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FORESTS & FORESTRY IN PANAMA

by

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As part of a seven-person team conducting a country environmental profile for AID, I spent four weeks in Panama in May, 1980, analyzing the forestry sector. In this abridged version of my report to AID I offer an overview of the forest resource base, analyze the management of the forest resources and address the major forestry problems.

SUMMARY

Of the twelve Holdridge Life Zones in Panama, more than 75% of the country occurs in just four Life Zones: Tropical Moist, Wet, Premontane Wet and Rain. The cuipo tree dominates more than 10,000 km^2 of eastern Panama. Other important forest types are dominated by single species such as cativo along the Rio Chucunaque, orey around the Laguna de Chiriquí and mangroves on coastal deltas. Little is known about the forests of the wet Caribbean lowlands or the mountainous superhumid areas.

Panama's forests decreased from 70% of the country in 1947 to 50% in 1974. Current rough estimates of forest cover are 40-45%. Estimates of important forest types vary considerably, ranging from 4,200 to 9,650 m^2 of cativo forests and 1,990 to 5,056 km^2 of mangroves. Advancing agricultural frontiers are destroying vast areas of forest along the Bayano-Yaviza highway, in the Caribbean lowlands of the central region, and on the upper Pacific slopes of the western cordillera.

The timber industry is based on only a handful of species, with cativo contributing approximately 50% of the logs. Panama's forests also make significant indirect contributions such as the mangrove breeding grounds of the white shrimp and the hydrologic regulatory functions of natural forests in mountainous watersheds.

The amount of deforested and degraded lands indicates that the agricultural conquests of the Darién and the Caribbean lowlands are doomed because most of the soils cannot sustain permanent agriculture. Reforestation totaling 4,500 ha is a mere token compared to annual deforestation exceeding 50,000 ha. RENARE is involved with three ambitious reforestation projects totaling 38,500 ha over a five year period.

Problems involving the forestry sector include indiscriminate agricultural colonization, weak institutional leadership, the poorly conceived forest concession system, complete absence of silviculture and forest management, lack of up-to-date information on forest utilization and conversion, poor timber utilization, and only token efforts to rehabilitate degraded soils.

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1. FOREST RESOURCES

1.A. General Description

The Republic of Panama (77,082 km^2 = 27,750 square miles) straddles the narrow isthmus that unites North and South America. In spite of the north-south land connection, Panama has an undulating east-west configuration (Fig. 1) that results in the Caribbean end of the Panama Canal being farther west than the Pacific end. The Pacific coastline (1,634 km) is more than twice the length of the Atlantic coastline (788 km). The South Carolina-sized country has geographical coordinates of 7° 12' - 9° 38' North and 77° 09' - 83° 03' West.

The 1980 population is estimated to be almost two million (26/km^2). Although slightly more than half the population lives in urban centers, approximately 30% of the national population is economically active. The annual rate of population increase averaged 3.1% between 1970 and 1976, thus nearly half of the Panamanian population is less than 15 years old.

Western Panama is dominated by the easterly extension of the Cordillera de Talamanca from Costa Rica and the appendage-like Azuero peninsula. The central lowlands are bisected by the Canal. Eastern Panama is framed by a series of coastal ranges: Serrania de San Blas and Serrania del Darién very close to the Caribbean coast; Serrania de Majé and Serrania del Sapo breached by the large Golfo de San Miguel; and the Serrania de Pirre near the Colombian border.

Holdridge Life Zones (described in GSH-3) in the extensive lowlands of Panama are determined primarily by rainfall regimes. The movement of tropical air masses from the Pacific and subtropical air masses from the Caribbean produce two distinct rainfall patterns: (1) The Pacific rainfall regime consists of a monsoon-type alternation of a seven month rainy season with a five month dry season. The dominance of northeasterly tradewinds from December to March in combination with the mountainous backbone of Panama produces a pronounced rainshadow effect throughout most of the Pacific lowlands. The severity of the rainless season is greatly strengthened by the drying effect of the moistureless winds descending over the hot lowlands. The mid-elevation rainy areas in eastern Panama (Serranias de Majé and Pirre and Sierra de Jungurudó) are in part due to orographic lifting of moisture-laden southwesterly tradewinds during June to August and greatly weakened northeasterly tradewinds during December to March. These differences from western Panama produce a more intense rainy season and a much weaker "dry" season near the Colombian border.

(2) The narrow Caribbean slope and lowlands have a distinct regime of two rainfall maxima and two minima; the former in June-July and November-December and the less rainy periods in September-October and February-March. The short "dry" seasons have sufficient rain so that effectively dry periods stressful to natural vegetation seldom occur.

Twelve Holdridge Life Zones occur in Panama (Table 1), with four Life Zones covering more than 75% of the country (Tosi 1971). Tropical Moist Life Zone includes most of the Pacific lowlands, extending from the Costa Rican border almost to the Colombian border. Only in the low central region does the Tropical Moist Life Zone extend across the isthmus to the Caribbean coast. Tropical Moist Life Zone also occurs as coastal bands in San Blas and around the Laguna de Chiriquí (Bocas del Toro province).

