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GOVERNMENT INCENTIVES TO ENCOURAGE REFORESTATION
IN THE PRIVATE SECTOR OF PANAMA

Report to RENARE, AID/PANAMA, and the FORESTRY SUPPORT PROGRAM

September 1983

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by

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I. INTRODUCTION AND EXECUTIVE SUMMARY

A. Purpose and Scope of Study

The governments of most countries of the world use one or more forms of incentives to encourage their private sectors to practice socially desirable forestry (Gregersen 1983). The countries of Latin America are among those which employ a great number and variety of incentives for afforestation and reforestation (Bombin 1975). The purpose of this study is to identify and evaluate alternative forms of afforestation and reforestation incentives appropriate for the private sector in the Republic of Panama.

Reforestation incentives for Panama will be based on a complex mixture of economic, social, political, and environmental objectives. This particular study concentrates on incentives to promote the establishment of industrial forest plantations. The proposed plantations are intended to have commercial ends, although they will meet socio-political and environmental objectives indirectly.

If the government of Panama (GOP) makes it a policy goal to increase reforestation, it can: (1) expand direct public investment by its own agencies, e.g., RENARE and IHRE; (2) tighten regulations that obligate the private sector to reforest, especially the private enterprises which are granted timber concessions on government lands; and (3) provide incentives that encourage the private sector to reforest (Gregersen 1983). At

present time GOP—especially RENARE—is studying and weighing all three approaches, but this particular investigation focuses primarily on the third (with linkages to the second).

For purposes of this report, reforestation incentives are defined as publicly-funded services and subsidies offered by GOP to assist private individuals and private enterprises to undertake industrial-type tree planting. In Panama as in other countries, reforestation may produce social net benefits in excess of the purely financial rate of return. Consequently, the private sector tends to under-invest in reforestation unless provided with direct and indirect government assistance to keep reforestation at a level commensurate with long-term social profitability (Inter-American Development Bank 1982, pp. 16-17). The rationale for GOP assistance to private-sector forestry is discussed in more detail in section II-A.

B. Problem Context

In principle, Panama now has a timely opportunity to promote reforestation through its private sector:

(1) The national treasury is not in a position to expand government reforestation programs. The sums of capital needed for a national program of afforestation/reforestation will be found only in the private sector.

(2) Panama's private sector includes a large banking and commercial sector, through which substantial streams of capital flow into investments in Panama and elsewhere. One of GOP's objectives must be to demonstrate that plantation forestry is a sound business investment, worthy of attracting a small share of this capital.

(3) Especially in the last year, Panamanians have been sensitized to the "deforestation crisis." Educated Panamanians speak of the "destructive logging" of Darien; the news media

relate the drought in the Central Provinces to removal of tree cover. Heightened environmental awareness is due in large part to the public relations efforts of the current Director of RENARE, and to speeches and articles by persons like Heckadon (see Heckadon and McKay 1982). RENARE, and GOP more generally, can take this opportunity to launch the national reforestation program on the basis of this public support.

(4) A great deal of technical groundwork for plantation forestry in Panama has been completed or is currently in progress. For example, FAO's species trials indicate favorable growth and development of Caribbean pine (Pinus caribaea var. hondurensis) in large areas of the country, mainly west of Panama City (UNDP/FAO 1980).

Panama's government sector—assisted by the international agencies—has accumulated several years of experience in managing tree nurseries and organizing tree planting in the field. While these efforts have been directed at protection planting for watersheds, the technology should be transferred without undue difficulty to commercial planting for industrial plantations.

FAO's current forestry project—"National Reforestation Program"—has the objective of identifying priority areas for industrial forest plantations through the integration of socioeconomic and bio-physical data bases. The intent is to write descriptive studies of the plantation potential of seven specific micro-regions of the country to serve the information needs of potential investors.

(5) A first part of Panama's reforestation program can be directed to import substitution. Panama's trade deficit in forest products exceeds \$20 million annually. Most of the imports are pulp and paper products, but the country also imports substantial quantities of coniferous (chiefly pine) sawnwood. While Panama's economy may be too small to justify import substitution of pulp and paper, the country clearly has prospects to displace imports of sawnwood.

(6) A current opportunity exists to learn from a proposed project to plant five thousand hectares of Caribbean pine near the Inter-American Highway between Santiago and Tole (RENARE/FAO 1983). If the project is approved, private landowners will borrow money from Panama's Agricultural Development Bank (BDA), whose initial capital will be supplied by the Inter-American Development Bank (IDB). If approved, this single project should be the key for RENARE, private landowners, and the financial community to observe which institutional arrangements serve (and do not serve) the needs of pine plantation forestry in the private sector.

(7) Reforestation of the logged-over lands on GOP's timber concessions will present great unknowns and hence great risks of failure. Politically, however, GOP cannot afford to ignore re-

forestation of the concessions, especially in Darien. RENARE's main opportunities to promote reforestation on the timber concessions are reform of timber concession policy, and expansion of R&D relevant to the socio-economic and biological reforestation difficulties characteristic of the concession areas.

(8) In theory, Panamanian law has granted tax incentives for forest plantations since at least 1966 (Decree-Law 39, Articles 53-57). In practice, these incentives have not been utilized for reasons which are not totally clear. The tax authorities (Ministerio de Hacienda y Tesoro) claim that they did not receive applications under this law; RENARE and the private sector contend that this was because Hacienda failed to write implementing regulations.

A new set of fiscal incentives is aimed at Panama's agricultural sector (Law 19, October 1982), and forestry is included in the definition of that sector. The existence of Law 19 is both a problem and an opportunity for reforestation in the private sector. It is a problem because the incentives are designed primarily for food production, and only parts of the law are relevant for reforestation. It is an opportunity because those parts which are relevant can possibly be combined with GOP assistance in-kind (e.g., forestry services, seedlings, etc.) to make a total assistance package that will attract the desired reforestation investments.

In sum, the important elements needed for reforestation to take place in Panama's private sector are present. The missing ingredient is an organizational framework by GOP to help get it started.

C. Summary of Recommendations

Recommended strategies for GOP to stimulate reforestation in the private sector are presented in Chapter V. These strategies are organized into three major areas: (A) policy reforms affecting timber concessions and timber cutting rights; (B) incentives to overcome the private sector's lack of knowledge about forest plantation investment opportunities; and (C) incentives to overcome the private sector's lack of financial

interest and lack of technical ability to realize the plantation investments.

Under (A), GOP will need a new forest law to replace Decree-Law 39. To improve the financial and psychological climate for investments in reforestation, GOP should: (1) implement a system of stumpage appraisal; (2) extend the duration of timber concessions; and (3) exempt man-made plantations on private lands from GOP control of cutting rights.

Under (B), GOP can do much to inform, educate, and demonstrate. Specifically, it should: (4) establish model forest plantation(s) along the Inter-American Highway; (5) prepare an investment profile for plantation forestry to be made available to the banking and commercial sector; (6) clarify Law 19 in the case of forest plantations, and propose implementing regulations so that forest plantations will receive those tax benefits; (7) closely monitor and assist the proposed BID/BDA pine project; and (8) publicize a "Private Sector Reforestation Program."

