMER.

STRATEGY: FINANCE SELECTIVE SERVICES OF AGRICULTURAL SECTOR INSTITUTIONS.

SUMMARY: PROJECT WILL STRENGTHEN INSTITUTIONAL INFRASTRUCTURE RESPONSIBLE FOR PROVIDING SERVICE TO SMALL FARMER BY (1)REORGANIZING MANAGEMENT, POLICY MAKING AND FIELD OPERATIONS OF THE MINISTRY OF AGRICULTURE (MAG) THROUGH ON-THE-JOB DEMONSTRATION TRAINING PROJECTS TO BE UNDERTAKEN BY MAG CENTRAL STAFF AND REGIONAL OFFICES. (2)ENCOURAGING THE COOPERATIVE MOVEMENT TO EXTEND MORE AND BETTER SERVICES TO MORE SMALL FARMERS, PROVIDING INCREASED AMOUNTS OF PRODUCTION CREDIT AND MARKETING/PROCESSING CREDIT. (3)STRENGTHENING THE MUNICIPAL DEVELOPMENT INSTITUTE (IFAM) ENABLING IFAM TO FINANCE IMPROVEMENT PROJECTS SUCH AS FARM TO MARKET ROADS, RURAL WATER SYSTEMS, ELECTRIFICATION AND AGRIBUSINESS RELATED PROJECTS.

GOAL: INCREASE PRODUCTIVITY OF SMALL FARMERS IN COSTA RICA.

PURPOSE: PROVIDE SMALL FARMERS WITH ACCESS TO MORE EFFICIENT FARMER ORGANIZATIONS AND GOVERNMENT INFRASTRUCTURES RENDERING IMPROVED PUBLIC SERVICES.

OUTPUTS: MINISTRY OF AGRICULTURE PROGRAM PLANNING, MANAGEMENT AND OPERATIONS ANALYSIS IMPROVED. FARMER COOPERATIVE ORGANIZATIONS ARE EXPANDED AND IMPROVED. COUNTY GOVERNMENT AND RURAL COMMUNITY SERVICES ARE IMPROVED.

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
PROJECT EVALUATION SUMMARY	01/01/71	AID LOAN 515-T-025, EVALUATION OF IFAM COMPONENT (1/77- 3/77)	17P		
PROJECT EVALUATION SUMMARY	06/30/77	RURAL DEVELOPMENT PROGRAM	21P		
LOAN PAPER/CAPITAL ASSISTANCE PAPER		RURAL DEVELOPMENT PROGRAM COSTA RICA		CS 301.33 A265	

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150129 SUB-PROJECTS: 00
PROJECT TITLE: INTEGRAL RURAL DEVELOPMENT — INITIAL FY: 76 FINAL FY: 79

PROBLEM: THE INEFFICIENT LAND USE PRACTICES WITH CONSEQUENT HIGH LEVELS OF UNEMPLOYMENT, SUBEMPLOYMENT, LOW INCOME, AND OUTMIGRATION IN THE CANTONES OF NICOYA, HOJANCHA, AND NANDAYURE ARE REINFORCED BY THE LACK OF CREDIT, LACK OF TECHNICAL ASSISTANCE, POORLY ORGANIZED MARKETING PRACTICES, LACK OF INFRASTRUCTURE, POORLY DEVELOPED INDUSTRY, AND INADEQUATE HOUSING AND PUBLIC SERVICES.

STRATEGY: CREATE A MODEL OF INTEGRATED RURAL DEVELOPMENT THAT AIDS IN RESOLVING THE PROBLEMS OF NICOYA, HOJANCHA, AND NANDAYURE AND PROVIDES GUIDELINES FOR DEVELOPING OTHER RURAL AREAS OF COSTA RICA.

SUMMARY: CREATING AN ALTERNATIVE MODEL OF DEVELOPMENT APPROPRIATE TO OTHER AREAS OF COSTA RICA ASSISTS IN RESOLVING THE PROBLEMS OF POOR LAND UTILIZATION AND LOCAL RESPONSIBILITY FOR DEVELOPMENT RESOURCES AND THE UNSUITABILITY OF THE FARM TECHNOLOGY AVAILABLE TO THE SMALL FARMER. THE MODEL FOCUSES ON IMPROVING THE STANDARD OF LIVING IN RURAL AREAS WHILE SIMULTANEOUSLY REDUCING OUT-MIGRATION, IMPROVING SOIL, WATER, AND FORESTRY RESOURCES. THESE CHANGES ARE ACHIEVED THROUGH THE COORDINATION OF SEVERAL EFFORTS BY GOVERNMENT AGENCIES. THE LOCAL GOVERNMENT, AND INTERESTED CITIZENS IN COMPILING AN INTEGRATED DEVELOPMENT PLAN FOR THE AREA.

GOAL: RURAL STABILITY, LOCAL GOVERNMENT ORIENTED TOWARD SOLVING LOCAL PROBLEMS, LOCAL PROJECTS CARRIED OUT BY NATIONAL INSTITUTIONS ARE BASED ON LOCALLY DEFINED PRIORITIES. 1

PURPOSE: DEVELOPMENT AND ACCEPTANCE OF A MODEL FOR INTEGRAL RURAL DEVELOPMENT BY THE GOVERNMENT OF COSTA RICA (GOCR) AND LOCAL AREA GOVERNMENTS. 1

OUTPUTS: LOCAL GROUPS FORMED FOR PLANNING, IMPLEMENTATION, AND COORDINATION OF ACTIVITIES; PUBLICATION AND PROMULGATION OF SOCIOECONOMIC INFORMATION; INCORPORATION OF NATIONAL PLANNING ORGANIZATIONS IN LOCAL PLANNING PROCESS; DEFINED ALTERNATIVE POLICIES; INDIGENOUS TRAINING; AND AN ON-GOING EVALUATION SYSTEM. 1

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
PROJECT APPRAISAL REPORT	09/10/77	INTEGRATED RURAL DEVELOPMENT PROJECT (DPG)			
PROJECT EVALUATION SUMMARY	01/28/79	INTEGRAL RURAL DEVELOPMENT (DPG) (1/11/79)	13P		

2.3 Resources Planning

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150122 SUB-PROJECTS: 00
PROJECT TITLE: AGRICULTURE AND NATURAL RESOURCES — INITIAL FY: 75 FINAL FY: 80

PROBLEM: MINISTRY OF AGRICULTURE'S MANAGEMENT, PLANNING, EVALUATION CAPABILITY IS WEAK.

STRATEGY: PROVIDE ADVISORS, TRAINING AIDS, PARTICIPANT TRAINING.