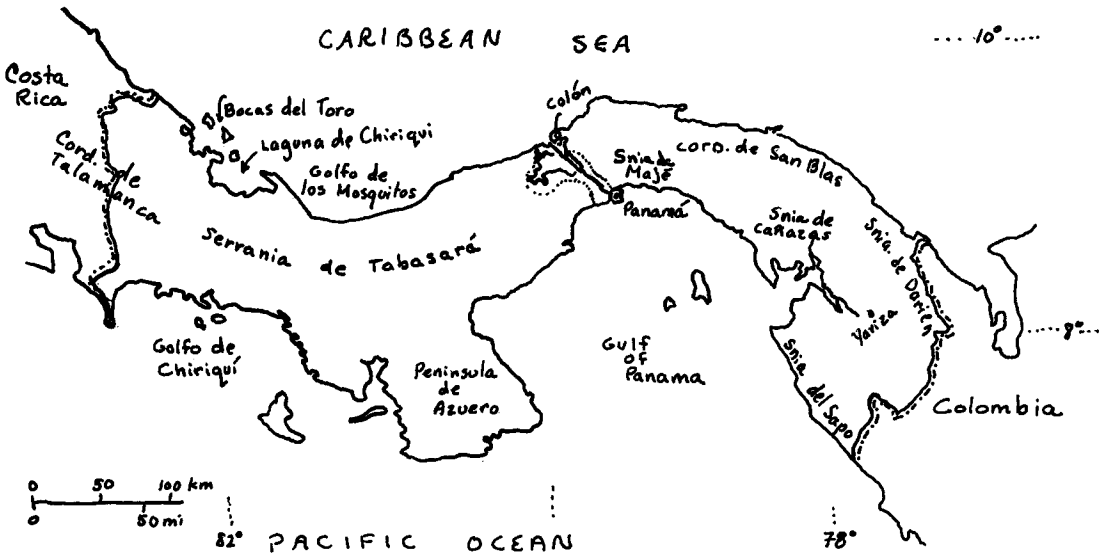

Figure 1. Map of Panama.

Table 1. Distribution of Holdridge Life Zones in Panama (data from Tosi 1971).

	Area (km^2)	%
1. Tropical Dry	5,630	7.44
2. Tropical Premontane Dry	2,070	2.74
3. Tropical Moist	24,530	32.43
4. Tropical Premontane Moist	2,400	3.17
5. Tropical Wet	10,900	14.44
6. Tropical Premontane Wet	15,200	20.09
7. Tropical Premontane Rain	9,975	13.19
8. Tropical Lower Montane Moist	9	0.01
9. Tropical Lower Montane Wet	1,378	1.82
10. Tropical Lower Montane Rain	2,370	3.13
11. Tropical Montane Wet	3	.004
12. Tropical Montane Rain	1,185	1.57
TOTAL	75,650	100.00

Tropical Wet and Premontane Wet Life Zones are usually found at elevations higher than Tropical Moist, or in wetter coastal areas. The most extensive area of Tropical Wet Life Zone occurs in the Caribbean lowlands of the central region. Premontane Rain Life Zone occurs all along the western cordillera, on the Serranias del Darién, Pirre, Junguradó, and Majé, plus a few other outliers on the Azuero Peninsula and highest parts of the Lago de Alajuela watershed.

The driest areas (Tropical Dry and Premontane Dry Life Zones) occur in a broad arc bordering the Bahia de Parrita; small outliers also occur east of Panama City and on Punta Garachiné. These dry areas are apparently related to nearby upwelling of cold water.

1.B. Major Forest Types

Cuipo-dominated forests (Fig. 2a) cover about 10,000 km^2 of the Tropical Moist lowlands in the eastern region of Panama. Although many other tree species are associated with cuipo (*Cavanillesia platanifolia*, Bombacaceae), it is the huge and abundant cuipo that gives such a distinctive aspect to the Darien lowlands. Large cuipo trees (Fig. 2b) may reach 40 m in height on a bole 2 m in diameter with a disproportionately small crown towering over other tree species. Several studies indicate cuipo occupies 39-60% of the timber volume (Donaldson 1963; Golley et al. 1975; Falla 1978a). The exceptional size and abundance of cuipo has attracted numerous attempts to find commercial uses for its wood. Cuipo wood is very light like balsa, but unusually weak. L. R. Holdridge likens cuipo to an overgrown vegetable. Detailed tests of cuipo wood for a variety of products, including paper and fiberboard, have been unsuccessful (Rankin 1963). It should be tested for cattle fodder.

Cativo forests are pure or nearly pure stands of *Prioria copaifera* (Caesalpiniaceae) that occur on alluvial flats inundated occasionally with fresh water, but with adequately-drained soils. Cativo forests occur most frequently along major rivers, such as those feeding into the Golfo de San Miguel. Lamb (1953) reported pure cativo stands on the banks of the Río Balsas. More recent studies along the Río Chucunaque indicate cativo dominated forests extend about 1 km to each side of the river (Donaldson 1963; Anonymous 1978). Cativo also occurs in mixed forests on better drained soils farther from rivers, as well as in the *Mora oleifera* forests (Fig. 3) inundated daily by brackish water. Cativo forests occur in the Bocas del Toro lowlands and are also reported to occupy 4,000 ha on Isla de Coiba (Falla 1978a).

Mangrove forests occur on both coasts of Panama, but are much more extensive on the Pacific estuarine deltas due to the appreciably greater tidal flux on the Pacific coast than in the Caribbean. The red mangroves (*Rhizophora brevistyla* and *R. mangle*, Rhizophoraceae) are overwhelming dominants of the mangrove forests, generally forming pure stands. The black mangrove (*Avicennia germinans*, Avicenniaceae) and*Pelliciera rhizophorae* (Theaceae) are occasional tree associates in the mangrove forests.

Orey forms pure stands in brackish swamps around the Laguna de Chiriquí in Bocas del Toro province. These forests of orey (*Campnosperma panamensis*, Anacardiaceae) probably have the highest stocking of timber known in the tropics, with average volumes of 382 m^3/ha for boles greater than 40 cm in diameter and 716 m^3/ha for all boles larger than 10 cm in diameter (Falla 1978a). Such impressive volumes of orey timber and its fiber suitability offer considerable potential for a pulp and paper industry (Holdridge et al. 1958).

Figure 2. (a) Cuipo-dominated forest southeast of the Bayano hydroelectric reservoir. Note the clearings and logging road at lower right. (b) Gary at the base of a giant cuipo tree in the Darien.