Under (C), GOP will contribute personnel time, tree seedlings, etc., in direct cooperation with the resources of private individuals and private enterprises. Four particular objectives are to: (9) combine private-public funds and assistance in-kind in order to expand reforestation R&D, preferably through the creation of a "Fund for Reforestation Research"; (10) provide government-funded plantation planning services to the private sector; (11) encourage the formation of private reforestation companies by having GOP assist them during

an initial "learning period" with seedlings and forestry services; and (12) create a private-public "Panama Reforestation Authority," consisting of a private-public Board of Directors, and charged with the policy and management of the programs, projects, and issues discussed in this report.

II. APPLICATION OF REFORESTATION INCENTIVES: OVERVIEW

A. Rationale for Government Intervention

Because reforestation incentives will represent an income transfer from GOP to a limited number of plantation-owning beneficiaries, the incentives are justified only if they are in the best interests of Panamanian society as a whole (i.e., all Panamanian taxpayers). That is, the socioeconomic net benefits with the reforestation incentives must exceed the net benefits that would accrue without the reforestation incentives. If the private financial rate of return from reforestation is sufficiently attractive without subsidy from GOP, then the provision of incentives becomes a wasteful and inequitable allocation of GOP's scarce tax monies.

For reforestation in Panama, the margin of socioeconomic return (for GOP) above the purely financial return (for private landowners, timber concessionaires, and other investors) is found in some combination of the following four factors:

(1) Tree cover produces environmental goods and services not accounted for by market prices. Among the most obvious are soil and water protection, wildlife habitat, and microclimate stabilization. In Panama there may be particular sensitivity to these environmental linkages given that the news media relate the current extremely serious drought (and consequent major losses of cattle and crop production) to past deforestation. Moreover, educated Panamanians throughout the country voice serious concerns about what they perceive to be destructive logging policy and practices in Panama's remaining forested regions.

(2) Depending upon its scale and timing, the establishment of man-made plantations may help relieve cutting pressures on Panama's remaining natural forests. In addition to the kinds of environmental benefits just described, this has strategic political and psychological value for GOP and for all Panamanians. Other intangible benefits relate to gene preservation, and to preservation of natural areas for scientific research (these benefits are distributed beyond Panama). Two other plausible--but less demonstrable--social benefits in keeping regions like Darien under tree cover are slowing the rate of illegal immigration by Colombians, and retarding the northward penetration from Colombia of hoof-and-mouth disease. Moreover, forest plantations constitute land "improvements," thus helping secure land ownership where tree planting occurs. It could be argued that this would contribute in a small way to the social stabilization of the Darien pioneer zone.

(3) The social "shadow price" (opportunity cost) of reforestation labor is often below the market wage rate if there is rural unemployment or underemployment; if the labor group is socioeconomically disadvantaged; and/or if the restlessness of the marginalized group is politically troublesome to the government. In Panama the best example of a low shadow price for reforestation labor is the food-for-work tree planting by disadvantaged campesinos and Guaymí Indians in the province of Veraguas (MIPPE 1983).

(4) Fiscal incentives and other means of government intervention are used worldwide to narrow regional income disparities for reasons of social equity, national unity, and national security (Modi 1982). GOP could implement reforestation incentives in the same way that Brazil has allowed higher subsidies for reforestation in its poorer regions (i.e., Amazon and Northeast) than elsewhere.

In summary, GOP should not lose sight of why reforestation may be more socially desirable than financially profitable. Many of the likely net benefits are intangible, but nevertheless

genuine and reflective of true social values. Although most of the apparent social benefits do not lend themselves to valuation, GOP will be obligated to specify as explicitly as possible the particular subset of extra-market benefits it expects to attain in any particular reforestation incentives program. This will improve GOP's decision-making by allowing it to obtain evaluation and debate from Panama's business, academic, and civic communities.

B. Defining the Target Problem

Following the classification scheme in Worrell (1970) and Gregersen (1983), GOP's reforestation incentives will be directed to overcoming one or more of three different constraints faced by Panama's private sector: (1) lack of knowledge on the part of private individuals and enterprises of the opportunities to invest in forest plantations; (2) lack of financial attractiveness of plantation investments due to, for example, the unbalanced cash flow pattern typical of the long production periods in timber growing; and (3) lack of technical capability to execute the plantation investment (even if it is financially attractive) due to the absence of special skills and essential factors of production.

Clearly, each constraint is addressed with a different policy instrument. Problem #1 requires education and demonstration; problem #2 requires special financing and/or direct subsidies; and problem #3 requires technical assistance. Because Panama is a small country with little tradition in

plantation forestry (especially for commercial purposes), all three types of interventions are required (see Chapter V).

C. Defining the Target Clientele

A national program of afforestation and reforestation in Panama should be oriented toward two major targets: (1) afforestation/reforestation on degraded pasture lands, a large but unquantified proportion of which are in private ownership; and (2) reforestation of logged-over forested lands on the government's timber concessions. These two targets differ significantly in their geographical-ecological setting; their socio-political setting; and their infrastructural-economic setting. A single design and implementation plan for reforestation incentives will not serve both targets equally well.

More specifically, the targets differ as follows:

(1) FAO's species trials (UNDP/FAO 1980) recommend Caribbean pine as an obvious choice of species for the degraded pasture lands west of Panama City, especially in the Central Provinces (Cocle, Veraguas, Herrera, Los Santos) and parts of Chiriqui. With due attention to questions of seed source, edaphic limitations, and application of boron and phosphorous, Caribbean pine is suitably planted in both the tropical moist and premontane wet life zones (Holdridge System), which together cover 50% of Panama. Moreover, (i) technologies to grow, harvest, and utilize Caribbean pine are relatively simple; (ii) Panama's imports of sawnwood are primarily of this species; and (iii) other forest development projects in progress or proposed for the near-term future avail of this species, affording good potential for technology and information transfer and the establishment of a critical mass of expertise.

On the other hand, the choice of species for timber concessions in provinces like Darien and Bocas del Toro is more problematic. To date, little scientific basis exists for selecting reforestation species or methods appropriate for logged-over tracts in the heavily forested zones of the country.

(2) Questions of land titles and land security are not generally a problem over much of the Central Provinces, but are a major issue in the frontier zones of Darien. This has immediate consequences for the riskiness of plantation investments.

(3) The reforestation clientele in Darien and Bocas del Toro is the logging and wood-processing subsector; the land-owning clientele in the Central Provinces is the agro-cattle subsector; the capital groups and individual sources of investment capital in Panama City are part of the urban banking and commercial subsector. Each of these subsectors reflects different knowledge levels, financial resources, and management objectives when presented with incentives for reforestation.

III. PANAMA'S EXPERIENCE WITH REFORESTATION INCENTIVES TO DATE

Various classification systems are available to catalog the different kinds of fiscal and other government incentives offered to the private sector. Tables 1 and 2 present examples of two such systems to help illustrate the range of measures to be considered.

Several qualifications apply to Table 2. First, the current cross-section of incentives is undoubtedly different from that which existed when the data were collected. In Brazil and Chile, to take just two examples, the laws and implementing regulations for reforestation incentives have been modified frequently.

Secondly, Panama presents a prime example of a country in which certain types of reforestation incentives are written into law, but in which there are no implementing mechanisms. Panama's tax benefits for reforestation are legislated in Articles 53-57

Table 1. Incentives for Reforestation and Afforestation in OECD Countries, Cited in Gregersen (1983).

(N = national level; L = local (state, municipal, etc.))