SUMMARY: PROJECT CONTINUES ACTIVITIES IN EVALUATION, NUTRITION PLANNING INITIATED IN PROJECT 515-0038. COMPLETES EVALUATION OF RURAL DEVELOPMENT PROGRAM FINANCED BY AID LOANS, MEASURING IMPACT AND ASSESSING EXPERIENCE. PROVIDES TECHNICAL ASSISTANCE IN PREPARATION OF ASSESSMENT OF NUTRITIONAL PROBLEMS. ADVISORS PROVIDE MINISTRY OF AGRICULTURE WITH TECHNICAL EXPERTISE TO IMPROVE MANAGEMENT. PARTICIPANTS ARE TRAINED IN AGRICULTURE, NUTRITION PLANNING, EXTENSION, SEED PROCESSING RECEIVE ASSISTANCE.

GOAL: DEVELOP RURAL SECTOR PLANNING IN COSTA RICA. 1

PURPOSE: IMPROVE PLANNING, PROGRAMMING, MANAGEMENT CAPABILITIES OF MINISTRY OF AGRICULTURE IN COSTA RICA. 1

OUTPUTS: 1. PLAN FOR EVALUATING RURAL DEVELOPMENT PROGRAMS COMPLETED. 2. SCOPE OF WORK FOR CONDUCTING NUTRITIONAL ASSESSMENT DEVELOPED. 3. MINISTRY OF AGRICULTURE'S MANAGEMENT, PLANNING DEPARTMENTS RECEIVED TECHNICAL ASSISTANCE.

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
PROJECT APPRAISAL REPORT	09/20/77				

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 515G138 SUB-PROJECTS: 00
PROJECT TITLE: SCIENCE AND TECHNOLOGY — INITIAL FY: 79 FINAL FY: 85

PROBLEM: THE LACK OF AVAILABLE FUNDING AND IN-COUNTRY TECHNOLOGICAL DEVELOPMENT RESULTS IN A DEARTH OF INDIGENOUS RESEARCH IN AREAS OF INDUSTRIAL TECHNOLOGY, NATURAL RESOURCES, AND ENERGY IN COSTA RICA. WITHOUT IN-COUNTRY RESEARCH CAPABILITIES IN THESE AREAS, COSTA RICA REMAINS VULNERABLE TO INCREASING LEVELS OF UNEMPLOYMENT, RISING PETROLEUM COSTS, AND SEVERE NATIONAL RESOURCE EXPLOITATION.

STRATEGY: FIVE-YEAR LOAN TO THE GOVERNMENT OF COSTA RICA (GOCR) FINANCES SHORT-TERM TRAINING AND TECHNICAL ASSISTANCE, INTERNATIONAL RESEARCHER EXCHANGE, MASTERS/PHD LEVEL TRAINING, TECHNOLOGY AND INDUSTRIAL SECTOR ASSESSMENTS, RESEARCH AND DEVELOPMENT PROJECTS, INFORMATION SEARCHES, PROJECT EVALUATIONS, AND FURNITURE, EQUIPMENT, AND VEHICLES. GOCR PROVIDES SUBSTANTIAL COUNTERPART SUPPORT INCLUDING ALL OPERATIONAL EXPENSES.

SUMMARY: LOAN IS PROVIDED TO THE GOVT OF COSTA RICA (GOCR) TO STRENGTHEN GOCR CAPACITY TO PLAN, CONDUCT, AND APPLY SCIENTIFIC AND TECHNOLOGICAL RESEARCH TO ITS PRODUCTIVE PROCESSES IN SUPPORT OF THE NATION'S POOR POPULATION, AND ITS NATURAL RESOURCES. FUNDS SUPPORT 3 ACTIVITIES WITHIN THE COSTA RICAN NATIONAL COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL RESEARCH (CONICIT), AN AUTONOMOUS GOCR AGENCY: 1)RESEARCH AND DEVELOPMENT ASSESSMENT, PLANNING & PROMOTION (RNAPP); 2)RESEARCH COMMUNITY SUPPORT (RCSS); 3)TECHNOLOGY EXTENSION (TE). RESEARCH WILL BE CONDUCTED BY AND ORIENTED TO LOCAL COSTA RICAN COMMUNITIES, RESULTING IN AN ON-GOING PROCESS OF INDIGENOUS TECHNOLOGICAL INNOVATION AND ADAPTATION.
RNAPP ACTIVITIES WILL INCLUDE INDUSTRIAL SECTOR ASSESSMENTS--IDENTIFYING THOSE SUB-SECTORS WHERE TECHNOLOGICAL CHANGE HAS THE MOST POTENTIAL FOR INCREASING LABOR DEMAND AND PRODUCTIVITY. CONICIT WILL FORMULATE A RESEARCH PROGRAM, CULMINATING IN MONETARY SUPPORT FOR APPROXIMATELY 30 RESEARCH SUB-PROJECTS.
TRAINING ACTIVITIES WILL BE CONDUCTED UNDER RCSS IN AREAS OF SCIENCE AND TECHNOLOGY, AND RESEARCH MANAGEMENT. FUNDS SUPPORT MASTER'S DEGREE LEVEL TRAINING FOR 35 RESEARCHERS, AND PHD LEVEL TRAINING FOR 6 RESEARCHERS. SHORT-TERM TRAINING, RESEARCH METHODOLOGY WORKSHOPS, AND GOCR-FUNDED RESEARCH ENTITY MANAGEMENT EVALUATIONS ARE ALSO PROVIDED.
THE TECHNOLOGY INSTITUTE OF COSTA RICA (ITCR) WILL RECEIVE SUPPORT TO UPGRADE ABILITIES OF ITS TECH EXTENSION UNIT TO PERFORM IN-DEPTH TECH CONSULTATIONS, PREPARE/PUBLISH TECH INFO PAMPHLETS, AND GIVE SHORT COURSES & DEMOS. THE TECH EXTENSION UNIT WILL USE EXISTING AGRI AND SMALL INDUSTRY EXTENSION SERVICES TO PROVIDE SMALL PRODUCERS WITH ACCESS TO NEW TECHNOLOGIES, BOTH INDIGENOUS & IMPORTED. PHD LEVEL SCHOLARSHIPS WILL BE PROVIDED TO UPGRADE KNOWLEDGE OF INDUSTRIAL TECHNOLOGISTS ON ITCR FACULTY.
LOAN MONIES WILL ALSO FUND A PROJECT COORDINATOR, AND PERIODIC, IN-DEPTH EVALUATIONS. GOCR CONTRIBUTES SUBSTANTIAL SUPPORT TO PROJECT ACTIVITIES, INCLUDING PROVISION OF ALL OPERATING EXPENSES.