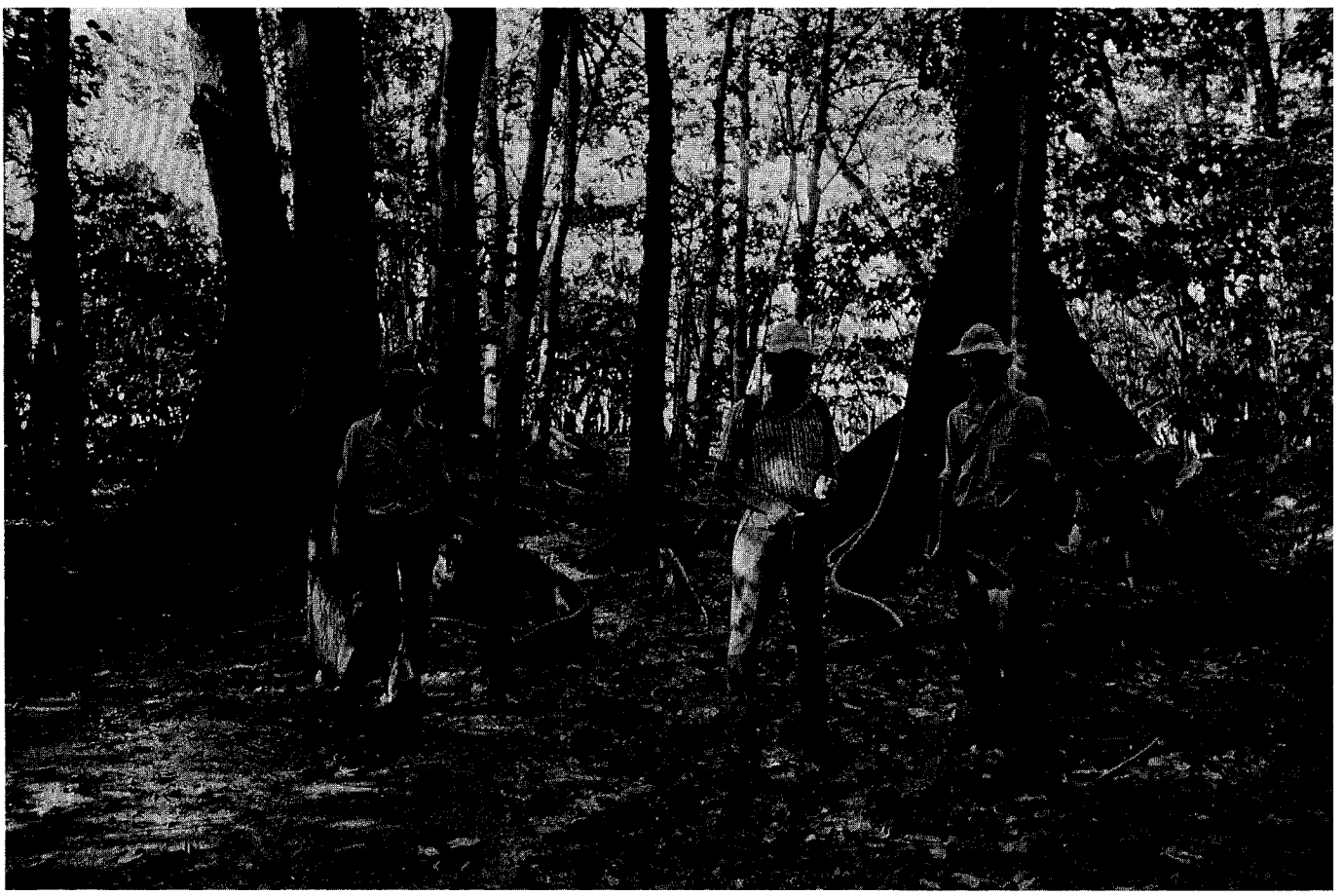

Figure 3. Mora (with sinewy buttresses) and cativo flooded occasionally with brackish water near the San Miguel Gulf in the Darién. Left to Right: Edgar Peña, Doug Pool, and Dave Janos.

A forest inventory of the Donoso district (Tropical Wet Life Zone) of the northern central region found adequate quantities of excellent timber trees such as *Dialyanthera otoba* and *Virola* spp. (Myristicaceae), *Carapa guianensis* (Meliaceae), *Minquartia guianensis* (Olacaceae), *Aspidosperma megalocarpon* (Apocynaceae) and *Sacoglottis* sp. (Humiriaceae).

The remaining forests of Panama, especially in the superhumid mountainous regions, are very poorly known. Except for the above-mentioned Donoso district, even the tropical wet lowlands along the Caribbean coast from Bocas del Toro to San Blas are also poorly known. Tropical oaks of several species (*Quercus* spp. Fagaceae) are conspicuous of Lower Montane Wet and Rain Life Zones in the western cordillera. The Montane Rain Life Zone on Volcan Barú is dominated by huge oaks (*Q. costaricensis*).

1.C. Status of Forests

At the time of Spanish exploration of the Pacific lowlands of Panama in the early 1500's, a considerable indigenous population practiced shifting cultivation over extensive areas extending from eastern Darién as far west as present-day

Santiago (Sauer 1966). Corn was the principal crop grown by the Indians. Despite substantial differences in the subjective estimates sent to the Spanish Crown as to the size of the indigenous populations and the amounts of land under cultivation, it is widely accepted that fields and young secondary vegetation were far more prevalent than undisturbed forest in the Pacific lowlands of eastern and central Panama. The striking present-day (modern) dominance of these regions by cuipo has led some authors (e.g. Budowski 1965; Bennett 1968) to attribute cuipo's success to large scale abandonment of land following decimation of the indigenous population by the Spanish conquest. This interpretation claims the cuipo-dominated forests are nearly 500 year-old-secondary forests; however, this is not supported by recent studies of tropical forest dynamics nor by the regeneration potential of cuipo (see Hartshorn 1978, for a more complete review).

Standley's (1928) remarks about collecting in good "jungle" near Chorrera indicate that it is safe to assume that practically all of Panama was clothed in forest in the 17th and 18th centuries. Even the dry areas in the central region should have supported forests, for I have found no evidence in the literature for the occurrence of extensive natural savannas in Panama.

The earliest estimates of forest cover in Panama (Table 2) indicate the paucity of forests in Coclé, Herrera and Los Santos provinces more than 30 years ago. Garver (1947) estimated 70% of the country (not including the Canal Zone) to be in forest.