Measures	Activities	Reforestation	Afforestation
A. DIRECT WITH LANDOWNER			
1. Cost-sharing			
(a) cash grants		N8, L3	N10, L4
(b) goods/materials		N5, L1	N6, L3
2. Services (management, marketing, etc.)		N4, L1	N5, L1
3. Subsidised credit (Loans)		N6, L1	N7, L1
4. Fiscal			
(a) tax rebates or exemptions		N4, L1	N5, L1
(b) special taxes (yield, property, etc.)		N3, L2	N3, L2
(c) other fiscal		N1	N1
5. Reduction of uncertainty			
(a) rental contract			
(b) price guarantees			
(c) insurance		N1	N1
(d) forest protection agreements		N1	N1
(e) land tenure security		N1, L1	N1, L1
(f) loan guarantees		N2	N2
6. Other:(specify)		N2, L1	N2, L1
B. INDIRECT			
1. Market information/ Price reporting		N3	N4
2. Extension/Education		N7, L5	N8, L5
3. Research and Analysis		N8, L4	N9, L4
4. General Forest protection		N5, L2	N4, L2
5. Infrastructure			

a/ Taken from Gregersen and Plochmann (1983); based on responses from 11 countries.

b/ Entries are interpreted as follows: "N8,L3" means eight countries have national incentives in the category and three have local (state, municipal or regional) incentives

INCENTIVES FOR AFForestation AND REFORESTATION

	DIRECT SUBSIDIES					CREDIT CONCESSIONS	TAX BENEFITS						
	Free Seedlings	Donation of small plots	Technical Assistance (free)	Capital Donation	Cooperation in Building of Infrastructure		RELATIVE TO LAND USE			RELATIVE TO INVESTED CAPITAL		RELATIVE TO EXPLOITATION AND FOREST PROFITS	
							Exemption of land tax	Exemption of property tax	Exemption of income tax	Exemption of inheritance & gift tax	Deduction of income tax	Exemption of income tax	Deduction of income tax
Argentina	x				x								
Bolivia			x			x							
Brazil						x							x
Chile	a/	b/	x	x		x		x					x
Colombia						x							x
Costa Rica	x		x			x							x
Dominican Republic				x		x							
Ecuador								x					
El Salvador			x	x		x							b/
Guatemala		x				x							x
Honduras													
Jamaica	x		x	x									
Mexico	x					x							
Nicaragua						x							
Panama	a/			x									
Paraguay			x										x
Peru		x		x		x							x
Uruguay													x
Venezuela			x	x		x							

a/ reduced price

b/ inappropriability

c/ 80% reduction

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Source: Adapted from: a) Luis Bombin, "Incentivos Economicos Forestales en America Latina," Rome: FAO, 1974; b) A. Izquierdo and Juan Seve, "Estudio de Incentivos de reforestacion para el sector privado," Universidad de Chile, 1970; and c) country studies prepared for the World Bank and other international organizations.

Table 2. Incentives for Reforestation and Afforestation in Latin America, Cited in Gregersen (1983).

of Decree-Law 39 (effective September 1966), but the tax authorities (Ministerio de Hacienda y Tesoro) have not enacted rules for carrying them out.

Finally, the pattern of incentives shown in Table 2 may or may not be rational for the countries in question. Ideally, a country's choice of reforestation incentives will be precisely targeted to overcome the particular mix of problems identified in section II-B. However, in practice, many of the incentives are very likely the result of historical accident; pressures from wood-industry special interests; partial analyses; and suggestions of legal (rather than forestry) experts. In Brazil, some \$1.9 billion (U.S. equivalent) was released from government coffers in just the first eleven years of that country's fiscal incentives program for reforestation, and yet through 1979 there was "little analysis of its financial profitability, overall impact on the economy, or compatibility with the nation's socioeconomic objectives" (Beattie and Ferreira 1979, p. 5).

Panama's limited experience with reforestation incentives to date will be referenced to the outline in Table 1: seedlings (Measure A.1.b); credit (Measure A.3); fiscal incentives (Measures A.4.a); and research and analysis (Measure B.3). This is necessarily a short discussion.

A. Seedlings

A number of governments in Latin America provide free or below-cost seedlings to private individuals and firms (Bombin 1975, p. 2). The provision of tree seedlings is an obvious

specialization of a natural resources agency, and can be done for reasons of publicity as much as for reasons of production subsidy.

In 1983 RENARE distributed some 600 to 800 thousand seedlings, many in connection with "Natural Resources and Environment Week" (Semana de los Recursos Naturales y Medio Ambiente) in June. At an approximate production cost of 12 cents per seedling, RENARE's seedling distribution amounted to assistance valued at \$72,000 to \$96,000. At first RENARE attempted to sell the seedlings at cost, but then later distributed the remaining seedlings gratis to eliminate excess stocks. RENARE limited the maximum number of free seedlings to 2,000 per individual, sufficient to plant one or two hectares.

IRHE likewise provides free seedlings to interested farmers in and around IRHE's watersheds in Chiriqui. Farmers come to IHRE's office to solicit the seedlings, partly in response to a radio program to stimulate their interest in conservation practices. However, the scale of this planting is small, since the IHRE nursery (at Boquete) produces just 200 thousand seedlings per year (a proportion of which are planted directly by contracted labor on land managed by IHRE).

Both RENARE and IHRE offer a limited amount of informal advice to farmers and other private individuals on how to plant and care for their seedlings. However, this service is not sufficiently developed to consider its extension in the formal sense. Secondly, the scale of the seedling distribution is

currently too small to suggest it as an assistance measure for industrial-type forest plantations. RENARE would have to expand nursery capacity significantly (perhaps by a factor of 5-10) before it could consider supporting industrial-scale forest plantations in a programatic way.

B. Credit

At present there is no line of credit for forest plantations in Panama, but it is worth reporting past and ongoing attempts in this area. The Agricultural Development Bank (BDA) has never extended loans for forest plantations. BDA has, however, made occasional loans for agriculture in which a part of the loan was used to plant trees around wells, canals, etc., for protection purposes. Currently, BDA reports a severe lack of funds to establish credit lines for other than its most traditional agricultural pursuits (even if it believed that forest plantations had financial merit).

After about four years of discussions and studies, the Inter-American Development Bank (IDB) is currently advancing its proposed Santiago-Tole project from a pre-feasibility to a feasibility stage. As envisioned in the pre-feasibility study (RENARE/FAO 1983), IDB will provide a loan of \$6 million through the offices of BDA to be used as credit for plantations of Caribbean pine. Borrowers will be private landowners on both sides of the Inter-American Highway between Santiago (Veraguas) and

Tole (Chiriqui). Technical assistance will be provided by RENARE. The target level of planting will be 5,000 hectares over five years.

The original proposal would have granted very concessionary terms to the borrowers (10-year grace period). However, those terms no longer are available, and BID presently reports that the maximum grace period will have to be limited to 5 years. This implies that there may well be a cash flow problem—and an absence of demand for the loans—unless a way can be found to tie the loans for pine plantations to other income-producing activities. Undoubtedly this will be a prime consideration in BID's feasibility study, which should be underway later this year.

C. Fiscal Incentives

Panama has two laws providing tax breaks for investments in forest plantations. As noted in previous parts of this report, they are Decree-Law 39 (September 1966) and Law 19 (October 1982). Since neither piece of legislation has been utilized, it is uncertain whether Law 19 cancels the provisions of Decree-Law 39. The legal and technical details are contingent upon a solid test case, of which there are no examples as of yet.