GOAL: PERMANENT SOCIO-ECONOMIC IMPROVEMENT OF COSTA RICA'S POPULATION, ESPECIALLY ITS POOREST GROUPS, THROUGH INCREASED ACCESS TO AND MORE PRODUCTIVE USE OF THE MEANS OF PRODUCTION.

PURPOSE: TO STRENGTHEN COSTA RICA'S CAPACITY TO PLAN, CONDUCT, AND APPLY TO ITS PRODUCTIVE PROCESSES, SCIENTIFIC AND TECHNOLOGICAL RESEARCH WHICH TAKES INTO ACCOUNT THE NEEDS OF COSTA RICA'S POOREST GROUPS, AND THE RATIONAL USE OF ITS NATURAL RESOURCES.

OUTPUTS: 1. RESEARCH AND DEVELOPMENT ASSESSMENT, PLANNING, AND PROMOTION: INDUSTRY SECTOR ASSESSMENT, TECHNOLOGY ASSESSMENTS, INFORMATION SEARCHES, RESEARCH & DEVELOPMENT PROJECTS, STRENGTHENED CONICIT (COSTA RICAN NATL COUNCIL FOR SCIENTIFIC & TECHNOLOGICAL RESEARCH) PROJECTS OFFICE; 2. RESEARCH COMMUNITY SUPPORT: TRAINED RESEARCHERS, MGMT EVALUATIONS OF RESEARCH ENTITIES, RESEARCH METHODOLOGY, STRENGTHENED CONICIT HUMAN RESOURCES OFFICE; 3. TECHNOLOGY EXTENSION: CONSULTATION WITH SMALL ENTREPRENEURS, TECHNOLOGY INFORMATION PAMPHLETS, MANUALS & GUIDES PUBLISHED AND DISTRIBUTED, SHORT COURSES AND TECHNOLOGY DEMOS, TECH INFO REQUESTS FILLED, DATA BANKS, CONTACT ESTABLISHED WITH FOREIGN DATA BASES, STRENGTHENED WATER OFFICE.

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 515G139 SUB-PROJECTS: 00
PROJECT TITLE: NATIONAL DEVELOPMENT INFORMATION SYSTEM — INITIAL FY: 79 FINAL FY: 84

PROBLEM: DEVELOPMENT INFORMATION IN COSTA RICA IS EITHER IN AN UNUSABLE FORM OR IT IS LATE, INACCESSIBLE, OR SIMPLY NON-EXISTENT. FOR EXAMPLE: BASIC, ACCURATE AGRICULTURAL DATA IS UNAVAILABLE; EXISTING RESEARCH AND SURVEY INFORMATION IS OFTEN UNKNOWN TO POTENTIAL USERS, RESULTING IN DUPLICATION OF EFFORTS; AND INFORMATION FOR GUIDING DEVELOPMENT ACTIVITIES IS NOT READILY AVAILABLE TO USERS. THUS, GOVT OF COSTA RICA PERSONNEL ARE HINDERED IN MAKING POLICY AND PROGRAM DECISIONS FOR DEALING WITH COSTA RICA'S INCREASINGLY COMPLEX DEVELOPMENTAL PROBLEMS.

STRATEGY: 5-YR-PROJECT CONSISTS OF A LOAN AND GRANT TO GOVT OF COSTA RICA (GOCR) TO FINANCE THE CREATION OF A NATIONAL DEVEL INFO SYS (SNID). LOAN FUNDS TECHNICAL SERVICES TO DESIGN, INSTALL, AND TEST SNID SYS. FUNDS ALSO PROVIDE SHORT-TERM TECH ASSISTANCE, VEHICLES, SYSTEM SUPPLIES, PROJECT COORDINATION COSTS, AND TRNG BY USDA OR BUCEN. GRANT FUNDS SERVICES OF EXPERTS IN COMPUTER SCIENCE AND INFORMATION MGMT. GOCR FINANCES OPERATING PERSONNEL, VEHICLES, MATERIALS, AND AREA FRAME SURVEY COSTS.

SUMMARY: 5-YR LOAN TO GOVT OF COSTA RICA (GOCR) WILL FINANCE THE CREATION OF A NATIONAL DEVELOPMENT INFORMATION SYSTEM(SNID). SNID WILL CONSIST OF A DEVEL DATA BANK, ONGOING SAMPLING SURVEYS, 3 DEVEL DOCUMENTATN CENTERS.
THE DEVEL DATA BANK WILL CONSIST OF GEOGRAPHICALLY CODED DATA SETS, ORGANIZED INTO MODULES COVERING: 1)AGR PRODUCTN/EMPLOYMT; NATURAL RESOURCES, AND LAND TENURE; 2)HEALTH, POPULATION, AND NUTRITN; 3)INDUSTRY EMPLOYMT/PRODUCTN; 4)BASIC NEEDS SUCH AS HOUSING, EDUCATN, ETC; 5)INFO ON PRIORITY PROGRAMS' INPUTS AND RESULTS; AND 6)ABILITY TO RETRIEVE INFO ON GOCR DOCUMENTS AND SURVEYS IN EACH RURAL SECTOR. THE DEVELOPMENT DATA BANK WILL BE SUPPORTED BY A NETWORK OF COMPUTER TERMINALS.
THE SECOND LOAN COMPONENT WILL FUND THE CONSTRUCTN OF AN AREA SAMPLING FRAME, 5 NATL SURVEYS, AND SPECIAL SURVEYS WHICH WILL GENERATE NEW AND NEEDED DATA ON AGR, LAND USE, AND THE RURAL POPULATN. THE AREA SAMPLING FRAME AND SURVEY WILL GENERATE REPRESENTATIVE DATA ON THE RURAL SECTOR, AND ESTABLISH A CONTINUING SURVEY MECHANISM.
THE 3 DEVEL DOCUMENTATN CENTERS WILL COLLECT AND MAKE AVAILABLE PRINTED INFORMATN SUCH AS GOCR OR GOCR-FUNDED PLANNING DOCUMENTS, FEASIBILITY STUDIES, AND SURVEY DOCUMENTATION. THESE DOCUMENTS WILL BE ABSTRACTED AND INDEXED. A KEY WORD ACCESS SYSTEM FOR DOCUMENTATION WILL BE DEVELOPED IN ORDER TO FACILITATE USER RESEARCH. THE DOCUMENTATION CENTERS' INDEX, ABSTRACT, AND KEYWORD SYSTEM WILL BE ACCESSIBLE TO THE FOLLOWING: 1)NATIONAL PLANNING OFFICE (MIPLAN); 2)OFFICE OF INFORMATION OF THE PRESIDENCY (CIP); 3)AGRICULTURAL SECTOR PLANNING OFFICE (UPSA); 4)MINISTRY OF HEALTH (MS); 5)INDUSTRIAL SECTOR PLANNING OFFICE (DSP)LAND 6)DIRECTORATE GENERAL OF STATISTICS AND CENSUS (DGEC).. OTHER ORGANIZATIONS WHICH HAVE INDICATED AN INTEREST IN UTILIZING DIS ARE: 1)MINISTRY OF AGRICULTURE; 2)CENTRAL BANK; 3)INSTITUTE FOR COLONIZATION; 4)NATIONAL PRODUCTION COUNCIL (CNP); AND 5)UNIV OF COSTA RICA. GOCR PERSONNEL WILL BE PROVIDED WITH TRAINING, SEMINARS, WORKSHOPS, ETC WHICH WILL PREPARE THEM TO CONDUCT THEIR OWN ANALYSIS PROGRAMS, STUDIES, AND OPERATE DIS.
ASSESSMENT OF THE AGP COMPONENT OF DIS IS APPENDED AS AN ANNEX.

