PN-ABA-801

The FORESTRY PRIVATE ENTERPRISE INITIATIVE

School of Forest Resources
North Carolina State University

School of Forestry and Environmental Studies
Duke University

Office of International Cooperation and Development
Forest Service, Forestry Support Program and
Southeastern Forest Experiment Station

Supported and funded by
Bureau for Science and Technology
Agency for International Development

FPEI Working Papers Series
June 1987

Southeastern Center for Forest Economics Research
Box 12254, Research Triangle Park, N.C. 27709 Telephone (919) 541-4221

Financial Aspects of Contract Reforestation in the Philippines

By

Patrick B. Durst

FPEI Working Paper No. 10

FPEI Working Paper Series
June 1987

The SCFER Institutions
USDA Forest Service Southeastern Forest Experiment Station
North Carolina State University Duke University

Durst, Patrick B. 1986. Financial Aspects of Contract Reforestation in the Philippines. Southeastern Center for Forest Economics Research, Research Triangle Park, NC. FPEI Working Paper No. 10, 92 pp.

About the Authors

Patrick B. Durst is a Special Projects Coordinator for the Forestry Support Program of the USDA Forest Service, Washington, D.C.

About FPEI Working Papers

FPEI working papers are a special series of SCFER working papers issued by the Southeastern Center for Forest Economics Research for the purpose of sharing the research findings of the Forestry Private Enterprise Initiative. These papers are distributed in order to promote the timely release of new theories, data and findings. Working papers represent various levels of research findings and readers are encouraged to contact the author(s) for more information. Some of the papers may be published in modified form elsewhere. An updated list and copies of FPEI Working papers are available from the Center at P. O. Box 12254, Research Triangle Park, NC 27709, (919) 541-4221.

THE FORESTRY PRIVATE ENTERPRISE INITIATIVE

FPEI is a cooperative project executed by the Southeastern Center for Forest Economics Research (SCFER) in collaboration with the USDA Office of International Cooperation and Development (OICD) and the USDA Forestry Support Program (FSP). The primary members of SCFER are the USDA Forest Service Southeastern Forest Experiment Station, North Carolina State University, and Duke University. FPEI is supported and funded by the United States Agency for International Development (AID), Bureau for Science and Technology (S&T) [through its Office of Forestry, Environment, and Natural Resources (FENR)].

Forestry Support Program

Financial Aspects of Contract Reforestation in the Philippines

Patrick B. Durst
Special Projects Coordinator
USDA Forest Service, Forestry Support Program
P.O. Box 2417
Washington, DC 20013
Washington, D.C.

October, 1986

funded by the
U.S. Agency for International Development
Bureau for Science and Technology
Office of Forestry, Environment and Natural Resources

through
RSSA BST-5519-R-AG-2188

which is jointly managed by the
USDA Office of International Cooperation and Development
and the
USDA Forest Service, Forestry Support Program

usaid/usda

FINANCIAL ASPECTS OF CONTRACT REFORESTATION IN THE PHILIPPINES

submitted to

Philippines Ministry of Natural Resources

and

U. S. Agency for International Development

by

Patrick B. Durst
Forestry Support Program
USDA Forest Service
P.O.. Box 2417
Washington, DC 20013

October, 1986

Funding for this study was provided by the USAID/Manila Office for Rural Agricultural Development, the Forestry Private Enterprise Initiative of the Southeastern Center for Forest Economics Research, and the USDA Forest Service Forestry Support Program.

Cooperation and support were extended by the Republic of the Philippines Ministry of Natural Resources and Development Alternatives, Inc.

ACRONYMS APPEARING IN THE REPORT

BFD	-	Bureau of Forest Development
FORMSS	-	Forest Resources Management Specialists Society
FPEI	-	Forestry Private Enterprise Initiative
GOP	-	Government of the Philippines
MADECOR	-	Mandala Agricultural Development Corporation
MNR	-	Ministry of Natural Resources
MPWH	-	Ministry of Public Works and Highways
MSBF	-	Manila Seedling Bank Foundation, Inc.
MWSS	-	Metropolitan Waterworks and Sewerage System
NEA	-	National Electrification Administration
NEPC	-	National Environmental Protection Council
PICOP	-	Paper Industries Corporation of the Philippines
PROFEM	-	Program for Forest Ecosystem Management
RRDP	-	Rainfed Resources Development Project
USAID	-	United States Agency for International Development
USDA	-	United States Department of Agriculture