Decree-Law 39 exempts plantation land and timber from all taxation (Article 54). It also allows tax deductions for the invested capital (Article 55). It exempts equipment, seed, and other materials needed for reforestation of import duties and

other taxes (Article 56). Finally, it permits GOP to offer cash incentives to stimulate scientific research on forestry development and industrialization (Article 57).

In 1980-1981 the FAO forestry project in Panama assigned Manuel Aullo U. to draft fiscal incentives for reforestation. The objective was to make this draft serve as the implementing regulations for Decree-Law 39. However, in 1982 Aullo's proposal was rejected by the Ministerio de Hacienda y Tesoro on grounds that they could not predict how much revenue might be lost to the Treasury. Also, Hacienda may have believed that fiscal incentives for forestry would be covered by upcoming Law 19.

Law 19 is intended to increase national production of food products and agricultural raw materials (including timber). It offers tax deductions to attract investment to the agricultural sector from non-agricultural sources (Article 4q), e.g., from the banking and commercial sectors. It also allows tax deductions for funds given to agricultural (including forestry) research and extension (Article 4r). Certain kinds and amounts of interest payments can be taken as tax credits (Article 4q,s). Producers within the agricultural sector are permitted tax deductions in proportion to capital invested (Article 5). A new credit fund, with subsidized interest, will be administered through the BDA (Article 19). A number of other provisions cover agricultural pricing policies and import policies, but they do not appear to have relevance for forest plantations.

D. Research and Analysis

RENARE and FAO are working together in at least two areas of highly applied research that constitute indirect incentives for industrial forest plantations. FAO published its species trials a few years ago (UNDP/FAO 1980), but a small amount of research continues on species and silviculture suitable for reforesting the timber concessions. For example, FAO continues to monitor experiments with enrichment planting (about 100 trees per hectare) in Darien.

Additionally, FAO and RENARE have begun producing information packages to help potential investors choose industrial plantation sites. These information guides--based on aerial photos--integrate a wide range of data on soils, roads, land ownership and titles, local population base, etc., to guide plantation decision-making. The first micro-region of 60 thousand hectares (El Valle de Anton) is underway, and each succeeding micro-region will take an estimated two to three months to complete. The underlying objective of this project is to improve reforestation planning from both the economic and ecological perspectives. The analysis goes a long way towards supporting the kind of reforestation zoning discussed in section IV-A.

IV. STRATEGIES AND CRITERIA FOR INCENTIVES DESIGN

This chapter serves as a bridge between the review of existing incentives (Chapter III) and the recommendations for future action (Chapter V). It briefly identifies the required conditions and criteria that must be met for reforestation incentives to be successful. In this respect, GOP is in an excellent position to learn from the experiences--both positive and negative--of other countries. These lessons will be framed in the context of criteria suggested by Hickman (1982) and Gregersen (1983).

A. Economic Efficiency

GOP will want land, labor, and capital to be combined to produce a high level of reforestation output (measured as the present net value of the plantation timber that will be harvested) for a given available set of the inputs (including the GOP subsidy or assistance). GOP's two principal controls to attempt to achieve reforestation efficiency are the level of subsidy it offers, and the system of economic and ecologic zoning it applies.

Brazil can be cited as one example of a country which learned that high subsidies can lead to high inefficiencies. Brazil's tax incentives were implemented so as to effectively give a 100% (or more) subsidy to the investor (Beattie and Ferreira 1979). Because the establishment of plantations was essentially "free" (or even capable of turning a net profit!), a mass wave of planting took place that strained IBDF's (Brazilian

Institute of Forest Development) capacity to approve, monitor, and control the reforestation projects.

The hurry to take advantage of the extremely generous tax incentives had at least five unfavorable consequences (Beattie and Ferreira 1979): (1) many plantations were established in remote backlands where land was cheap, without due regard for eventual harvesting and transport difficulties; (2) some plantations were located in very small and isolated parcels, ignoring the economies of scale that might occur if there were a "critical mass" of plantations in concentrated blocks; (3) land use was sometimes distorted so that some plantations were located on agricultural soils, while other "reforestation" was accomplished by first clearing away the native forest; (4) inadequate planting quality and maintenance occurred until IBDF was eventually able to improve its vigilance; and (5) the very generous government subsidies may have led to such inefficient plantation location and size that Brazil's harvesting and transport costs will be too high to allow it to successfully compete in the world export market.

The implications of this for Panama are straightforward. First, private landowners and/or investors should not be permitted "free," or nearly free, forest plantations (with the possible exception of demonstration plots). This will generate an instantaneous and large demand for the subsidy(ies) that GOP will not be able to meet. It will also produce various inefficiencies in the location, size, and quality of the

plantations. The private investor's percentage of the equity must be sufficient so that he, along with GOP, shares an intense interest in allocating that equity very carefully.

Secondly, GOP must establish a system of economic and ecologic zoning to control the timber species, location, and minimum scale of reforestation projects approved for GOP incentives. Most Latin American governments which grant incentives for reforestation use such systems. This should be ideally suited to RENARE's technical capabilities. This zoning should combine several data bases: the Holdridge Life Zone System (for Panama); FAO's species trials (UNDP/FAO 1980); road maps; soils and topographic maps; and FAO's (E. Montenegro's) current project to produce information packages describing the plantation potential of seven micro-regions. RENARE should not rely on this last source exclusively, since applications for the incentives are likely to arise outside of the micro-regions, as well.

B. Administrative Capacity

Whatever the type of reforestation incentive(s) selected, GOP will have to allocate personnel-time and overhead costs to administer them. This refers principally to the RENARE directorate, RENARE foresters, and RENARE legal counsel. For tax incentives, some administrative time also may be required of the Ministerio de Hacienda y Tesoro. Regulations and implementation strategies can be made numerous and complex to attempt to obtain the best possible reforestation results (in a technical sense)

for a limited number of incentives participants. Alternatively, the incentives can be administered loosely to reach a greater number of incentives participants with the same administrative budget, but with less confidence that each plantation will be technically efficient (Gregersen 1983, p. 14).

If the reforestation incentives are made available for discrete reforestation "projects," an important control over GOP's administrative costs will be minimum allowable scale of plantation. A minimum of 200 hectares clearly will result in fewer project applicants than a minimum of 2 hectares. Here there is an immediate tradeoff between minimizing administrative costs and maximizing social equity (see section IV-D).

C. Legal Controls and Policing

Some types of incentives will be associated with a minimum of legal details. Examples include plantation demonstrations; GOP-funded reforestation research; and various other indirect incentives. On the other hand, direct incentives (seedlings, forestry services, or tax reductions offered directly by GOP to individual investors) may demand a certain performance standard to be met by the beneficiary. This can be in the form of a formal contract (as Chile has used) containing numerous clauses to specify the penalties for non-compliance. Of course, GOP must then employ policing to make this effective. Administrative costs (IV-B) rise accordingly.

Whatever type of incentive(s) is provided, GOP should pay particular attention to legal controls which regulate re-sale of

reforested areas. Costa Rica's experience is one in which government-subsidized plantations have been divided into small lots for second homes. The reforestation owners undoubtedly find this lucrative, but the government does not meet the social goal of creating an industrial timber base.