Falla (1978a) reports country-wide estimates of forest cover between 1950 and 1974 (Table 3). The 1970 data are considered to be the most accurate because they are derived from country-wide forest inventories carried out by FAO in 1970 and 1971. Falla's 1974 estimate was derived by adjusting forest boundaries observed during aerial reconnaissance flights. The data in Table 3 yield annual deforestation rates ranging between 0.5 and 1.0%, yet Falla (1978b) reports the agricultural frontier advanced 2.7% per year during the early 1970's. It was impossible to verify either figure; however, since the agricultural frontier advances at the expense of forests in Panama, it seems the latter figure may be closer to reality. Projection of an intermediate per annum rate of deforestation at 1.5% from the 1970 estimate yields 29,254 km^2 or 38% of the country with forest cover in 1980. RENARE (National Directorate for Renewable Natural Resources) and FAO (Food and Agricultural Organization of the United Nations) foresters think the actual forest cover is around 45% of the country. It is instructive to note that the two most completely forested provinces of Panama (Bocas del Toro and Darién) have a combined surface area of 25,889 km^2 or 34% of the country.

The uncertain status of Panama's forests is further exemplified by the considerable differences in the estimates of cativo, orey and mangrove forests in Panama (Table 4). Falla's estimate of 965 km^2 of cativo forests for the entire country seems too high, since the cativo forests in Bocas del Toro and on Isla de Coiba are minor in comparison with Darién. No explanation is given for the grossly different estimates of mangrove forests given by Falla (1978a,b).

Field observations by both land and low-level aerial overflights indicate several active fronts of deforestation. In the Darién, agriculturalists continue to advance up the principal valleys and lower slopes (e.g. Rios Sambú, Balsas, Tuira and Sabanas). Large-scale clearing is occurring along the entire length of the Interamerican Highway between Bayano and Yaviza. Even the steep slopes on the northern flanks of the Serrania de Majé are being rapidly deforested (Fig. 2a). Several foci of deforestation activities occur in the coastal hills from

Table 2. Forest cover in Panama in 1947; data from Garver (1947) do not include the Canal Zone.

Province	Total Area km^2	Forest Area km^2	Forest Area (%)
Bocas del Toro	8,915	8,650	95
Coclé	5,035	1,150	30
Colón (+San Blas)	7,465	6,900	95
Chiriquí	8,758	3,850	40
Darién	16,803	15,350	99
Herrera	2,427	200	15
Los Santos	3,867	1,100	30
Panamá	11,292	10,400	90
Veraguas	11,086	4,850	40
CANAL ZONE	964		
T O T A L	77,136	52,450	70%

Table 3. Sequential estimates of forest area in Panama.

Year	km^2	%	Source
1947	52,450	70	Garver 1947
1950	52,445	68	Falla 1978a
1960	45,000	58	Falla 1978a
1970	40,816	53	Falla 1978a
1974	39,000	50	Falla 1978a

Table 4. Area estimates (km^2) of forest dominated by single species in Panama.

Region (Source)	Cativo	Orey	Mangrove
1. East of Canal Zone (Donaldson 1963)	387	--	1,040
2. Darién (Anon. 1978)	457	--	337
3. Entire Country (Falla 1978a)	--	625	5,056
4. Entire Country (Falla 1978b)	965	760	1,990

the Golfo de San Blas west to Portobelo. Probably the most aggressive deforestation is occurring in a large area of Caribbean lowlands extending from the Canal Zone southwest to Coclesito. The rolling coastal hills are being completely denuded of forest from the Río Lagarto to Punta Limón near Coclé del Norte. The remaining forests south of this area are being severely squeezed by aggressive deforestation radiating from Coclesito. Forest cutting even extends over the continental divide between Cerro Flores and Cerro Colorado. Appreciable slash-and-burn agriculture is claiming forests in the lower valleys and slopes of the Rios Teribe and Changuinola in Bocas del Toro province.

The Panamanian predilection for fire has had and continues to have disastrous consequences for forest resources. The impoverishment and meager productivity of the Pacific lowlands of the central region are largely due to loss of trees through repetitive burning. Deliberate fires not only consume the felled trees, but often penetrate adjoining forest and kill many more standing trees. With annual burning it is no surprise so little forest remains on the Pacific side of Western Panama (Fig. 4). Between San Felix and Hato Chami, 15-20% of the slopes were burned in 1980. A wild fire also destroyed huge areas of forest on the southwestern flanks of Volcan Barú during the 1980 dry season.

1.D. Direct Economic Role of Forests

Forests not only are the source of many indirect benefits such as watershed protection, nutrient conservation, habitat preservation, biotic diversity, etc., but also provide direct contributions to the Panamanian economy, estimated by Falla (1978a) at 2.0-2.2% of GNP. Timber, of course, is the primary forest product. Between 1965 and 1975 forest exploitation produced an annual average of 225,000 m^3 of logs valued at $3.18 million (Falla 1978a). Seventy-five percent of the logs went into sawn lumber and the remainder for plywood. The construction industry utilizes 65-85% of the sawn lumber. The national wood market grew at an annual rate of 4.6% between 1965 and 1975.

From 1960 to 1975 cativo supplied roughly 50% of the logs to the national market, with about 75% of the cativo logs coming from the Darién. Cativo is used primarily as core stock for plywood and to a lesser extent as face veneer and form lumber. Quality woods such as caoba (mahogany, *Swietenia macrophylla*, Meliaceae) and cedro amargo (Spanish cedar, *Cedrela mexicana*, Meliaceae) have diminished greatly in quantity from their post World War II importance to where they provided only 10% of the timber used in 1974. According to Falla (1978a) 94% of the logs marketed in 1976 were supplied by only five species: cativo, espavé (*Anacardium excelsum*, Anacardiaceae), amargo amargo (*Vatairea* sp., Fabaceae), cedro espino (*Bombacopsis quinatum*, Bombacaceae) and zapatero (*Hieronyma oblonga*, Euphorbiaceae). Espavé, amargo amargo and cedro espino are components of the cuipo forest in the eastern region. Zapatero comes from the tropical wet forests of the northern central region.