GOAL: PERMANENT SOCIO-ECONOMIC IMPROVEMENT OF COSTA RICA'S POOREST GROUPS THROUGH INCREASED ACCESS TO, AND MORE PRODUCTIVE USE OF, THE MEANS OF PRODUCTION AND THROUGH POPULAR PARTICIPATION.

PURPOSE: IMPROVED INFORMATION BASE FOR DEVELOPMENT POLICY-MAKING AND FOR PLANNING AND MANAGEMENT OF PRIORITY DEVELOPMENT PROGRAMS AND PROJECTS.

OUTPUTS: 1.DEVELOPMT DATA BANK CONTAINING GEOGRAPHICALLY CODED DATA ON: A)AGRICULTURE AND NATURAL RESOURCES; B)HEALTH & NUTRITION; C)INDUSTRY & EMPLOYMENT; D)INPUTS TO AND RESULTS OF A SAMPLE OF SPECIFIC PROGRAMS IN PRIORITY SECTORS; E)COMMUNITY AND POPULATION CHARACTERISTS. 2.NATIONAL AREA SAMPLING FRAME AND SURVEY CAPABILITY. 3.DEVELOPMENT DOCUMENTATION CENTERS.

PROJECT EVALUATION DOCUMENTATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 515G144
PROJECT TITLE: REMOTE SENSING PILOT PROJECT — INITIAL FY: 77 FINAL FY: 81

DOCUMENT TYPE: PROGRESS REPORT/INTERIM REPORT
DOCUMENT TITLE: QUARTERLY PROGRESS REPORT: CONTRACT FOR REMOTE SENSING TECHNICAL SUPPORT
AUTHOR(S): CANNON,TIMOTHY A
CONTRACT: AID/LA-C-1253
PROJECT(S): 515014400
PUBLICATION DATE: 07/10/78
CALL NUMBER:
ORGANIZATION: RESOURCES DEVELOPMENT ASSOCIATES
OTHER ID:
PUBLICATION NO:

ABSTRACT: INITIAL QUARTERLY PROGRESS REPORT(PUR 3/1-6/30/78 PERIOD) BY RESOURCES DVLP ASSOCIATES(RDA) CONTRACTOR OF ONE-YEAR COSTA RICAN REMOTE SENSING PILOT PROJECT. PROJ DESIGNED TO DEMONSTRATE APPLICATION OF REMOTE SENSING AERIAL PHOTOGRAPHY TECHNOLOGY TO NATURAL RESOURCE INFORMATION GATHERING & ANALYSIS AND TO PREPARE COSTA RICAN TECHNICIANS TO PLAN A MAJOR ROLE IN THE EXECUTION OF A 4-YEAR FOLLOW-UP NATIONAL PROJ. RESULTS ARE TO BE APPLIED TO MONITORING & PLANNING FOR AGRICULTURAL AND URBAN SECTORS AND FOR REFORESTATION & REPLENISHMENT OF RESOURCES DEPLETED BY EXPLOITATION,EROSION,DEFORESTATION,AND ALLUVIAL DAMAGE.
RDA PILOT PROJ TEAM REPORTS PROJ ACTIVITIES FOR INITIAL 4 MONTHS THROUGH 6/30/78: THE PROJ DESIGN WAS FINALIZED IN PRELIMINARY PLANNING. THE MAJORITY OF THE AERIAL PHOTOGRAPHY HAS BEEN COMPLETED AND ACQUIRED AT THE COSTA RICAN NATIONAL GEOGRAPHIC INSTITUTE(IGN). THE QUALITY OF THE IMAGERY IS JUDGED TO BE EXCELLENT AND AT SUFFICIENT SCALES TO PERMIT EASY INTERPRETATION & TRANSFER OF INFO. NASA-ACQUIRED LAND SATELLITE II IMAGERY OF AREA HAS NOT YET BEEN RECEIVED BY RDA. SAMPLING DESIGN FOR LAND RESOURCES COVER TYPING IS BEING FINALIZED;FILM CALIBRATION TESTS ARE BEING RUN;AND PREPARATION OF BASE MAPS & SCALED COSTS FOR RESOURCES MAPPING HAS BEEN INITIATED.
5 COSTA RICAN PROFESSIONALS RECEIVED 4 WEEKS PARTICIPANT TRNG AT THE EAY ST. LOUIS EARTH RESOURCES OBSERVATIONAL SURVEY PROGRAM(ERSUS) FACILITY;AT THE SUNNYVALE ELECTRO-MAGNETIC SYSTEM LABS(ESL) FACILITY;& FROM THE SAN JOSE STATE UNIV GEOGRAPHY DEPARTMENT. TRNG INVOLVED ACTUAL USE OF PROJ-OBTAINED COSTA RICAN DATA AND A VARIETY OF EXPOSURE TO OTHER ASPECTS OF THE FIELDS OF REMOTE SENSING AND RESOURCE ASSESSMENT & MGMT.
AT THE SUGGESTION OF AN USAID OFFICIAL,RDA TEAM WILL EXAMINE THE PROBLEM OF INTEGRATING AREA FRAME SAMPLING DATA INTO ITS RESOURCE DATA SYSTEM. THE RDA TEAM WILL JOURNEY TO COSTA RICA TO INITIATE GROUND SAMPLING AND TO WORK WITH COSTA RICAN COUNTERPARTS ON THE VERIFICATION OF GROUND DATA. THE TEAM WILL ALSO BEGIN THE PILOT PROJECT'S MONITORING SYSTEM DESIGN AS WELL AS THE FINAL PHOTOGRAPHIC ANALYSIS.