D. Social Equity

The focus of this study is incentives to promote industrial forest plantations. Industrial forest plantations must be relatively large to achieve low unit costs of management and harvesting. This implies that the principal beneficiaries of GOP's reforestation incentives will be those landowners and investors who already enjoy a high standard of material welfare.

Nevertheless, GOP can attempt to design the incentives so as to locate (e.g., by means of zoning) forest plantations where they will create needed employment and external environmental benefits in the relatively poorer regions of Panama. For instance, the incentives could favor (or be limited to) designated sub-regions of the Azuero Peninsula; designated sub-regions near Guaymi settlements and peasant farming centers (asentamientos and juntas agrarias); and designated sub-regions of the socially and environmentally stressed pioneer zones in Darien.

GOP also controls the type of incentive(s), and this choice is not neutral with respect to social welfare. For example, GOP incentives to support taungya agro-forestry (on Darien timber

concessions) have a more immediate and observable welfare objective than, say, efforts to facilitate tax reductions under Law 19.

E. Continuity and Flexibility

Incentives for afforestation/reforestation should consider the entire series of production and management decisions from seedling to ultimate timber harvest (Gregersen 1983, p. 10). If GOP is sufficiently motivated to grant incentives to the private sector for plantation establishment, then it should be equally motivated to insure that--many years later--those plantations are harvested. Post-planting monitoring will be needed to enable GOP to measure the effectiveness of its incentives in the light of changing social, political, and economic circumstances. RENARE, and GOP more generally, must remain sufficiently flexible to modify the reforestation incentives fairly frequently, if the lessons of other Latin American countries carry over to Panama.

F. Conforming with Other Incentives Policies

GOP's choice of incentives for industrial forest plantations must be consistent with its choice of incentives for private enterprise in other sectors and other production activities. GOP employs a wide spectrum of incentives for private producers in Panama's agricultural sector. These include crop insurance (through ISA), subsidized loans (through BDA), tax incentives (through Law 19), and research services (through IDIAP).

Additionally, GOP has recent experience with mixed private-public enterprises (COFINA, Cemento Bayano, Consejo Nacional de Inversiones). This suggests that GOP is willing to consider a wide range of possible incentives mechanisms, and that it is not committed to just one or two specific forms on purely political or ideological grounds.

G. Budget Impacts

Which particular agency(ies) of GOP will bear the costs of the reforestation incentives? RENARE's budget is the certain target if the incentives consist primarily of forestry assistance and analysis, e.g., provision of seedlings and forestry services. BDA will incur overhead, transactions costs, and other costs if reforestation incentives take the form of subsidized loans. Hacienda y Tesoro will lose tax revenues if the incentives concentrate on fiscal measures. Clearly, the various components of GOP will not be indifferent to the incidence of the incentives costs. The proper design of reforestation incentives will have to balance budget levels (i.e., ability to pay) against administrative reward (i.e., opportunity to benefit) in the case of each separate agency.

V. RECOMMENDATIONS

An action plan to encourage reforestation in Panama's private sector has three main components: (A) policy reform affecting timber concessions and timber cutting rights; (B)

incentives to overcome the private sector's lack of knowledge about forest forest plantation investment opportunities; and (C) incentives to overcome the private sector's lack of financial interest and technical ability to realize the plantation investments.

Whatever the level and type of incentives offered by GOP to the private sector for reforestation, the incentives should logically be part of a larger reform that raises timber prices, and that liberalizes timber cutting rights for forest plantations on private lands. This is the subject of Section A.

Section B recommends means by which GOP can increase technical and financial information about the opportunities for industrial plantations. These are principally indirect incentives to educate and to publicize. They are relatively inexpensive for GOP; can be accomplished in a relatively modest time frame; and entail a minimum of organizational and legal planning.

The direct incentives follow in Section C. They comprise various combinations and levels of GOP personnel time, tree seedlings, and land offered in cooperation with the resources of private individuals and private enterprises. The direct incentives are intended to enhance the private sector's technical ability to establish commercial plantations, and to lower the private sector's costs (increase private financial returns) during an initial "learning period." Compared to the indirect incentives, the direct incentives generally will require a

greater commitment of GOP resources, time, and logistical and legal input.

A. Policy Reform

Panama is in serious need of a new forestry law to replace antiquated Decree-Law 39. Since 1966 when Decree-Law 39 was issued, Panama's demand for timber has expanded greatly; environmental awareness has likewise increased; and systems of natural resources management have become more sophisticated. The severe deficiencies of Decree-Law 39 interfere with offering incentives to assist the private sector with reforestation.

This first section is written to assume that partial policy reforms are possible without a new forestry law. However, it is also assumed that the Director of RENARE will be taking every possible opportunity to speak for the creation of entirely new legislation.

1. Implementation of Stumpage Appraisal

RENARE's present sales of standing timber on government timber concessions at far below ordinary stumpage prices ("land rent") understates the true scarcity value of timber in Panama. The low level of timber prices does not stimulate the proper psychological or financial climate for reforestation investments.

RENARE's Director should seek external assistance (e.g., from FAO or a bilateral aid program) to implement a stumpage appraisal system in order to raise timber prices. FAO recently

prepared a guide on this subject oriented to the needs and problems of countries like Panama (contact Tom Catterson, AID Africa Bureau, Washington, D.C.). Implementation of stumpage appraisal should ultimately improve the conditions and increase the incentives for the private sector to commit capital to reforestation. However, this will be a long-term proposition demanding considerable institutional change.

2. Extending the Duration of Timber Concessions

RENARE cannot reasonably expect private enterprise to reforest timber concessions unless those concessions are granted for periods substantially longer than the two-year agreements now in effect. Under present circumstances a private enterprise risks committing capital to reforest government land, not knowing the eventual disposition of the timber to be regenerated there.

Therefore, along with the transition to stumpage appraisal, RENARE should extend the length of timber licenses to periods commensurate with the long-term character of forest management. Long-term leases of 20, 50, and even 99 years are used in some countries. RENARE should carefully study FAO's Forestry Paper No. 1 (Forest Utilization Contracts on Public Land, by Franz Schmithusen) for guidelines appropriate for Panama.

3. Exempting Man-Made Plantations from Government Control of Timber Cutting Rights

GOP (through RENARE) is legally empowered to regulate the cutting of trees on all lands, including private lands (Decree-Law 39, esp. Articles 15-21). Obviously, this law is difficult

to enforce in practice. However, private enterprises express the belief that, if they are to invest in commercial man-made plantations on private lands, RENARE should not be in a position to step in to control cutting rights.

The Director of RENARE should assign RENARE's legal counsel to study legislative and institutional means to exempt the harvesting of man-made forest regeneration and regeneration on private lands from government regulation. This exemption must be clearly communicated to the private sector.

B. Overcoming Lack of Knowledge

The knowledge barrier has to be judged of critical importance in Panama. Compared with countries like Brazil and Chile, Panama has very little forestry plantation experience or tradition. Plantation technologies have to be introduced before they can be diffused. Other than the teak plantation started by the Chiriqui Land Company in the late 1940s, Panama has no industrial forest plantations of any appreciable scale (i.e., greater than five or ten hectares). Thus there is no model of what to do, or how to do it.

GOP can take a number of steps to demonstrate plantation technologies; help coordinate the preparation of investment profile(s) for plantation forestry; clarify and help write the implementing regulations for fiscal incentives for reforestation; and publicize a private sector reforestation program. These four

components can be combined in various ways, and each component has concrete short-term results that can be measured.