TABLE OF CONTENTS

		PAGE
I.	INTRODUCTION	1
	A. Purpose and Scope	1
	B. Problem Context	2
	C. Notes on Cost Computations	6
	D. Organization of the Report	8
II.	BUREAU OF FOREST DEVELOPMENT REFORESTATION	9
	A. Programs and Approach	9
	B. Expenditures and Accomplishments	10
	C. New Directions - BFD's First Reforestation Contracts	14
III.	CASE STUDIES OF CONTRACT REFORESTATION EXPERIENCE	15
	A. Manila Seedling Bank Foundation, Inc.	15
	B. Mandala Agricultural Development Corporation	22
	C. Paper Industries Corporation of the Philippines	26
	D. National Electrification Administration	30
IV.	REQUIREMENTS AND COSTS OF PROPOSED RRDP REFORESTATION	36
	A. RRDP Basic Development Assumptions	36
	B. Costs of Proposed RRDP Activities	38
	C. Related Costs	42
V.	CASH FLOW ANALYSIS OF CONTRACT REFORESTATION	44
	A. Annual Cash Flows	44
	B. Investment Analysis	48
	C. Sensitivity Analysis	52
	D. Timing of Investments	53
	E. Cost Recovery Options	55
	F. Related Policy Issues	60
VI.	SUMMARY	63
VII.	REFERENCES	65
VIII.	INDIVIDUALS CONSULTED AND PERSONS PROVIDING ASSISTANCE DURING PREPARATION OF THIS STUDY	66

PAGE

LIST OF TABLES

TABLE 1 - Area reforested annually by the government and private sectors: 1976 - 1985 4

TABLE 2 - Bureau of Forest Development costs for establishment, maintenance, and protection of narra reforestation areas 11

TABLE 3 - Summary of Bureau of Forest Development reforestation cost proposals for 1987 12

TABLE 4 - Bureau of Forest Development accomplishments and expenditures at regular reforestation project sites, 1978 - 1985 13

TABLE 5 - Manila Seedling Bank Foundation costs for establishment, maintenance, and protection of mixed species reforestation areas 18

TABLE 6 - Manila Seedling Bank Foundation accomplishments and expenditures at La Mesa and Marikina watersheds 19

TABLE 7 - MADECOR costs for establishment, maintenance, and protection of 42-hectare mahogany reforestation area in western Pangasinan 23

TABLE 8 - MADECOR costs for establishment, maintenance, and protection of 200-hectare mango reforestation area in western Pangasinan 24

TABLE 9 - MADECOR costs for establishment, maintenance, and protection of 50-hectare cashew reforestation area in western Pangasinan 25

TABLE 10 - Paper Industries Corporation of the Philippines costs for establishment, maintenance, and protection of falcata reforestation areas in eastern Mindanao 28

TABLE 11 - National Electrification Administration costs for establishment, maintenance, and protection of biomass plantations in Camarines Sur 32

TABLE 12 - National Electrification Administration costs for establishment, maintenance, and protection of biomass plantations in Ilocos Norte 33

PAGE

TABLE 13 - National Electrification Administration accomplishments and expenditures, 1980 - 1984 35

TABLE 14 - RRDP projected costs for establishment, maintenance, and protection of reforestation areas (500-hectare contract, 18-30% slope) 40

TABLE 15 - RRDP projected costs for establishment, maintenance, and protection of reforestation area (500-hectare contract, greater than 50% slope) 41

TABLE 16 - Description of conditions and development costs at selected reforestation sites in the Philippines 43

TABLE 17 - Cash flow model (per hectare) for typical contract reforestation project - - production forest 45

TABLE 18 - Cash flow model (per hectare) for typical contract reforestation project - - protection forest 49

TABLE 19 - Annual cash flows and investment analysis for RRDP production and protection contract reforestation 51

TABLE 20 - Sensitivity analysis of internal rate of return to changes in costs and yields for production forests 54

TABLE 21 - Timing of payments required for 500-hectare reforestation contracts during initial establishment period 56

PAGE

APPENDIX A - Contract Reforestation Detailed Computation of Cost Estimates 69

APPENDIX B - Maintenance/Harvesting/Revenue Assumptions for Production Forest 85

APPENDIX C - Maintenance/Harvesting/Revenue Assumptions for Protection Forest 91

I. INTRODUCTION

A. Purpose and Scope

This report is submitted to the Philippine Ministry of Natural Resources (MNR) and the U. S. Agency for International Development (USAID) Office for Rural Agricultural Development, Manila, Philippines. USAID/ORAD partially funded the evaluation from grants provided to the Government of the Philippines (GOP) under the Rainfed Resources Development Project (RRDP). Additional support for the study was provided by the Forestry Private Enterprise Initiative (FPEI), a project of the Southeastern Center for Forest Economics Research, the USDA Forest Service Forestry Support Program, and USAID's Bureau for Science and Technology. The primary clients for the data and observations presented in this report are assumed to be reforestation planners with the MNR and USAID, and contractors working for these two agencies.

The focus of the study is cash flow and financial viability of contract reforestation. The RRDP is currently being redesigned to incorporate more contracting ventures. Similarly, the MNR's Bureau of Forest Development (BFD) is interested in expanding reforestation efforts by contracting the services of private companies. This report is intended to serve as a tool for USAID and MNR policymakers in these efforts.

B. Problem Context

As early as 1978, the National Environmental Protection Council (NEPC) identified 13 provinces in the Philippines where over half the land area was already badly eroded (NEPC 1978). LANDSAT photographs taken 2 years later reveal approximately 5 million hectares of grass and open areas existed within zones officially designated as forest land by 1980. That total is believed to have increased by another 900,000 hectares in the last 5 years (Revilla 1985). Logging, upland farming, fires, insects, and disease continue to reduce forest cover at an alarming rate.