DOCUMENT TYPE: PROGRESS REPORT/INTERIM REPORT
DOCUMENT TITLE: QUARTERLY PROGRESS REPORT: CONTRACT FOR REMOTE SENSING TECHNICAL SUPPORT
AUTHOR(S): CANNON,TIMOTHY A
CONTRACT: AID/LA-C-1253
PROJECT(S): 515014400
PUBLICATION DATE: 10/20/78
CALL NUMBER:
ORGANIZATION: RESOURCES DEVELOPMENT ASSOCIATES
OTHER ID:
PUBLICATION NO:

ABSTRACT:

DOCUMENT TYPE: PROJECT EVALUATION SUMMARY
DOCUMENT TITLE: REMOTE SENSING PILOT PROJECT: PROJECT EVALUATION SUMMARY
AUTHOR(S): DEL PRADO,SANDY
CONTRACT: AID/LA-C-1253
PROJECT(S): 515014400
PUBLICATION DATE: 12/18/78
CALL NUMBER:
ORGANIZATION: USAID/COSTA RICA
OTHER ID: USAID/COSTA RICA: 79-8
PUBLICATION NO: PS1501

ABSTRACT: 12/78 PROJ EVAL SUMMARY EVALUATES FIRST 12 MONTHS OF ANTICIPATED 15-MONTH REMOTE SENSING PILOT PROJECT IN COSTA RICA. PILOT PROJ DESIGNED TO DEMONSTRATE APPLICATION OF REMOTE SENSING AERIAL PHOTOGRAPHY TECHNOLOGY TO NATURAL RESOURCE INFO GATHERING & ANALYSIS,AND TO PREPARE COSTA RICAN TECHNICIANS TO EXECUTE A 4-YEAR FOLLOW-UP NATIONAL PROJ. EVAL FOCUSED ON ANALYSIS OF PROJ OUTPUTS AND PROGRESS TOWARD END-OF-PROJ INDICATORS(BASED ON PROJ DOCUMENTATION,PROGRESS REPORTS,AND INTERVIEWS OF PROJ PRINCIPALS.
CONSIDERABLE PROGRESS ACHIEVED IN RELATION TO PROGRAM DESIGN: FIVE COSTA RICAN PROFESSIONALS REPRESENTING INVOLVED AGENCIES RECEIVED ON-SITE PARTICIPANT TRNG AT THE EARTH RESOURCES OBSERVATION SYSTEM(EROS) FACILITY,SAY-ST LOUIS,MISS,AND AT THE SAN JOSE STATE UNIV GEOGRAPHY DEPT. SIX MONTHS LATER,THE PARTICIPANTS RECEIVED FOLLOW-ON TRNG IN DATA INTERPRETATION,DIGITAL ANALYSIS,AND MAP PREPARATION AT THE OFFICE OF THE RESOURCES DVLP ASSOCIATES(RDA) CONTRACTOR. COSTA RICAN NATIONAL GEOGRAPHIC INSTITUTE PERSONNEL RECEIVED RDA TRNG IN AERIAL PHOTO TECHNIQUES,AIRCRAFT OPERATIONS,AND COLOR INFRARED PHOTOGRAPHY. SATELLITE IMAGERY(LANDSAT),AERIAL PHOTOGRAPHY,AND FIELD SURVEY DATA COLLECTED ON 5,000 SQ MILES OF COSTA RICA CURRENTLY BEING UTILIZED BY PARTICIPANTS IN THE PREPARATION OF PROJ AREA MAPS. INSTITUTIONALIZATION OF A DATA COLLECTION,ANALYSIS,AND UTILIZATION SYSTEM IS NOW UNDER DISCUSSION WITH FORMATION OF A SPECIAL OFFICE BEING PROPOSED. UTILIZING NEW EXPERTISE IN LAND USAGE & RESOURCE MAPS,PARTICIPANTS ARE EXPECTED TO IMPLEMENT LAND MGMT PLANNING IN THEIR RESPECTIVE AGENCIES.
PROBLEMS ENCOUNTERED WERE NOT OF MAJOR IMPORT: LATE ARRIVAL OF LANDSAT DATA;A FAILURE IN THE EROS IMAGE PROCESSING SYSTEM;AND HEAVY AGENCY WORK LOADS OF PARTICIPANTS NECESSITATING POSTPONEMENT & ULTIMATE COMPRESSION OF RDA FOLLOW-ON TRNG.
SUCH DELAYS WILL LIKELY NECESSITATE 6-WEEK EXTENSION OF PROJ COMPLETION DATE. EOPS CONDITIONS SUBSTANTIALLY MET,HOWEVER,AND FOLLOWING IN-DEPTH TECH EVAL,TRANSITION TO NATIONAL PROJ STAGE ANTICIPATED.
PROGRAM MANAGER DIRECTED TO DETERMINE FARD FOR PILOT PROJ EXTENSION & POTENTIAL EFFECTS OF HIATUS BETWEEN PROJECT STAGES.

2.4 Conservation

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150142 SUB-PROJECT: 00
PROJECT TITLE: CONSERVATION EDUCATION — INITIAL FY: 78 FINAL FY: 80

PROBLEM: THE COSTA RICAN ASSOCIATION FOR THE CONSERVATION OF NATURE HAS NOT ADEQUATELY EDUCATED THE PUBLIC ON THE DANGERS OF NEGLECTING NATURAL RESOURCES AND CONTAMINATING THE ENVIRONMENT. AS A RESULT, LAND IS USED IRRATIONALLY, AND NATURAL RESOURCES ARE EXPLOITED, THREATENING SERIOUS ECONOMIC AND SOCIAL COSTS.

STRATEGY: TWO YEAR PROJECT CONSISTS OF OPERATIONAL PROGRAM GRANT TO ASCONA TO FINANCE CONSULTANTS AND CONTRACTORS, EQUIPMENT AND MATERIALS, TO IMPROVE ITS CAPABILITY TO EDUCATE THE PUBLIC ON CONSERVATION AND ECOLOGY.