4. Establishment of Model Forest Plantations

The pine plantations at the La Yeguada watershed are not easily accessible, nor are they examples of plantations intended for industrial purposes. Therefore, RENARE should establish a demonstration plantation fringing the edge of the Inter-American Highway, probably at some location between Penonome and Santiago. This plantation will be the model and demonstration site for landowners, wood-industry executives, and investors from the Panama City commercial sector. The plantation will be marked with large and attractive signs to inform observers about growth rates, silvicultural treatments, expected products, and possible financial yields. The signs also will tell observers where they can get more technical information (RENARE will have to prepare attractive and well-written pamphlets). Other signs will point out that tax incentives are available under Law 19 (see Recommendation #6). The plantation should be inaugurated by a very high-level political figure (the President?), with large media coverage to help GOP promote the "Private Sector Reforestation Program" (see Recommendation #8).

The Director of RENARE should appoint one of his most competent forestry engineers to manage this project, probably in consultation with FAO (Elsa Bognetteau). The project manager will choose the plantation sites (must be private land on the Inter-American Highway); build the necessary fences; arrange the

transport of seedlings and planting labor (probably from La Yeguada); and administer all plantation maintenance, sign building, and publicity. This demonstration plantation must be first-class in every respect.

In addition to P. caribaea, RENARE should demonstrate other plantation species at the same location or elsewhere along the Inter-American Highway. Among these other species are mango, teak, gmelina, cedro espino, caoba, cedro, and Khaya senegalensis (contact Waldemar Albertin). The procedures to establish these demonstrations, and the strategies to publicize them, will parallel those discussed for pine.

5. Preparation of an Investment Profile for Plantation Forestry

The concept of investment in plantation forestry as a business venture must be communicated to Panama's business and banking community. Much of Panama's urban-based commercial sector does not presently understand that forestry is more than protecting watersheds and wildlife. Furthermore, those who do understand forest plantations in the business sense do not have specific data for investment decision-making. This decision-making depends on the kind of biological and cash flow data which now exist for some forest plantation species in some countries (contact Waldemar Albertin), but which currently do not exist in Panama.

Panama's newly-created National Investment Council (Consejo Nacional de Inversiones) is presently considering preparation of

an investment profile for the forestry sector (contact Armando Martinez). This Council is an advisory service and conduit for foreign capital entering Panama, and it also can be a broker to match foreign enterprise with Panamanian partners.

RENARE should not lose this crucial opportunity to help integrate FAO's plantation information packages (see section III-D) with the Consejo's planned investment profile. In the immediate future, the Director of RENARE should convene a working session bringing together himself, Ing. Montenegro, Ing. Martinez, Waldemar Albertin, Charles Greenwood (BID), and two or three representatives of the private sector (e.g., A. Melo and F. Manfredo) to discuss specific details for the investment profile.

6. Clarification of Law 19 and Preparation of Implementing Regulations

A key to the entire "Private Sector Reforestation Program" is the provision of tax incentives under Law 19 to subsidize plantation costs. The Director of RENARE should convene an expert panel to study and advise on how to best make use of Law 19 as applied to the specific case of forest plantations. The panel's evaluation should take into account the recommendations in this report; the incentives specified in Decree-Law 39 (Articles 53-57); and the draft Ante-Proyecto by Aullo. The panel should consider whether the proposal by Aullo could be modified in conformance with Law 19 to become the implementing regulations for that law. If not, the panel should assess the prospects for an entirely new law for forest-based investments.

Panel members should include two from RENARE (in addition to the Director); two from the private sector (e.g., A. Melo and F. Manfredo); and two from the Ministerio de Hacienda y Tesoro (e.g., G. Nunez and P. Padilla). A part of this panel purposely overlaps the group appointed to prepare the investment profile (discussed in Recommendation #5).

The Director of RENARE should widely distribute results of the panel's findings to potentially interested parties in the private sector. These findings also will be important for the plantation demonstration and publicity (Recommendation #4), the investment profile (Recommendation #5), and the promulgation of a "Private Sector Reforestation Program" (Recommendation #8).

7. Monitoring of the Proposed BID/BDA Pine Project

RENARE should continue its contribution of personnel-time and other resources to support BID's study of a project to make loans to private landowners for pine plantations. The success or failure of this single project will have lasting psychological repercussions for the next several years.

The Director of RENARE should designate one of his staff to provide him with brief periodic memos on the status of the project.

8. Promulgation of a "Private Sector Reforestation Program"

If the prospects in the preceding recommendations are promising—and if some of the direct incentives proposed in

Section C are feasible--then RENARE should consider packaging the various components under the name "Private Sector Reforestation Program." Obviously, the Program should not be announced until it is quite certain that it will be technically and politically successful. A study period of about one to two years should be appropriate.

At that point, the Director of RENARE should insure that the various components are well integrated; that there is appropriate information diffusion; and that the public-private linkages are compatible and efficient. The objective of publicizing the Private Sector Reforestation Program will be to generate interest and potential investment from private individuals and enterprises who would not otherwise learn of the plantation opportunities.

C. Overcoming Lack of Financial Attractiveness and Lack of Technical Capability

When GOP's assistance consists of explicit cost-sharing with particular landowners, capital groups, or timber concessionaires, the incentives are said to be direct. The direct incentives proposed here will require considerably more detail to plan and implement than can be provided within the scope of this report. The present objective is simply to outline the concepts.

9. Cost-Sharing the Research, Development, and Extension of Reforestation Technologies

RENARE could do more to work in cooperation with the private sector to improve reforestation technologies. The technologies

to grow seedlings of Caribbean pine--and to plant them in the field--evidently are well understood in Panama. RENARE should study the demand that might exist for a course on this subject for prospective clientele in the private sector.

However, most of RENARE's R&D of reforestation technologies should be oriented to the timber concessions, where pine may not be the species of choice. At present, reforestation of the timber concessions entails great unknowns and great risks of failure in the technical and scientific areas, as well as in the institutional and administrative areas. There are several x-technologies (with major experimental features) that should be tested. One such technology is to contract colonos to plant trees on the concessions in some sort of agro-forestry system (contact A. Melo).

The Director of RENARE should appoint a joint RENARE-concessionaire task force to recommend reforestation research strategies for the timber concessions. Under Law 19, the concessionaires are allowed tax deductions for funds they contribute to state or private research institutions. RENARE should seek to establish a "Fund for Reforestation Research," with legal and institutional bases derived from that law. Secondly, a fixed percentage of timber concession fees should be deposited directly into this Fund. RENARE's contributions in personnel, vehicles, etc., could represent the equity from GOP. The Fund would be managed by a private-public Board of Directors

in the same manner as (or as a component of) the Panama Reforestation Authority (see Recommendation #12).

10. Provision of Plantation Planning Services

RENARE should designate two or three forestry engineers to become specialists in the planning and management of forest plantations. This probably will require short-term training outside of Panama. The extension services of these forestry engineers should then be made available free of cost (or at half-cost) to private landowners and private companies. The forestry engineers should assist in the choice of plantation sites, establishment of tree nurseries, and implementation of planting practices and silvicultural treatments.

Restrictions will be required to limit the maximum amount of personnel-time offered to any single private entity. Likewise, there should be a minimum size of private entity to insure that RENARE's assistance is aimed at industrial-scale (not backyard) plantations.