Garver (1947) lists 63 saw timber species. Twenty years later only 30 species were used (Falla 1978b). Although FAO identified 300 potentially commercial timber species in Panama, the national market accepts only 50 species (Anon. 1979). The dominance of the national market by so few species means logging operations are very costly and inefficient. Considerable quantities of good wood are bypassed in the logging of a few species. This would be acceptable silviculturally if the forests were controlled, protected and managed for a sustained yield of timber. Advance of the agricultural frontier, however, is an important source of timber, thus considerable volumes of non-harvested timber are burned

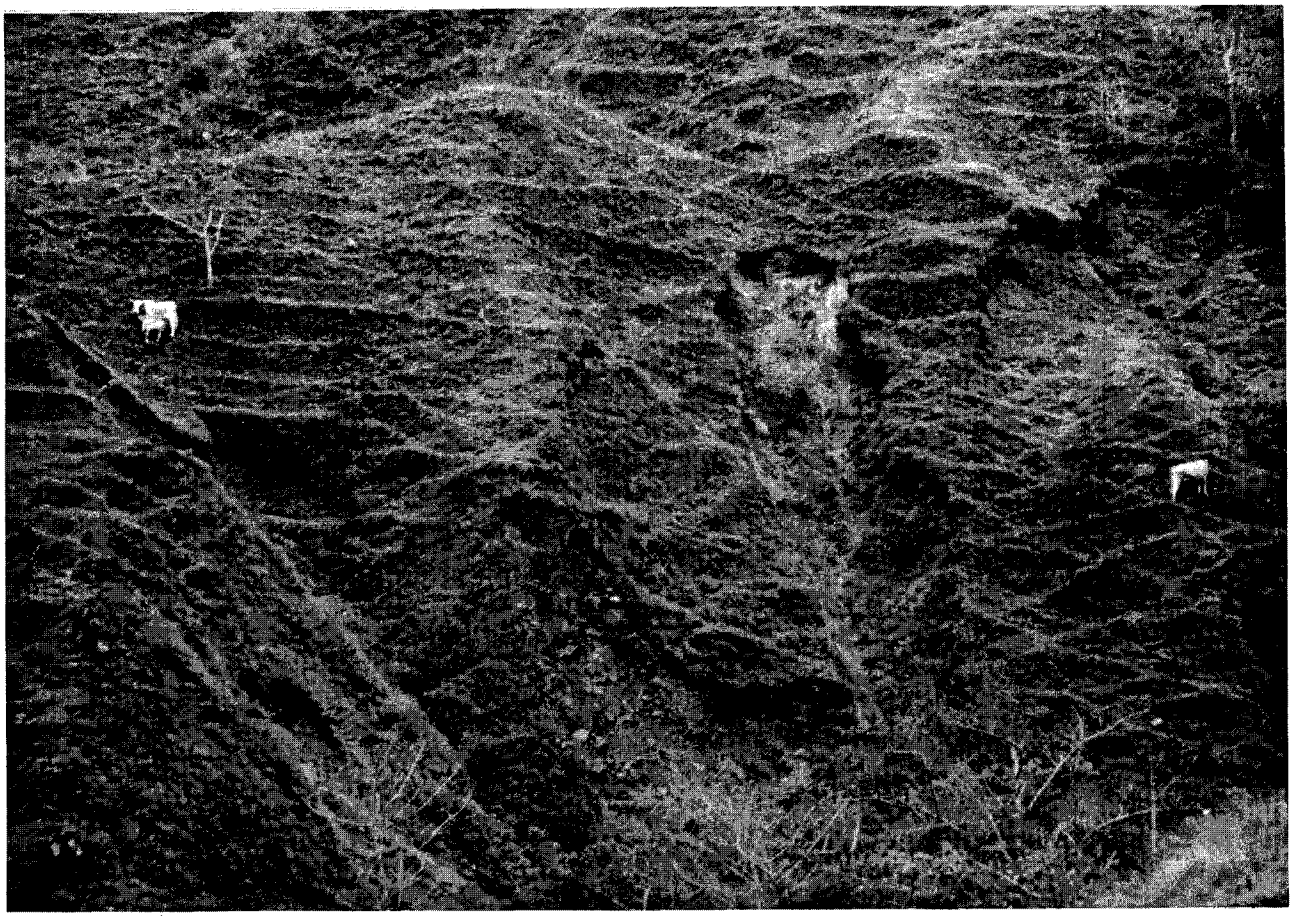

Figure 4. Deforested and overgrazed land on steep slopes near Hato Chami, eastern Chiriquí. The lack of forest cover contributes to the numerous landslides on this degraded landscape.

by colonists. Falla (1978b) estimates 75% of the timber felled by colonists is not harvested. The restricted national market is in part due to the opening of substantial forests along the Interamerican Highway and a rapid "creaming" of the preferred species. Now that the highway has reached Yaviza and the development of penetration roads slows, the next few years should see increasing acceptance of other species.

Mangrove forests contribute both directly and indirectly to the Panamanian economy. Red mangrove bark is a major source of tannin for the tanning industry. Although no such industry exists in Panama, 1,841 tons were exported to Costa Rica in 1974 (Falla 1978a). (Costa Rica prohibits the cutting of her own mangrove forests.) General impressions indicate mangrove bark harvesting and export have increased substantially since 1974. Because of concern about the irrational harvest of mangrove bark, the governor of Chiriquí Province recently decreed a halt to mangrove exploitation starting in 1981. Yet there is talk of establishing a tanning industry in eastern Chiriquí.

The most important function of mangrove forests is as breeding grounds for the white shrimp, keystone of Panama's $30 million shrimp export industry. Destruction of mangrove forests will have definite repercussions on the shrimp industry, already beset with over-fishing problems.

No reliable data exist in Panama on the consumption of firewood and charcoal, yet FAO estimates Panama's 1975 consumption of firewood to be 1,450,000 m^3, equivalent to 0.86 m^3 per capita (Falla 1978a). Increasing costs of petroleum derivatives have undoubtedly increased rural dependence on and use of firewood. Sources of firewood are becoming scarce in the deforested Pacific part of the central region.