SUMMARY: OPERATIONAL PROGRAM GRANT WILL BE PROVIDED TO THE COSTA RICAN ASSOCIATION FOR THE CONSERVATION OF NATURE(ASCONA) TO CONDUCT A NATIONAL EDUCATIONAL CAMPAIGN PROMOTING RATIONAL RESOURCE CONSERVATION AND ENVIRONMENTAL PROTECTION. GRANT COMPRISES THREE INTERRELATED ELEMENTS: ENVIRONMENTAL EDUCATION, ENVIRONMENTAL INVESTIGATION, INSTITUTIONAL STRENGTHENING.
IN THE EDUCATION ELEMENT ASCONA WILL WORK WITH LOCAL PRESS, RADIO, AND TV STATIONS. IN ADDITION ASCONA WILL CONDUCT SEMINARS, HOLD CONFERENCES, PRESENT ROUND TABLE DISCUSSIONS AT NATIONAL AND LOCAL LEVELS, AND GIVE LECTURES AS REQUESTED. TO GENERATE INTEREST IN CONSERVATION AMONG COSTA RICAN YOUTHS, ASCONA WILL PROMOTE COMPETITIONS IN ENVIRONMENTAL PROTECTION AND NATURAL RESOURCE SUBJECTS.
IN THE INVESTIGATION ELEMENT, ASCONA WILL SERVE AS A PRIVATE SECTOR CENTER FOR ENVIRONMENTAL TECHNICAL ASSISTANCE, IDENTIFYING NEEDS AND ATTEMPTING TO PROVIDE SOLUTIONS FROM ITS IN-HOUSE VOLUNTEERS' EXPERTISE. FOUR STAFF MEMBERS PAID UNDER THIS OPG, OR FOUR OUTSIDE ADVISORS ALSO CONTRACTED WITH OPG FUNDS. THESE ACTIVITIES WILL INCLUDE IMPLEMENTING LEGAL DEFENSE PROGRAMS TO PROTECT THE ENVIRONMENT, INDEXING LAWS RELATING TO CONSERVATION, CONDUCTING STUDIES OF COSTA RICA'S NATURAL RESOURCES TO BE USED BY DEVELOPMENT PLANNERS.
TO STRENGTHEN ITS OWN CAPABILITIES ASCONA WILL INSTITUTIONALIZE A FUND RAISING PROGRAM. ALSO, ASCONA WILL OBTAIN TECHNICAL ASSISTANCE TO SET UP A PROCESS FOR IDENTIFYING LONG-RANGE GOALS AND PREPARING WORK PLANS. WITH ASCONA ASSISTANCE, LOCAL AFFILIATE GROUPS WILL BE ESTABLISHED THROUGHOUT THE COUNTRY. AS A RESULT OF THE ABOVE ACTIVITIES, ASCONA'S IN-HOUSE TECHNICAL STAFF CAPABILITY IN FOREST ECOLOGY, SOILS CONSERVATION, BIOLOGY, SCIENCE EDUCATION, BIOCHEMISTRY, AND OTHER RELATED SKILLS WILL BE IMPROVED.

GOAL: TO PROTECT THE NATURAL RESOURCE BASE SO THAT ITS LONG TERM CONTRIBUTION TO ECONOMIC DEVELOPMENT CAN BE MAXIMIZED.

PURPOSE: TO INCREASE THE EFFECTIVENESS OF THE COSTA RICAN PRIVATE SECTOR IN PROMOTING RATIONAL PRACTICES OF NATURAL RESOURCE CONSERVATION AND ENVIRONMENTAL PROTECTION.

OUTPUTS: A. NATURAL RESOURCES AND ENVIRONMENTAL EDUCATION ELEMENT: 1. PUBLICATIONS AND VIDEO-VISUAL PROGRAMS; 2. SEMINARS, ROUND TABLE CONFERENCES, AND LECTURES. B. ENVIRONMENTAL RESEARCH AND INVESTIGATION ELEMENT. C. INSTITUTIONAL STRENGTHENING ELEMENT.
1.GRANT FUNDS: A.TECHNICAL ASSISTANCE--FORESTER/ECOLOGIST(18MOS); SOILS CONSERVATION SPECIALIST(18 MOS); BIOLOGIST(12 MOS); EDUCATOR(SCIENCE)(12 MOS); BIOCHEMIST(12 MOS); FUND-RAISING CONSULTANT(12 MOS); LAWYER(6 MOS); PROGRAM PLANNER(18 MOS). B. COMMODITIES--DRAFTING TABLE AND SUPPLIES; MOVIE PROJECTOR AND SLIDES; CAMERAS; TYPEWRITERS; COPYING MACHINE; OFFI

DESIGN AND EVALUATION DOCUMENTS IN DEVELOPMENT INFORMATION CENTER

DOCUMENT TYPE	DATE	DOCUMENT TITLE	PAGES	DIC CALL NO	PUB NO
PROJECT EVALUATION SUMMARY	10/23/79	ENVIRONMENTAL EDUCATION (ASCONA)	3P		
SPECIAL EVALUATION REPORT	10/24/79	EVALUATION OF USAID OPG TO ASCONA..(10/14/79-10/24/79).	26PAGES		

PROJECT DESIGN INFORMATION

COUNTRY/BUREAU: COSTA RICA — PROJECT: 5150145 SUB-PROJECT: 00
PROJECT TITLE: NATURAL RESOURCES CONSERVATION — INITIAL FY: 79 FINAL FY: 83

PROBLEM: FROM 1959 TO 1977 THE AREA OF COSTA RICA COVERED BY DENSE FORESTS DECREASED BY MORE THAN 41%. THIS DEFORESTATION HAS BEEN CAUSED BY A GROWING, MIGRATING RURAL POPULATION, BY LAND SPECULATORS AND BY ABSENTEE OWNERS WHO CLEAR LAND TO PROTECT IT. AS A RESULT SOILS HAVE BECOME ERODED AND COMPACTED, AND FERTILITY HAS DECLINED, REDUCING AGRICULTURAL PRODUCTION. WHILE THE GOVT HAS BECOME AWARE OF THE IMPORTANCE OF NATURAL RESOURCE MANAGEMENT, ITS CAPACITY TO MANAGE THESE RESOURCES IS NOT STRONG AS IT NEEDS TO BE.

STRATEGY: 5-YEAR PROJECT CONSISTS OF LOAN AND PARTICIPANT TRAINING TO STRENGTHEN THE INSTITUTIONAL MECHANISMS WHICH MANAGE RENEWABLE NATURAL RESOURCES IN COSTA RICA. HOST COUNTRY PROVIDES BUDGETARY AND IN-KIND CONTRIBUTIONS.