The effects of large-scale deforestation are readily evident in the Philippines. Deteriorating watershed conditions result in devastating floods that have become the rainy season rule rather than the infrequent and isolated inconvenience of earlier decades. Property damage and crop losses from floods total in the billions of pesos each year. Erosion is rapidly reducing the productivity of the uplands, and increasing sediment loads of streams clog reservoirs and irrigation systems. During dry seasons, the reduced water retention capacity of denuded watersheds renders many irrigation systems useless. In some areas of the country even wood for cooking and basic construction is now scarce.

The need to offset forest destruction has not gone unnoticed, but the record of reforestation accomplishments in the Philippines is less than glamorous (Serrano 1984). Regular BFD reforestation projects have planted a total of only 371,643 hectares since 1916, or about 5,300 hectares per year. Although planting efforts intensified in the last ten years, the government and private sectors planted an average of only 57,284 hectares per year since 1976. Moreover, the rate of planting has fallen by two-thirds since 1983 (Table 1).

The need to dramatically accelerate the pace of reforestation in the Philippines is undeniable. No single approach will solve the problem, however. Traditional reforestation strategies are still appropriate for some situations, but they must be complemented with innovative new approaches if reforestation is to be significantly advanced.

One such alternative -- contract reforestation -- has recently captured the attention of a number of forestry planners from the MNR and other organizations. The contract approach is analogous to the system employed in the road and building construction industry where the private sector already plays a vital role supporting government development objectives. Under the contract reforestation scheme, companies are contracted to rehabilitate specified tracts of land within an agreed period (usually 3 to 5 years). After the initial rehabilitation

Table 1 Area Reforested Annually by the Government and Private Sector : 1976 - 1985

Year	Government Sector			Private Sector				Grand Total
	Total	BFD	Other Agencies	Total	Timber Licenses	ITP/TF AFF	PD 1153 & Others	
	ha							
1976	23,228	20,977	2,251	8,505	8,275		230	31,73
1977	33,365	23,677	9,688	19,898	17,276	1,088	1,534	53,26
1978	44,686	34,343	10,343	33,739	22,006	5,011	6,722	78,42
1979	51,858	35,305	16,553	27,539	20,132	545	6,862	79,39
1980	39,881	32,956	6,925	20,635	15,579	1,162	3,894	60,51
1981	33,296	30,707	2,589	31,245	20,096	6,482	4,667	64,54
1982	35,201	31,202	3,999	28,061	21,588	972	5,501	63,26
1983	42,239	27,155	15,084	36,299	31,703	3,554	1,042	78,53
1984	16,088	15,520	568	22,847	14,186	7,011	1,650	38,93
1985	12,684	9,965	2,719	11,607	8,819	1,500	1,288	24,29

Source: Philippine Forestry Statistics, 1984. p. 45
BFD Annual Report, 1985. p. 63 - 64

contract is completed, the established plantation is transferred to the government (i.e., the BFD) for protection and management. Alternatively, a maintenance contract is signed, allowing the company limited utilization rights in exchange for protecting the area and a share of the profits. The concept is based on the premise that competition in the private sector forces more efficient management and mobilization of resources than is normally achieved by government agencies. The contract system is also more performance-oriented since contractors are paid only when work is completed in accordance with specified guidelines.

The concept of contract reforestation is not new. It has been practiced for many years in other countries, including the United States. In the Philippines, proponents have advocated the contract approach at least since the 1970s (Bucad 1978; Bucad and Donaso 1985). The Manila Seedling Bank Foundation, Inc. (MSBF) is generally credited as the first company to successfully implement large-scale reforestation contracts, although timber companies and government agencies have a long history of contracting individuals or groups to perform specific reforestation activities (e.g., site preparation, planting, weeding).

Although some contract reforestation experience has been gained in the Philippines, little documenation of these efforts is available to forestry planners. Cost data are

especially fragmented. Therefore, it is difficult for policymakers and managers to adequately allocate funds for reforestation contracts or evaluate proposals from potential contractors. This report helps close the information gap on contract reforestation costs by reviewing the experience of existing contractors and examining the cash flows likely to result under contracts being designed by the RRDP. Special emphasis is placed on expected revenues as these have significant implications for proposed schemes for recovering reforestation costs.

C. Notes on Cost Computations

A great deal of confusion surrounds the costs required to reforest land in the Philippines. Naturally, costs vary with different climatic, edaphic, topographic, and social conditions. Beyond these differences, however, addition confusion stems from three sources:

1. Different accounting procedures are practiced by various organizations, leading to questions about what expenditures are charged as reforestation costs. Road construction costs, for example, may be charged as a cost of harvesting by one company, while to others it is a cost of reforestation. Still others may be fortunate enough to pass road costs on to the Ministry of Public Works and Highways, in which case such costs may not appear in their accounts at all.