Another significant secondary forest product is wood for fence posts. Despite the use of living fence posts, Falla (1978a) estimates 110,000 m^3 of wood are used per year for new fence posts.

Forests are the source of numerous secondary products such as balata (chicle), rubber, fruits, wild game, etc. that are insignificant to the national economy or don't even enter into economic calculations and projections.

1.E. Projected Utilization of Forest Resources

Falla (1978b) attempts to project the national demands for wood products from 1975 to 2005 based on low and high rates of growth in demand. His 30 year low-high growth projections are 431-531% for wood, 234-345% for wood pulp, 310-310% for posts and 0-0% for firewood. His logic for predicting demand for firewood to remain constant is not explained. Falla uses two alternative hypotheses to project the change in land use: (1) the historical advance of the agricultural frontier at 2.7% per year; and (2) a substantially reduced rate of advance at 0.3% per year as a consequence of agro-technological advancements. The former model projects the land cleared for agriculture to expand from 18,690 km^2 (1975) to 41,450 km^2 (2005), which would reduce Panama's forests to 11,000 km^2 by 2005. The latter model would reduce forests to 36,200 km^2, but the assumption of a technological fix for Panama's agricultural (including cattle ranching) problems seems too far-fetched to merit consideration. Falla (1978b) concludes that an intermediate 1.5% rate of advance of the agricultural frontier would deforest about 10,000 km^2 between 1975 and 2005. He suggests that mixed forests and cativo forests will each supply about one-third of the national market over the next 30 years.

1.F. Reforestation

In spite of rampant deforestation exceeding 50,000 ha per year, and the abundance of degraded lands in the western Pacific lowlands (Figure 4), reforestation has been little more than token. According to RENARE and FAO officials, tree plantations totaled 4,500 ha in 1979. The plantations are mostly *Pinus caribaea* and are largely in the La Yeguada area. Several hundred ha of teak (*Tectona grandis*) planted near Puerto Armuelles by the Chiriquí Land Co. have been felled and burned by agricultural colonists.

RENARE has three ambitious reforestation projects: (1) the UN World Food Program plans to plant 8,000 ha of trees in four years; (2) the AID Panama Canal watershed project calls for 10,500 ha of tree plantations in five years; and (3) an IDB (Interamerican Development Bank) project plans 20,000 ha of commercial tree plantations over the next five years along the highway between Santiago and Tolé.

2. FORESTRY MANAGEMENT

The Directorate-General of Renewable Natural Resources (RENARE) is wholly responsible for the administration, delimitation, inventory, protection and utilization of Panama's forest resources. RENARE is a dependency of the Ministry of Agricultural Development (MIDA).

2.A. RENARE Administration

As a dependency of MIDA, RENARE's policy, direction, control and budget must be approved by the Minister of Agriculture and the Ministry's central offices in Santiago. RENARE's regional offices also fall under the aegis of MIDA's regional officers. Dealing with the decentralized MIDA offices in Santiago and the cumbersome regional arrangement with MIDA limits RENARE's ability to effectively program and execute projects.

RENARE has been severely limited by meager budgetary appropriations from MIDA. Through most of the 1970's RENARE received roughly $600,000 for annual operations. Only in 1979 did RENARE's budget increase substantially because of government obligations to the Canal watershed project. In 1977, RENARE had 144 permanent employees and an additional 105 on contract. By 1979 the number of employees nearly doubled. The forestry department accounted for about two-thirds of all RENARE personnel in 1977.

Formal forestry education is non-existent in Panama. A University of Panama forestry curriculum was abandoned several years ago. Although RENARE is experiencing difficulty finding qualified professionals in natural resources, the absence of a national forestry school is not as critical as one may suppose. RENARE has 23 students in seven foreign countries majoring in natural resources. If competent young foresters such as Ing. Tomás Vásquez are representative of the students now studying in foreign countries, then RENARE has a bright future. Panamanian foresters trained in foreign countries should have a positive impact on RENARE's approaches to natural resource problems and projects.

2.B. Forestry Projects

From 1966 to 1972, FAO carried out a major and multi-faceted forestry project under the title "Forestry Demonstrations and Forest Inventories". FAO staff and consultants produced 18 technical reports that form the core of basic information about Panama's forest resources. RENARE foresters conducted the forest inventory of the Darién for the OAS (Organization of American States) project (Anon. 1978).

Current RENARE forestry projects include (1) a U. N. World Food Program initiated in 1979 that provides food in return for planting trees. (2) A FAO 30-month project to strengthen RENARE's forestry department. The FAO program includes a strong silvicultural component. Ing. Arturo Romero has completed a field census and analysis of all plantations and species trials established by the earlier FAO project. Romero's results should be very useful for reforestation and agroforestry projects planned for Panama. If the FAO program to strengthen RENARE's forestry department gets off to a good start, it will probably be renewed for several additional years. (3) A short (6-month) FAO mini-project to rationalize forest utilization with the rapid opening of the Darién. FAO consultants are preparing reports on colonization, forest utilization and the potentials for using cuipo wood. (4) RENARE in collaboration with IRHE and AID plans

to manage an 800 ha forest reserve near Yaviza for use as an energy source. (5) Newspapers recently reported the signing of an agreement between RENARE and CATIE (Tropical Agricultural Research and Education Center) to develop tree plantations for firewood, but candidate areas have not yet been selected.

3. MAJOR PROBLEMS

3.A. Colonization

There is no question that colonization is the overwhelming contributor to the deforestation of Panama. The rapid and uncontrolled advance of the agricultural frontier (Fig. 5) is encouraged by the government's attitudes and programs to conquer the Darién and Bocas del Toro, the only provinces still with large blocks of forests. The government of Panama has not made any serious effort to organize and direct colonization nor attempted to prohibit colonization of lands not suitable for agriculture. Agricultural colonization is now advancing onto lands unsuitable for traditional agriculture, hence deforestation and inappropriate land use can only exacerbate the deterioration of Panama's natural resources.