SUMMARY: LOAN IS PROVIDED TO THE GOVT OF COSTA RICA TO STRENGTHEN THE INSTITUTIONAL MECHANISMS WHICH MANAGE RENEWABLE NATURAL RESOURCES. PROJECT COMPONENTS INCLUDE RESEARCH, PILOT ACTIVITIES, PLANNING, EDUCATIONAL PROGRAMS, AND TRAINING.
TWO TYPES OF POLICY ANALYSIS AND RESEARCH WILL BE FINANCED. THE FIRST WILL EXAMINE THE EFFECTS OF VARIOUS LEGAL, POLITICAL, FINANCIAL, AND SOCIO-ECONOMIC POLICIES ON NATURAL RESOURCES CONSERVATION AND MGMT. THE SECOND WILL EMPHASIZE TECHNICAL AND SILVICULTURAL RESEARCH.
A PILOT MICRO-WATERSHED MANAGEMENT PROJECT WILL BE CONDUCTED IN THE UPPER NOSARA WATERSHED OF GUANACASTE PROVINCE. PROJECT WILL INVOLVE CATTLE AND RANGE MANAGEMENT ON SMALL AND MEDIUM SIZE FARMS, AND WILL INCLUDE ON-FARM REFORESTATION AND A CONSERVATION DEMONSTRATION AND FRUIT TREE EXTENSION PROGRAM.
A REFORESTATION AND CATTLE MANAGEMENT IMPROVEMENT PILOT PROJECT WILL BE CONDUCTED TO TEST A REFORESTATION SUBSIDY SCHEME IN COMBINATION WITH A SUPERVISED CREDIT PROGRAM FOR PASTURE AND CATTLE IMPROVEMENT.
A FORESTRY PRODUCTION PILOT PROJECT WILL ALSO BE CONDUCTED TO LAY THE GROUNDWORK FOR A LARGE-SCALE FORESTRY PRODUCTION PROGRAM. MANAGEMENT TECHNIQUES FOR NATIVE FORESTS WILL BE TESTED AND RECOMMENDATIONS MADE.
FIVE RESOURCE MANAGEMENT PLANS WILL BE PREPARED FOR PRIORITY GEOGRAPHIC AREAS. PLANS WILL EXAMINE THE OVERALL FEASIBILITY OF DIFFERENT ALTERNATIVES; WILL MAKE RECOMMENDATIONS FOR OPTIMUM LAND USE; AND WILL INCLUDE PROPOSALS FOR CARRYING OUT RECOMMENDED CHANGES AS WELL AS ESTIMATES OF THE COST OF SUCH PROGRAMS.
ENVIRONMENTAL AND CONSERVATION EDUCATION ACTIVITIES WILL BE CONDUCTED IN THE BRAULIO CARRILLO NATIONAL PARK. RECREATION AREAS AND NATURE TRAILS WILL BE ESTABLISHED, AND A VISITOR CENTER AND ENVIRONMENTAL EDUCATION CENTER WILL BE CONSTRUCTED. A LONG RANGE MANAGEMENT PLAN WILL ALSO BE PREPARED.
APPROXIMATELY 44 WORKSHOPS WILL BE CONDUCTED FOR 315 PROJECT AND GOVERNMENT PERSONNEL. FOREIGN IN-SERVICE AND OBSERVATION TRAINING WILL BE PROVIDED FOR 36 PARTICIPANTS; 63 PERSON-MONTHS OF SHORT-TERM FOREIGN TRAINING WILL BE PROVIDED FOR 42 PARTICIPANTS; AND 60 PERSON-YEARS OF GRADUATE LEVEL TRAINING WILL PROVIDED FOR 30 PARTICIPANTS.

GOAL: COSTA RICA'S FOREST, LAND, AND WATER RESOURCES EXPLOITED ACCORDING TO THEIR BEST LONG TERM USE.

PURPOSE: INSTITUTIONAL MECHANISMS THROUGH WHICH THE GOVT OF COSTA RICA MANAGES RENEWABLE RESOURCES STRENGTHENED.

OUTPUTS: 1.POLICY ANALYSIS RESEARCH: A)POLICY STUDIES; B).TECHNICAL RESEARCH 2.PILOT PROJECTS: A)MICRO WATERSHED MANAGEMENT PLAN UPDATE, REFORESTATION, RANGE MANAGEMENT, SOIL CONSERVATION, AGRO-FORESTRY. B)PRODUCTION FORESTRY PILOT--NATURAL FOREST MANAGEMENT, REFORESTATION, TROPICAL FOREST EDUCATION CENTER, FOREST PROTECTION. 3.CONSERVATION/ENVIRONMENTAL EDUCATION: A)PARK PROTECTION; B)ENVIRONMENTAL EDUCATION/RECREATION ACTIVITIES. C)SCIENTIFIC ENVIRONMENTAL RESEARCH. 4.REFORESTATION/CATTLE MANAGEMENT: A)REFORESTATION; B)IMPROVED CATTLE MANAGEMENT.5.MANAGEMENT PLANS: A)PREPARATION OF MANAGEMENT PLANS FOR 5 PRIORITY WATERSHEDS..6.TRAINING: A)WORKSHOPS; B)FOREIGN IN-SERVICE AND OBSERVATION TRAINING; C)SHORT-TERM

APPENDIX V

Government Agencies with Environmental Responsibilities

1.0 Ministerio de Agricultura y Ganaderia (MAG)

2.0 Oficina de Planificación Nacional y Política Económica (OFIPLAN)

3.0 Instituto de Tierras y Colonizacíon (ITCO)

4.0 Corporación Costarricense de Desarollo (CODESA)

5.0 Dirección General de Geologia, Minas, y Petroleo

6.0 Institute Costarricense de Electricidad (ICE)

Sources: MITRE. 1980.
U.S. AID. 1979.

1.0 Ministerio de Agricultura y Ganadería (MAG)

The Ministerio de Agricultura y Ganadería has the primary responsibility for agricultural and rural development. Its responsibilities include research and extension services for farmers, animal and crop health, pest eradication, forestry, irrigation and drainage projects, fish and wildlife, national parks, and the national weather service. Figure 1 shows the organization of the MAG; the following is a brief description of the subdivisions of MAG with major environmental duties.