2. Costs incurred in different years are often compared directly, with no adjustments made for inflation. For example, it is not unusual to see 1980 costs of one organization compared with the 1983 costs of another, with no adjustments. These types of proverbial apple-and-orange (mango-and-chico?) comparisons often lead to inappropriate conclusions with respect to the cost-effectiveness of various reforestation efforts, especially when costs are compared across the high-inflation years of 1978-1981 and 1983-1985.

3. Consideration is often made of "hectares planted" rather than "hectares surviving" (i.e., areas "effectively" reforested). If a firm spends ₱7,000 per hectare to plant, but achieves only 50 percent survival, its "effective" cost of reforestation is actually ₱14,000 per hectare, not ₱7,000.

As much as possible, these areas of confusion are mitigated in this report. Efforts were made to group costs systematically across each organization surveyed. This occasionally required some shuffling of costs to obtain consistent categorization. In cases where expenditures are unknown or unobtainable (e.g., road costs are unavailable for some organizations), data gaps are noted (e.g., Tables 10, 11, 12). To overcome the problem of comparing peso expenditures made in different years, adjustments are made according to annual changes in the Consumer Price Index. Costs adjusted to 1985

values (e.g., Tables 10, 11, 12) can be considered directly comparable to current 1986 values since inflation has been held in check since the end of 1985. All future costs and revenues are presented in real 1986 values, with no attempts to predict inflationary trends. Documentation of the physical inputs (e.g., worker-days of labor, kilograms of fertilizer, number of seedlings, etc.) is also provided whenever possible. Finally, when survival rates are known to be less than 80 percent, notation is provided and the "effective" cost of reforestation is estimated.

D. Organization of the Report

Four main sections follow. Section II reviews traditional BFD reforestation programs to provide an historical perspective of costs and accomplishments. Section III examines the experience of four selected organizations that are now active in contract reforestation. Section IV provides cost analysis of "typical" contract reforestation projects as proposed under the redesigned RRDP. Section V focuses on cash flow analysis and cost recovery aspects.

II. BUREAU OF FOREST DEVELOPMENT REFORESTATION

A. Programs and Approach

Since its formation in 1972, the BFD has been the government's primary reforestation agency. The BFD's Reforestation and Afforestacion Division currently manages 97 regular reforestation projects, 4 special reforestation projects, and the government's Program for Forest Ecosystem Management (PROFEM). In addition, the BFD cooperates on 6 foreign-assisted reforestation projects (MNR/BFD 1984). Regular reforestation projects account for about 75 percent of all BFD planting.

Regular BFD reforestation projects follow a traditional approach to reforestation development. Emphasis is placed on planting permanent trees. Analysis of the guidelines and budgeted costs for regular BFD reforestation projects (Table 2) confirm this bias of the BFD for traditional climax species planting. Species like narra and mahogany are most commonly included in regular BFD projects, and seldom is allowance made for planting nurse trees or short-term economic species. Watershed protection appears to be the primary objective of the BFD, as no provisions are made for harvesting stands which have been developed. Contingencies for dealing with claimants and settlers in reforestation areas are usually limited.

B. Expenditures and Accomplishments

Tables 2 and 3 provide clues to the reasons for BFD's often ineffective reforestation programs. Especially noticeable is the minimal amounts budgeted for plantation maintenance and protection (i.e., patrolling and fire control). Allotments for site preparation are also relatively low.

Although Tables 2 and 3 indicate the BFD budgets approximately ₱7,000 to ₱9,000 per hectare for reforestation, analysis of actual BFD expenditures (adjusted to 1985 values) indicates a figure closer to ₱11,400 is spent planting each hectare (Table 4). Moreover, even Table 4 does not reflect the "effective" costs of BFD's regular reforestation projects since it is widely recognized that survival rates at BFD planting sites are rarely better than 60 percent (Bulletin Today 1984). BFD officials unofficially acknowledge that survival rates average less than 50 percent. Effective costs of BFD reforestation are therefore likely to be at least ₱22,000 per hectare.

Various facets of the BFD's operations have been identified as contributing to the agency's lackluster reforestation performance. Reviewing such limitations in this report would have little constructive value, however. The historical record of BFD's reforestation efforts is provided merely to underscore the need for a change in direction for the country's reforestation program.

Table 2. Bureau of Forest Development costs for establishment, maintenance, and protection of narra reforestation areas. (2 x 2 spacing).
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook					
3. Roads & trails	1 km trails/50 ha		3.3	142.07	1.6
4. Field office/bodega					
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
labor	P42.62/day		65.6	2,793.74	
fertilizer	1 gm/sdlg	2.8 kg		11.00	
plastic bags	10% mort. allow.	2,750 pcs.		330.00	
seeds	P.75/liter	28.8 l		21.56	
subtotal				3,156.30	36.2
8. Site preparation	strip clearing		17.2	731.64	8.4
9. Soil conservation					
10. Planting			42.0	1,790.03	20.5
11. Maintenance					
labor			17.0	1,122.60	
fertilizer	40 gm/sdlg	100.0 kg		400.00	
subtotal				1,522.60	17.4
12. Supervision & mgn't				1,386.60	15.9
13. Tools & misc.					
GRAND TOTAL				8,729.24	100.0

Source: Bureau of Forest Development, Reforestation and Afforestation Division, 1986.