Panama's soil degradation problems, human demographic trends and uncontrolled colonization preclude any early possibility of slowing the rapidly advancing agricultural frontier. The only realistic hope for saving some of Panama's forests is by redirecting colonization away from the traditional slash/burn/crop/pasture approach to a more rational utilization of the forest resources.

Panama is an ideal candidate to develop forest colonization based on a "forest farming" concept, whereby the colonist would manage his forest on a sustained yield basis. (This is similar to the AID-Costa Rica loan for combining colonization and production forestry described in GSH-10). If you could convince the Santeño colonists, who despise trees, to participate in such a forest colonization project, it would be a shocking sociologic breakthrough.

3.B. Institutional Leadership

Though it is easy to blame RENARE's weaknesses on financial constraints, lack of qualified personnel and the policy control by MIDA, these difficulties seem to be endemic in most national forest services in tropical America. RENARE is founded upon an adequate set of laws and has ample legal jurisdiction to manage, develop and conserve Panama's renewable natural resources. That RENARE has done so little, even with its limited funds and not too limited personnel, suggests it lacks effective leadership. The director of RENARE, Ing. Irving Diaz, was on an extended "vacation" during my four weeks in Panama and though I made numerous requests directly to Ing. Diaz, I never succeeded in discussing with him Panama's forestry sector. RENARE has started to grow in capability and in personnel due to the AID and FAO institutional building programs, but strong and competent direction is essential. RENARE desperately needs competent and effective leadership if it is to carry out a successful program of administering Panama's renewable natural resources.

3.C. Forest Concessions

Decree No. 39 explicitly states RENARE's obligations to establish three classes of forests (production, protection and special) on national forest lands. Despite an FAO report (Deveaux 1973) proposing 13 production forests, five pro-

tection forests and six special forests covering 48,010 km^2 (62% of the country) not a single production forest has been legally established. Panama's timber industry depends upon forest concessions granted by RENARE, exploitation permits to private land-holders and unpredictable spot purchases from agricultural colonization. The concessions are for a one to two year period permitting the concessionnaire to exploit the timber on small areas (200-1000 ha) of government land. The consequence of such ephemeral concessions is that the concession-holder is only interested in maximizing profitable timber exploitation without thought of a second harvest, let alone the long-term management of the forest for a sustained yield of timber. This type of concession arrangement might be acceptable if a strong forest service would oversee the exploitation and assure follow up with silvicultural treatments and forest management as part of a regional production policy. But RENARE's supervision of concessions is negligible and forest management is non-existent.

RENARE does have a valid argument against concession fees going to municipalities, but it is doubtful that money alone would improve the exploitation and management of *de facto* production forests. Under the present system of short-term, small concessions, the timber industry has a justified--albeit shortsighted --reason for ignoring forest managment. A classic situation exists where private industry won't do anything about sustaining the basic resource of the industry, while the government agency legally responsible for the resource also does nothing except grant logging concessions. Meanwhile the natural resource continues to be depleted and becomes more costly and difficult to renew.

A state-controlled corporation might be a potential mechanism to rationally manage the forest resources of a region, but the experience with the Bayano hydroelectric facility is not particularly encouraging. Bayano Corp. has one forester (seconded from RENARE) and no forest management plans for the critical watershed. Aerial overflights indicated considerable logging activity and some active slash-and-burn agriculture within the Bayano watershed. Another alternative would be for RENARE to greatly expand (to at least 5,000 ha) and lengthen (to a minimum of 20 years) the concessions and to strictly supervise and control harvesting techniques, management plans and silvicultural treatments used by private concessionnaires. The latter set of requirements are beyond the present capabilities of RENARE.

National and community production forests with effective administration, technical management and protection must be legally established. Simple establishment by executive decree or legislative law without the necessary institutional capability and commitment to implement legal mandates is worthless and may cause more problems than the failure to legally establish production forests.

3.D. Silviculture and Forest Management

As implied in the preceding section, forest management is non-existent in Panama. The absence of silvicultural programs for cativo and red mangrove is simply inexcusable. How the government agency responsible for renewable natural resources can ignore two species that have such an important role in the national economy is beyond comprehension. RENARE apparently takes comfort in the fact that the estimates of area in cativo forests have been following an *increasing* trend over the past 10 years--even though cativo exploitation shows the same trend. RENARE should initiate experimental forest management projects in the major forest types, specifically cativo, red mangrove, orey, cuipo and the mixed wet forests of Bocas del Toro, with actual or potential commercial importance.