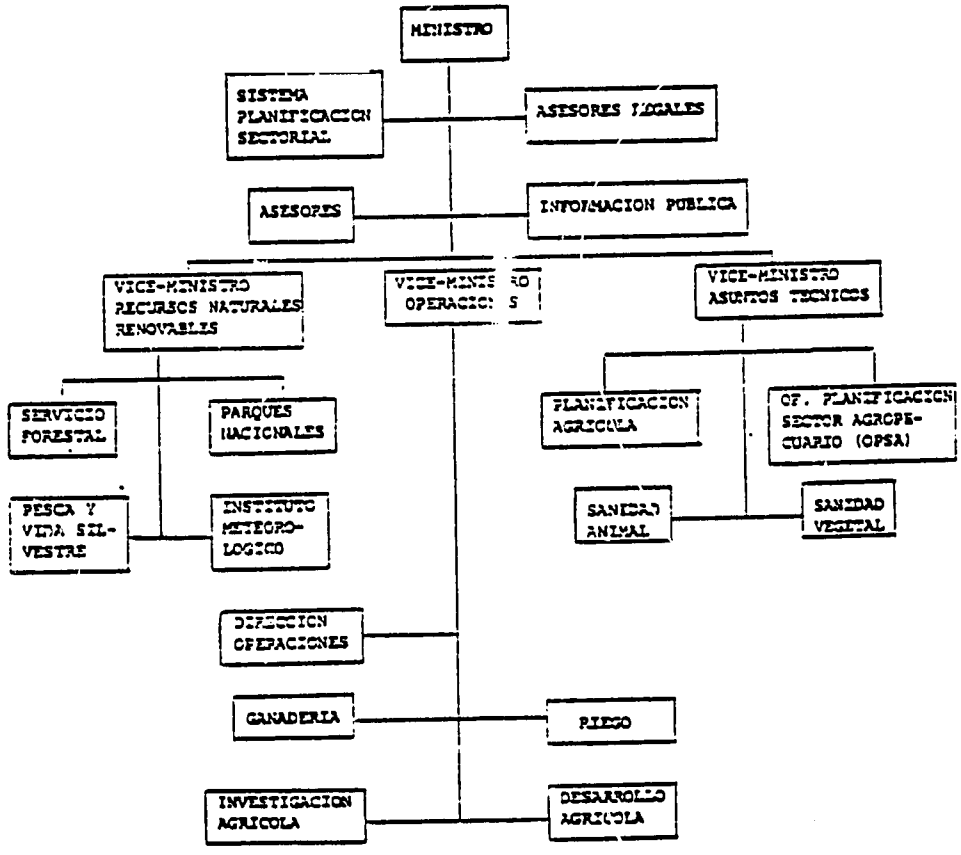

Figure 1. Organization of MAG

Source: U.S. AID. 1979.

Dirección General Forestal (DGF). The DGF has primary responsibility for all forest management policies and programs, including an inventory of all forest resources, research on forest products and watersheds, and the establishment of surcharges for cutting. The DGF is financed by a basic operations fund from the central government and a special "Forest Fund", which is created to receive donations from private parties or organizations and monies collected by taxation of forest products. Technical staff of the DGF includes professional silviculturists with B.S. or M.S. degree, cartographers, agronomists, biologists and forest rangers.

Servicio de Parques Nacionales (SPN). The SPN is responsible for the development and administration of national parks, including the determination of areas likely to require protection. Like the DGF, the SPN is supported both by the central government and a special fund, the National Parks Fund, which receives private donations and income directly from the parks. Personnel includes 110 park rangers, making Costa Rican parks the best patrolled in Latin America.

Oficina de Planificación del Sector Agropecuario (OPSA). This office is part of the National Planning System and part of the organizational structure of the MAG. OPSA produces the National Agricultural Development Plan in collaboratión with the Oficina de Planificac on Nacional y Polítca Económica (OFIPLAN).

2.0 Oficina de Planificación Nacional y Polítca Económica (OFIPLAN).

OFIPLAN, located in the Ministry of the President, is responsible for designing medium and long-term development plans and presentation of budget proposals to the central government and legislature. The National Resources Department, a unit composed of 2 people, carries out continuing evaluation of the natural resources policies of all agencies and is responsible for the coordination of natural resources planning between agencies.

3.0 Instituto de Tierras y Colonización (ITCO)

ITCO is responsible for farm settlement programs and land distribution, including organization and training of farmers. It is an autonomous public organization with its own legal powers and financial resources. ITCO in collaboration with DGF, is attempting to develop a system of operations designed to make best use of forest lands located within centers of rural development. ITCO will be carrying out forest colonization plans in the Sarapizui area just north of the Cordillera Central, with support from various offices of MAG.

4.0 Corporación Costarricense de Desarollo (CODESA).

CODESA is a semi-autonomous development agency, two-thirds controlled by the government, and one-third by the private sector. Its board of

directors is likewise composed of both government and private representatives, and the agency can issue bonds. Formed for the purpose of encouraging economic growth, CODESA finances, designs, and implements major development projects.

5.0 Dirección General de Geologia, Minas, y Petroleo

A branch of the Ministry of Economy, Industry, and Commerce, the Office of Geology, Mines and Petroleum is responsible for fossil-fuel and mining activities. Activities were at a standstill in 1979, awaiting passage of a new law on hydrocarbons for regulating companies prospecting and developing oil and coal reserves (MITRE 1980).

6.0 Instituto Costarricense de Electricidad (ICE)

ICE, the national electric utility, develops hydroelectric resources and coordinates electrification efforts throughout Costa Rica. ICE plans, constructs, and operates facilities, contracting with both local and foreign firms when necessary. Professional staff includes economists, engineers, geologists, chemists and meteorologists. Current projects include the Arenal and Corobici hydroelectric projects (Appendix II).

APPENDIX VI

Acronyms Used in this Report

ASCONA	Asociación Costarricense para la Naturaleza (Costa Rican Natural History Association)
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Education Center)
CONICIT	Consejo Nacional de Investigación Científica y Tecnológica (National Committee for Scientific and Technical Research)
DGF	Dirección General Forestal (General Forest Office)
DSA	Departamento de Sanamiento Ambiental (Environmental Health Department)
FAO	United Nations Food and Agriculture Organization
ICCA	Instituto Costarricense de Acueductos y Alcantarillado (Costa Rican Institute of Aquaducts and Sewers)
ICE	Instituto Costarricense de Electricidad (Costa Rican Electricity Institute)
IGN	Instituto Geográfico Nacional (National Geographic Institute)
ITCO	Instituto de Tierras y Colonización (Land and Colonization Institute)
IUCN	International Union for the Conservation of Nature and Natural Resources
JAPDEVA	Junta de Administración Portuarios de la Vertiente Atlántica (Port Administration of the Atlantic Coast)
MAG	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Cattle)
OFIPLAN	Oficina de Planificación Nacional y Política Económica (Office of National Planning and Economic Policy)
OPSA	Oficina de Planificación Sectorial Agropecuaria (Office of Agricultural Sector Planning)
OTS	Organization for Tropical Studies
SPN	Servicio de Parques Nacionales (National Park Service)
UNEP	United Nations Environmental Program
U.S. AID	United States Agency for International Development
WWF	World Wildlife Fund

APPENDIX VII

Select Bibliography

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2. Flora and General Ecology
3. Vertebrate Fauna
4. Conservation
5. Rural Development
6. Health

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