Table 3 Summary of Reforestation Cost Proposals for 1987, as Submitted to the BFD Planning and Evaluation Division by Regional Offices.

Region	Seedling Production Cost/ Seedling	Cost/ ha.	Establishment	Protection	Total
	pesos	- - - - - - - - - -	pesos/ha	- - - - - - - -	
1	0.90	2,475	3,700	615	6,790
2	0.82	2,255	4,613	126	6,994
3	1.61	4,428	3,330	615	8,373
4	1.61	4,428	3,330	615	8,373
5	0.95	2,613	5,998	280	8,891
6	0.82	2,255	2,144	290	4,689
7	0.97	2,668	5,225	359	8,252
8	-	-	-	-	-
9	2.21	6,078	3,618	415	10,111
10	0.57	1,568	3,080	284	4,932
11	0.52	1,430	3,214	236	4,880
12	1.05	2,888	5,125	218	8,231
Mean	1.09	3,008	3,943	368	7,320

Source: BFD Planning and Evaluation Division
Note: Proposals do not include costs of management and administration or infrastructure development.

Table 4 Bureau of Forest Development Accomplishments and Expenditures at Regular Reforestation Project Sites, 1978 - 1985

	Area Planted	Expenditures (actual)	Expenditures (1985 values)	Reforestation Cost (1985 values)	Effective Cost (assuming 50% survival)
	ha.	--- million pesos ---		---- pesos/ha. ----	
1978	34,343	91.60	322.97	9,404	18,808
1979	35,305	91.65	275.92	7,815	15,630
1980	22,800	100.92	256.17	11,236	22,472
1981	19,996	124.77	280.04	14,005	28,010
1982	19,354	135.15	275.15	14,217	28,434
1983	14,201	128.68	238.18	16,772	33,544
1984	11,306	110.71	136.30	12,056	24,112
1985	9,157	114.48	114.48	12,502	25,004
Total	166,462		1,899.21		
Mean				11,409	22,818

Source: BFD Annual Reports, 1978 - 1985 (for area planted).
BFD Accounting Division, 1986 (for actual expenditures).

Note: 1985 values calculated by adjusting 1978 - 1984 expenditures according to changes in the Consumer Price Index as reported in the Phil. Statistical Yearbook, 1985.

C. New Directions - BFD's First Reforestation Contracts

To their credit, conscientious BFD officials readily concur with calls for "new" reforestation approaches, including the contracting of private firms. The BFD has issued at least four contracts already. These include 200-hectare establishment and 700-hectare maintenance contracts with the Manila Seedling Bank Foundation in Marikina, a 42 hectare contract with MADECOR in western Pangasinan, a 1,600-hectare contract with the Forest Resources Management Specialists Society (FORMSS) in Tarlac, and a contract with Blue-Green Agroforest and Marine Resources covering 277 hectares, also in Tarlac.

These contract arrangements exhibit various degrees of success, from wholly satisfactory performance to almost totally unsatisfactory performance. Problems with existing contracts relate to the lack of formal procedures for evaluating proposals, delays in the payments for work completed, evaluation difficulties, and failure to clearly specify performance standards and contract conditions. Despite these difficulties, the BFD has gained valuable experience and has taken the first steps toward developing a sound contracting program. MNR planners, along with RRDP advisers, are drawing from these first contracting experiences of the BFD to establish firm guidelines for contractors, managers, administrators, and evaluators.

III. CASE STUDIES OF CONTRACT REFORESTATION EXPERIENCE

While a number of government agencies and private companies are showing strong interest in the concept of contract reforestation, a few such organizations already have experience with the contract approach. Information and data on the contracting experiences of Manila Seedling Bank Foundation, Inc. (MSBF), Mandala Agricultural Development Corporation (MADECOR), Paper Industries Corporation of the Philippines (PICOP), and the National Electrification Administration (NEA) are presented in the following subsections. These data have been provided by the respective orgnizations in the interest of improving the system of reforestation in the Philippines. Nevertheless, the proprietary nature of the data should be respected. Two of the companies (i.e., MSBF and MADECOR) are, in fact, likely competitors for future reforestation contracts. With this in mind, USAID and MNR officials should restrict the circulation of this portion of the report.

A. Manila Seedling Bank Foundation, Inc.

The MSBF has the most extensive experience implementing reforestation contracts of any firm in the country. Their records are also among the most complete.

The MSBF currently has two formal contracts for reforestation. In addition, the firm leases an industrial tree

farm area and is developing three other areas for the national government.

MSBF's contracts include 1,785 hectares in the La Mesa Dam Reservoir area and 700 hectares in the Marikina Watershed Reservation. The contracts for the two areas were awarded by the Metropolitan Waterworks and Sewerage System (MWSS) and the BFD, respectively. Planting at both sites was completed in 1983 and the MSBF is now managing the sites under maintenance contracts.