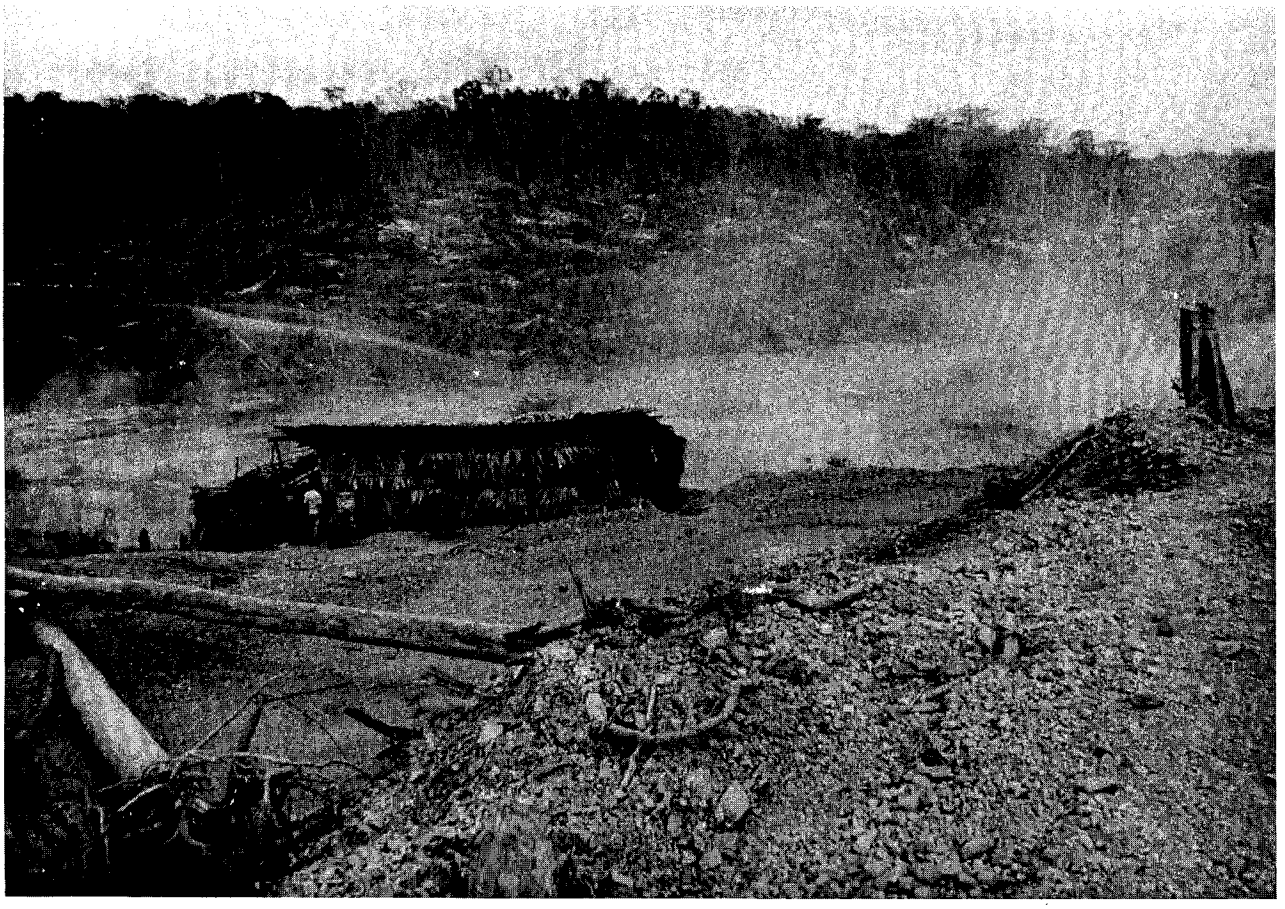

Figure 5. Slash and burn agriculture along the new Interamerican Highway to the Darien.

Emphasis should be given to developing compatible multiple uses of the resources, while maximizing biomass production from the forests. RENARE should give highest priority to silvicultural programs for cativo and red mangrove that will demonstrate effective management techniques for ensuring sustained yields and continued ecosystem functioning of these two important resources.

3.E. Forest Utilization and Conversion Data

Despite a substantial number of reports on Panamanian forests and forestry sector, the latest available data are no more recent than 1975 and some have not been updated in more than a decade. Attention has been drawn in sections of this report to substantial discrepancies in the estimates of a particular resource, e.g. areas of mangrove forests and of cativo forests. Widely disparate estimates for a particular resource can only suggest that single source estimates must be viewed with considerable caution.

RENARE has largely ignored the importance and necessity of accurate current statistics in the administration of renewable natural resources. I have the distinct impression that RENARE's forestry department has been relying on the substantial documentation produced by the 1966-1972 FAO project and has only recently awakened to the need to up-date information on forest products exploitation and utilization.

Neither RENARE nor any of the collaborating international donors has plans to assess the status of forests and the rate of deforestation in Panama. RENARE acknowledges significant deforestation is occurring and joins the media and conservationists in blaming it on uncontrolled agricultural colonization. But RENARE seems to prefer to be a passive bystander rather than exercise its legal responsibilities to Panama's natural resources.

3.F. Timber Utilization

Panama's timber industry has been traditionally based on the utilization of a small number of species to meet national demands for wood and wood products. If the literature is to be believed, the timber industry's acceptance of species decreased slightly in the past three decades. Due to cultural preferences, local availability, uncontrolled exploitation, and the lack of appropriate wood technology, few species are harvested from mixed tropical forests. There are numerous examples of a tree species having a highly preferred status in one country and a lesser status in a neighboring country. FAO studies in Panama indicate about 300 tree species have commercial potential.

The poor species acceptance by Panama's timber industry is not representative of the pattern in other Central American countries (excluding the pine-rich countries of Honduras and Guatemala), where local markets are rapidly accepting new timbers. The unchanging Panama situation is most likely due to the rapid opening of the Darién via the Interamerican Highway. Vast areas of virgin forest became accessible in the past decade, permitting an adequate supply of preferred logs. Forest exploitation along the newly-opened sections of the highway are restricted to "high-grading" of the few preferred species. Now that the highway has reached Yaviza and secondary road construction occurs slowly, the flow of premium timbers should decrease appreciably. As scarcity and inaccessibility drive up the prices of the preferred species, the national market should begin to accept new species.

Wood technology studies and information can play a key role in facilitating entrance of lesser known woods into national markets. RENARE is the appropriate agency for wood technological information, but has done nothing in the area since the FAO project terminated in 1972. The new FAO project will include a wood technologist to work on some of Panama's potential timbers.

3.G. Rehabilitation of Degraded Soils

Deforested lands considered unsuitable for agriculture or pasture (Fig. 4) are estimated to cover between 10,000 km^2 (Falla 1978a) and 18,000 km^2 (Mayo Mendez in Anon. 1979). Mayo Mendez' estimate is equivalent to 23% of the country. The majority of the degraded soils occur in the Pacific central region, including most of the Azuero Peninsula. Because of the dearth of natural vegetation in the region, and the socio-cultural nature of the human population, it is completely unrealistic to depend on or even consider natural vegetation for soil rehabilitation. The only realistic possibility for soil rehabilitation is through reforestation. At least 50% of the degraded soils could be rehabilitated with commercial tree plantations. On degraded soils designated as protection areas, such as watersheds, the natural vegetation should be allowed to recover, rather than reforested with costly tree plantations that may not be as effective as natural secondary vegetation.

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