These RENARE plantation specialists should advise private landowners and private firms to apply for small-scale plantation demonstrations (also see Recommendation #4). A policy board (such as the one that would exist under Recommendation #12) will rule on these applications. Funding for the demonstration plantations will be partly or entirely from the "Fund for Reforestation Research" (Recommendation #9). Alternatively, the Director of RENARE should investigate whether BID could fund this

training and extension activity out of its pre-investment funds for the proposed Santiago-Tole project.

11. Assistance to Private Reforestation Companies

In countries like Brazil, Chile, Colombia, and Costa Rica, much reforestation is done by independent reforestation companies. These companies are licensed by their governments, but they are strictly private enterprises which plant for other private enterprises (either for cash, tax incentives, or equity in the forest plantations). Assuming that some of the measures suggested here stimulate the private demand for tree planting services, GOP should consider temporary assistance to enable such a reforestation firm(s) to become established.

This assistance will consist of some combination of below-cost seedlings, government-paid tree planting labor, and government-paid forestry services (see Recommendation #10). The assistance should be granted for the first "x" years of the firm's operation. The assistance should aim to achieve a "yy"% cost-share per hectare, but RENARE's total resource commitment (in-kind) over the "x" years should not exceed B/ "zzz" thousand. The assisted reforestation companies should be encouraged (or even required) to establish a certain minimum percentage of their plantations on lands that they do not own themselves.

Applications for the assistance from potentially interested reforestation companies will be reviewed and acted upon by a

policy board (Recommendation #12). The policy board also will determine the amounts of "x," "y," and "zzz."

Another means to assist a potential Panamanian reforestation company is to encourage a partnership with an experienced foreign firm. The Director of RENARE should inquire whether BID will be able to help provide the foreign partner as part of BID's technical assistance package for the proposed Santiago-Tole project.

12. Establishment of a Private-Public Panama Reforestation Authority

This last recommendation is the most comprehensive, potentially embracing each of the previous objectives. It will create a mixed private-public organization in charge of all reforestation policy and resource allocations. This organization could be a corporation, an institute, or other legal entity consistent with the kind of private-public partnership being tested in COFINA, Cemento Bayano, Consejo Nacional de Inversiones, etc. For present purposes, this private-public reforestation body will be called an "Authority."

The Panama Reforestation Authority will have a Board of Directors (policy board) to make decisions on the kinds of programs, projects, and issues discussed in Recommendations #1-11. The Authority will be the key body to press for a new forestry law; to clarify and help implement the tax incentives in Law 19 (or to argue the merits of alternative tax incentives for the forestry sector); to start the Fund for Reforestation

Research; and to implement the other incentives for reforestation suggested in this report.

The Authority's legal and institutional terms of reference-- and its private-public composition--are extremely critical and complex. The Director of RENARE, with the Minister of Agriculture, should convene an executive-level working session(s) to obtain a diversity of views on the purposes, organization, and legal foundations of the proposed Authority. The executive session(s) should include:

- Four representatives of MIDA and RENARE, including the Minister of Agriculture and the Director of RENARE, accompanied by legal and advisory counsel.

- Two representatives of the President's Office, comprising legal and policy advisors.

- Two representatives of Panama's existing private-public institutions, such as one from Consejo Nacional de Inversiones and another from COFINA.

- Four representatives of Panama's wood-based industries, including individuals such as A. Melo and F. Manfredo.

- Three representatives of bilateral and international assistance organizations, such as AID (R. Gomez) and BID (C. Greenwood).

The session(s) should aim to produce specific and tangible recommendations that can be implemented in the near-term future. The Minister of Agriculture, together with the Director of RENARE, will communicate these recommendations directly to the President's Office.

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ANNEX A: INDIVIDUALS CONSULTED DURING
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ANNEX B: FINANCIAL POTENTIAL OF PINE AFFORESTATION/ REFORESTATION IN PANAMA

This annex will provide a rough guide to the costs and returns of a hypothetical plantation of Caribbean pine. The figures used here--particularly for yields and prices--are merely educated estimates, but the analysis is indicative of the kind of data needed to construct an investment profile (Recommendation #5).

A. Target Level of Planting

Over the past 15 years, Panama has been importing 10-30 thousand cubic meters of coniferous sawnwood annually. Depending upon which statistical source is used (U.N. Commodity Trade Statistics; FAO Yearbook of Forest Products; or official statistics of Government of Panama), the annual average import volume has been 17-19 thousand cubic meters; the annual average import value (c.i.f.) has been \$1.7-\$1.9 million (1980 currency). Most of the sawnwood imports are Caribbean pine from Honduras and Nicaragua, with lesser quantities of southern pines (P. taeda, P. elliottii) from the U.S.

These import figures indicate a minimum target level of pine sawlog production of 9.2 thousand cubic meters annually. This target is based on the following very conservative assumptions: (1) Panama's demand for coniferous sawnwood will remain static at 12 thousand cubic meters per year (average for 1976-80) at constant prices; (2) a minimum of 50% of all coniferous sawnwood imports are of a product and grade mix that can be produced by plantation-grown P. caribaea in Panama; (3) Panama will not export pine sawlogs or pine sawnwood; and (4) the average bandmill utilization factor (i.e., conversion efficiency) for plantation-grown pine sawlogs will be as high as 65%.

The land area needed to produce 9.2 thousand cubic meters of sawlogs annually is calculated from growth and yield data. RENARE/FAO estimate an average mean annual increment (MAI) of 14 cubic meters per hectare per year over a 20-year rotation for the proposed Santiago-Tole project (RENARE/FAO 1983, Table #29). The sawlog portion of the total yield is 180 cubic meters, for an average of 9 cubic meters of sawlogs per hectare per year. Applying this relatively modest average annual yield, the needed plantation area is 20.4 thousand hectares.

However, it can be argued that the RENARE/FAO estimates of MAI and sawlog yield are understated. MAI at La Yeguada watershed ranges from 4-37 cubic meters--with an average of only 8 cubic meters--measured at ages 9-11. This is for plantations which have had minimum silvicultural treatment, and which in many cases were planted with poor seed on thin soils, and at less than optimal spacing. The upper extreme of 37 cubic meters

occurs in the small parcel adjacent to the nursery, where growing conditions are ideal. Across the true field plantings in the thin and rocky soils of the La Yeguada watershed, "good" soils produce 20 cubic meters (contact Elsa Bognetteau). A figure of 20 cubic meters is well within the MAI range in FAO's species trials, measured at ages 10-11 (UNDP/FAO 1980, p. 92).

Higher yield estimates obviously decrease the estimate of the required plantation base. If average MAI can be maintained as high as 20 cubic meters through careful plantation planning and soil survey, then the required plantation base falls to 14.3 thousand hectares ($14/20 \times 20.4$). If at the same time rotation age can be shortened to 15 years, the plantation base falls still further to 10.7 thousand hectares ($15/20 \times 14.3$).

In sum, the estimated minimum plantation base is between 10.7 and 20.4 thousand hectares to meet a conservative scenario of pine sawlog demand. At an estimated cost of no less than \$468 per hectare (to be discussed later), the capital requirement exceeds \$5.0-\$9.5 million (excluding all overhead and transactions costs). This level of investment needs to be greater if: (1) after some experience, Panama looks beyond import substitution to the export market; (2) effective demand develops for pine pulpwood, either through exports or through the existence in the future of a small (e.g., groundwood) pulp mill(s); and (3) import substitution goals are made more ambitious to encompass products like utility and telephone poles imported by IRHE and INTEL, respectively.