At the La Mesa site, a fairly elaborate planting scheme developed. Climax trees (usually gmelina) were planted 4 m x 4 m, with nurse trees such as auriculiformis and ipil-ipil planted 2 m x 2 m or 4 m x 1 m. Ipil-ipil was planted 1 m x 1 m, or even closer, in 20 meter strips along the roads to serve as firebreaks.

MSBF operations are substantially more capital intensive than most reforestation efforts observed in the Philippines. The firm produces virtually all its seedlings at the highly automated central nursery in Quezon City. Seedlings are then transported to planting sites by trucks. Site preparation is mostly done using heavy tractors and bulldozers. A good road system is developed to allow the passage of the tractors used in site preparation and to facilitate later patrol operations and marketing of products.

Material inputs are also substantial. At La Mesa, where soil pH is normally below 5.0, up to 3 tons of lime was applied prior to planting. Seedlings also receive generous applications of fertilizer.

Table 5 outlines in more detail the costs incurred by the MSBF to reforest land using the nurse tree/climax tree/densely-planted firebreak system. Most notable are the large expenditures for roads, site preparation, and maintenance.

The costs presented in Table 5 are verified by detailed accountants' records at the MSBF. Yearly expenditures at La Mesa and Marikina, adjusted to 1985 values, are shown in Table 6. Average costs per hectare for developing plantations at these two sites are about ₱18,000 and ₱16,000, respectively, in 1985 values. If investments in the central nursery and high-level administrative talent were charged more heavily to individual projects, the average costs for development might approach ₱20,000 per hectare.

A visit to the La Mesa project attests to the effectiveness of MSBF's methods. Survival and growth are good to excellent. Lessons from the MSBF experience are simple. Agencies must be willing to invest money in reforestation to get results. Secondly, experienced professional personnel, willing to live at the development site, are a must. Thirdly, development

Table 5. Manila Seedling Bank Foundation costs for establishment, maintenance, and protection of mixed species reforestation areas.

Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook					
3. Roads & trails					
roads	2 km/100 ha				
trails	1 km/100 ha				
subtotal				1,650.00	8.3
4. Field office/bodega	1/200 ha			350.00	1.8
5. Laborers' quarters	1/200 ha			650.00	3.3
6. Nursery house					
7. Nursery operations	at cent. nursery				
gmelina	4 x 4 spacing	688 sdlg		495.36	
auriculiformis	2 x 2 spacing	2,475 sdlg		742.50	
ipil-ipil	for firebreaks	1,031 sdlg		257.50	
transport	by truck	4,194 sdlg		383.68	
subtotal				1,879.04	9.5
8. Site preparation					
manual brushing	1,200 sq m/w-d		8.3	291.67	
mechanical	heavy tractor	.8 days		2,880.00	
fire lines			2.4	84.58	
subtotal			10.7	3,256.25	16.4
9. Soil conservation					
10. Planting					
labor	P35/day		45.7	1,600.55	
fertilizer	30 gm/sdlg	114 kg		657.57	
lime	3 tons/ha	60 bags		1,548.00	
subtotal				3,806.12	19.2
11. Maintenance					
labor			87.4	3,059.35	
fire tower	1/100 ha			100.00	
fertilizer	100 gm/sdlg	381 kg		1,906.00	
subtotal				5,065.35	25.5
12. Supervision & mgn't					
salaries				2,370.00	
operating exp.				840.00	
subtotal				3,210.00	16.2
13. Tools & misc.					
GRAND TOTAL				19,866.76	100.0

Source: Manila Seedling Bank Foundation, Inc., 1986.

Table 6. Manila Seedling Bank Foundation accomplishments and expenditures at La Mesa and Marikina Watersheds.

Year	Area planted	Expenditures (actual)	Expenditures (adjusted to 1985 values)
	ha	thousand pesos	
La Mesa			
1978	100	448.9	1,582.8
1979	130	632.7	1,898.7
1980	115	902.5	2,290.9
1981	440	3,718.0	8,344.8
1982	500	4,194.4	8,539.0
1983	500	4,507.8	8,343.5
1984	--	1,203.4	1,481.5
Total	1,785	15,607.7	32,481.2
Average development cost per hectare (1985 value).....			P18,197
Marikina			
1980	130	566.7	1,438.6
1981	170	1,593.5	3,576.5
1982	--	360.5	733.9
1983	400	2,618.5	4,846.6
1984	--	683.6	841.6
Total	700	5,822.8	11,437.2
Average development cost per hectare (1985 value).....			P16,339

Source: Manila Seedling Bank Foundation, Inc., 1986
Note: 1985 values calculated by adjusting actual expenditures according to changes in the Consumer Price Index as reported in the Philippine Statistical Yearbook, 1985.

demands a multi-year commitment, preferably with a vested economic interest in the success of the development.

MSBF costs can certainly be reduced somewhat without jeopardizing success. Many sites could operate effectively with a less developed road network, for example. Substituting labor for mechanized site preparation is another option that would reduce costs. And, as the MSBF has learned, planting more acid-tolerant species reduces the need for heavy lime applications.