B. Financial Cash Flows

The projection of cash flows is necessarily speculative at this point in time. The projection requires knowledge of cost streams, product outputs, and stumpage prices through a rotation period. It also requires the specification of a discount rate to reflect the opportunity cost of capital.

Cost Streams.—Table B-1 shows the costs of pine reforestation, slightly simplified from the figures presented in the pre-feasibility study for the Santiago-Tole project (RENARE/FAO 1983, Table #25). The cost data essentially reflect RENARE's records and informed estimates for the current pine planting at La Yeguada.

For reforestation in the private sector oriented to commercial plantations, costs should fall below those in Table B-1. Labor efficiencies and reforestation organization could be expected to be more highly developed in private sector planting for commercial ends than in public sector planting for watershed protection. Secondly, the sites to be planted will be more accessible and will be located on more favorable topography than is current watershed reforestation at La Yeguada. Thirdly, the highly probable absence of a domestic pulpwood market for thinnings may decrease planting density to 3m x 3m (1,100 seedlings per hectare) from the 2.5m x 2.5m density proposed in Table B-1.

Table B-1. Cost Stream for a Hypothetical Hectare of Caribbean Pine Established on Degraded Pasture Land.

<u>Year</u>	<u>Practice</u>	<u>Cost/Ha/Yr</u>
0	Site preparation (1)	\$119
0	Planting stock, fertilizer, pesticides (2)	230
0	Planting (3)	59
1	Replant seedling loss (4)	13
1-3	Clean (5)	7
0-20	Stand protection and maintenance (6)	7

(1) Includes construction of access trails and fire breaks; marking and digging of planting holes; seedling transport. 18 person-days at \$6.60 per person-day.

(2) 1,600 seedlings at \$0.12 each; 1 kg. of pesticide at \$2.50; 100 kg. of fertilizer (with boron) at \$0.30 per kg.

(3) Labor for planting, application of fertilizer, and application of pesticide. 8 person-days at \$6.60 per person-day.

(4) 50 seedlings (at \$0.12) plus 1 person-day (at \$6.60).

(5) 1 person-day at \$6.60.

(6) Labor to maintain firebreaks and access trails. 1 person-day at \$6.60.

Consequently, Table B-1 should be viewed as an upper bounds consistent with computing rates of return conservatively. The present value of the cost stream (per hectare) is as follows: at a 10% discount rate, \$497; at a 15% discount rate, \$479; at a 20% discount rate, \$468.

Product Output.—In keeping with making this financial analysis conservative, the product output scenario conforms to RENARE/FAO's (1983) assumption that MAI is only 14 cubic meters per hectare per year over a 20-year rotation. The sawlog yields in Table B-2 are identical to those in the RENARE/FAO study.

However, Table B-2 assumes that post production will substitute for pulpwood production. RENARE/FAO hypothesize that 65 cubic meters of pulpwood will be produced over the 20-year rotation. Yet intermediate harvests may find their best sales potential in the form of fence posts and other types of posts and poles. Newly initiated fence post production at La Yeguada indicates that the first thinning can produce some 300-500 fence posts per hectare. Here it is assumed that the final harvest will produce as many fence posts as the first thinning (400 per hectare), and that intervening thinnings will produce posts at half this level (200 per hectare).

Stumpage Prices.—RENARE/FAO (1983, Tables #29 and #31) use \$74 and \$42 as implicit stumpage prices (per cubic meter) for sawlogs and second-quality sawlogs, respectively. These estimates are considerably higher than the estimates of "world prices" for plantation-grown pine, Table B-3. Especially in view

Table B-2. Product Output Assumptions for the Hypothetical Hectare of Caribbean Pine Plantation.

<u>Year</u>	<u>Posts</u> (No.)	<u>2nd-Quality Sawlogs</u> ----- (Cubic Meters) -----	<u>Sawlogs</u>
8	400	0	0
12	200	16	5
17	200	11	18
20	400	52	78
<u>Totals</u>	<u>1,200</u>	<u>79</u>	<u>101</u>

Table B-3. World Stumpage Prices for Plantation-Grown Sawtimber, Estimated by Sedjo (1983, Table D-1).

<u>Region and Type</u>	<u>2nd-Quality Sawlogs</u> ----- (US\$ per Cubic Meter) -----	<u>Sawlogs</u>
Chile, <u>P. radiata</u>	\$14-18	\$21-25
South Brazil, <u>P. taeda</u>	19-23	26-30
Amazonia Brazil, <u>P. caribaea</u>	19-23	26-30
South Africa, <u>P. patula</u>	16-20	23-27
Kalimantan, <u>P. caribaea</u>	14-18	21-25

of Panama's active trading sector, the country's pine sawnwood production cannot expect protection behind tariffs and other trade barriers. Therefore, this study adopts prices of \$27 per cubic meter of sawlogs, and \$19 per cubic meter of second-quality sawlogs, to represent approximate mid-values of Sedjo's (1983) data.

With respect to posts, current selling prices for fence posts produced at La Yeguáda are \$1.00 to \$1.25 per post for markets in and near Panama City. Production costs per post (including chemical treatment and transport to market outlets) are \$0.60 to \$0.70, leaving a margin of about \$0.50 as stumpage (contact Elsa Bognetteau). However, the size of the fence post market is not known, and expanded supply may cause future prices to fall if the market becomes saturated. Here a floor stumpage price of \$0.25 per post will be assumed.

Discounted Revenue Flow.--The stumpage price data and yield data can be combined to obtain the flow of gross revenue through the rotation. Gross revenue is then discounted to find its present value. Discounted cost is subtracted from discounted revenue to obtain discounted net revenue.

The first column of Table B-4a shows that nominal gross revenue totals \$4,528 per hectare. However, the present value of the discounted revenue stream is considerably lower, as expected in light of the long production period in timber growing.

Table B-4b culminates this series of estimates and computations by showing the present net value of the hypothetical

Table B-4. Projections of Gross and Net Revenue for the Hypothetical Hectare of Caribbean Pine Plantation.

B-4a. Gross Revenue

<u>Year</u>	<u>Nominal</u>	<u>Discounted</u>		
		<u>at 10%</u>	<u>at 15%</u>	<u>at 20%</u>
8	\$100.00	\$ 46.65	\$ 32.69	\$ 23.26
12	489.00	155.81	91.40	54.84
17	745.00	147.39	69.23	33.58
20	3,194.00	474.76	195.15	83.31
<u>Totals</u>	<u>4,528.00</u>	<u>824.61</u>	<u>388.47</u>	<u>194.99</u>

B-4b. Net Revenue

<u>Discount Rate</u>	<u>Present Value</u>		
	<u>Cost</u>	<u>Revenue</u>	<u>Net Revenue</u>
10%	\$497	\$825	\$328
15%	479	388	- 91
20%	468	195	-273

hectare of pine plantation at the three alternative discount rates. It can be seen that present net value is positive at the 10% rate, but negative at 15% and 20%. Table B-4b therefore implies that the internal rate of return is greater than 10% but less than 15%. More precisely, the internal rate of return is close to 13.5%.