Reforestation is rarely inexpensive, however. Although not all areas require the level of inputs used by the MSBF, some areas may demand even more substantial inputs.

After establishing plantations at La Mesa and Marikina, the MSBF entered into long-term maintenance contracts (7-8 years) with its client agencies. The contracts allow the MSBF to harvest and sell products from the plantations under prescribed management plans. In exchange, the MSBF manages and protects the areas at no charge to its clients. In the La Mesa case, net income from the operations is shared with the MWSS on a 50-50 basis.

Leafmeal, fuelwood, and charcoal are currently produced at the La Mesa site. Leafmeal is produced from ipil-ipil leaves harvested from firebreaks. Leaves are dried and

milled, then sold to feed companies for about ₱2.20 per kilogram. Yields range from 4 to 5 tons per hectare per year up to 8 to 9 tons on well-managed sites. Since approximately one-tenth of the area is occupied with ipil-ipil firebreaks, each hectare produces at least 400 kilograms of leaves each year.

Plantations are thinned about 5 years after thinning, with a second thinning expected 2 years after the first. A minimum of 400 climax trees per hectare are retained for watershed protection. Yields from thinnings occasionally approach 30 tons per hectare, but probably [redacted] average about 20 tons per hectare.

Fuelwood and charcoal are produced from plantation thinnings and nurse tree removals. Fuelwood is cut into 1-meter lengths and sold as industrial fuel or household firewood. The MSBF currently receives about ₱450 per ton for fuelwood delivered to buyers in Metro Manila. Charcoal is produced in six kilns, each capable of yielding about 1 ton per week. Charcoal sells for about ₱1,650 per ton delivered.

In the first 8 months of 1986, the MSBF sold a monthly average of 233 tons of fuelwood, at ₱423/ton; 20.8 tons of charcoal, at ₱1,650/ton; and 2.4 tons of leafmeal, at ₱2,100/ton. Monthly income averaged ₱137,968 or ₱77/ha/month (₱928/ha/yr). Normal costs of production and sales average 50 percent of gross

revenues. Additional monthly maintenance and protection costs are estimated at ₱60,000 or ₱34/ha/month (₱403/ha/yr). This translates to a potential net revenue of ₱61 per hectare per year under present conditions. It should be noted that the MSBF halted harvesting operations for almost 4 months in early 1986. Under favorable conditions, the MSBF expects to increase monthly sales of fuelwood, charcoal, and leafmeal to 300, 20, and 50 tons, respectively. With those sales, net income would increase to about ₱487 per hectare per year.

B. Mandala Agricultural Development Corporation

MADECOR currently has a contract with the BFD to reforest a 42-hectare tract in western Pangasinan using mahogany and other forest species. The firm has also entered into a joint venture with the Natural Resources Development Corporation (NRDC) to develop 3,000 hectares of land for mango and cashew production adjacent to the BFD site. The Pangasinan sites present moderate to harsh conditions with steep slopes and rocky soil. Access to the mango and cashew sites is difficult.

MADECOR is planting mahogany spaced 3 m x 4 m, while cashews are planted 4 m x 4 m and mangoes are spaced 10 m x 10 m (100/hectare).

Tables 7, 8, and 9 detail the costs incurred by MADECOR in developing the mahogany, mango, and cashew plantations respectively. Most notable are the costs incurred for plantation

Table 7. MADECOR costs for establishment, maintenance, and protection of 42 hectare mahogany reforestation area in western Pangasinan (3 x 4 spacing).
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
1. Map preparation			worker-days	pesos	
2. Project logbook					
3. Roads & trails					
4. Field office/bodega	20 sq m/42 ha			57.14	0.4
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
labor			5.7	200.00	
seedlings	purchased	1,200 sdlg		720.00	
nursery layout	25 sq m total	.6 sq m		5.95	
pesticide		.07 liters		13.21	
fertilizer	10 gm/sdlg	1.2 kg		5.35	
plastic bags		714 pcs.		121.43	
seeds		.07 bags		1.79	
subtotal				1,067.73	7.9
8. Site preparation			13.0	455.00	3.4
9. Soil conservation					
10. Planting					
labor	P35/day		58.2	2,036.38	
fertilizer	100 gm/sdlg	33.3 kg		374.85	
subtotal				2,411.23	17.9
11. Maintenance					
labor	incl. 6 weedings		143.8	5,033.78	
fertilizer	100 gm/sdlg/yr	166.6 kg		749.70	
pesticide	3 applications	2.5 liters		462.50	
subtotal				6,245.98	46.4
12. Supervision & mgn't					
salaries				2,352.86	
operating exp.				535.71	
subtotal				2,888.57	21.4
13. Tools & misc.				344.71	2.6
GRAND TOTAL				13,470.36	100.0

Source: Mandala Agricultural Development Corporation, 1986.

Table 8 . MADECOR costs for establishment, maintenance, and protection of 200 hectare mango reforestation area in western Pangasinan (10 x 10 spacing).

Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook				200.00	1.4
3. Roads & trails					
4. Field office/bodega	100 sq m/200 ha			250.00	1.7
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
labor			3.0	105.00	
water supply	1 unit/200 ha			125.00	
holding area	1000 sq m/200 ha	5 sq m		50.00	
seedlings	purchased	115 sdlg		1150	
subtotal				1,430.00	9.9
8. Site preparation			16.3	568.75	3.9
9. Soil conservation					
10. Planting			18.5	645.70	4.5
11. Maintenance					
labor			71.7	2,509.00	
fertilizer	300 gm/sdlg/yr	166.6 kg		405.00	
pesticide	1 l/ha/yr	3 liters		555.00	
subtotal				3,469.00	23.9
12. Supervision & mgn't					
salaries				4,972.11	
operating exp.				1,106.17	
subtotal				6,078.28	41.9
13. Tools & misc.				1,858.40	12.8
GRAND TOTAL				14,500.21	100.0

Source: Mandala Agricultural Development Corporation, 1986.

Table 9. MADECOR costs for establishment, maintenance, and protection of 50 hectare cashew reforestation area in western Pangasinan (4 x 4 spacing).

Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook				200.00	1.3
3. Roads & trails					
4. Field office/bodega					
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
labor			.6	21.00	
seedlings	purchased	880 sdlg		3,080.00	
pesticide		.1 liter		18.50	
subtotal				3,119.50	20.7
8. Site preparation			8.0	280.00	1.9
9. Soil conservation					
10. Planting			55.4	1,937.66	12.9
11. Maintenance					
labor	incl. 6 weedings		103.4	3,617.50	
fertilizer	inc. each yr.	343.8 kg		1,546.38	
pesticide	1 l/ha/yr	3 liters		555.00	
subtotal				5,719.38	38.0
12. Supervision & mgn't					
salaries				2,628.00	
operating exp.				882.00	
subtotal				3,510.00	23.3
13. Tools & misc.				303.36	2.0
GRAND TOTAL				15,069.90	100.0

Source: Mandala Agricultural Development Corporation, 1986.

maintenance, especially for the mahogany and cashew areas. Significant expenditures are made for multiple weedings and heavy fertilizer applications.

Weaknesses in the MADECOR development schemes are the lack of expenditures for roads and trails, limited implementation of fire control measures, and reliance on single-species planting designs (for the fruit production areas). Furthermore, MADECOR purchased many of the seedlings they have planted so far, thus increasing the cost of their operation and depriving the program of the opportunity to select only top-quality seedlings for planting.

Notwithstanding the weaknesses cited above, MADECOR is doing a respectable job of developing a rather difficult site. Especially commendable is their weeding and maintenance program.

C. Paper Industries Corporation of the Philippines

PICOP operates a 182,000 hectare concession in eastern Mindanao, including about 30,000 hectares of land the company has reforested. The area is very favorable for plantation development, as rainfall is plentiful and evenly distributed, the topography is gentle, and the soil is fertile. Furthermore the company has a fabulous road system that was developed to facilitate harvesting of the primary and secondary forests in the concession. The excellent road system allows PICOP to produce

most of its seedlings at a central nursery and transport them at relatively little cost to any planting site. The roads also allow workers and managers to commute to work sites each day, thus eliminating the need for costly field offices and temporary quarters for laborers.

PICOP's primary reforestation species are falcata, bagras, and Caribbean pine. Falcata is planted 3 m x 3 m, for a total of 1,111 trees per hectare. Bagras is planted 3 m x 3 m or 3 m x 2 m, and pine is planted 3 m x 3 m or 4 m x 4 m.

PICOP has utilized a partial contract approach to reforestation for several years. Contracts are issued to individuals and groups for site preparation, planting, and maintenance, while PICOP retains management contral and shoulders all responsibility for producing seedlings.

Table 10 outlines PICOP's costs of reforestation under the partial contract system. The company's largest expenditures are for maintenance of seedlings and supervision and management. Essentially all maintenance costs are for weeding. Little or no fertilizer is applied because the soil is relatively fertile. Furthermore, the consistent and plentiful rainfall minimizes the need for protection against fire. Growing conditions are favorable for both seedlings and competing weeds, however,

Table 10. Paper Industries Corporation of the Philippines costs for establishments, maintenance, and protection of falcata reforestation areas in in Eastern Mindanao
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook					
3. Roads & trails					
4. Field office/bodega					
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations	P1.30/sdlg	1,222 sdlg		1,588.60	13.2
8. Site preparation	P.10/sq m		28.9 (est)	1,012.05	8.4
9. Soil conservation					
10. Planting	P1.11/sdlg		38.8 (est)	1,357.41	11.2
11. Maintenance	5 weedings		109.4 (est)	3,829.85	31.7
12. Supervision & mgn't	incl. evaluation			3,120.00	25.8
13. Tools & misc.					
14. Incentive payment	85% sdlg) 2 m			1,162.20	9.6
GRAND TOTAL				12,070.11	100.0

Notes:

1. Table does not include costs of roads which PICOP charges against harvesting account
2. No field offices are established; management is from central office only.
3. Costs presented are derived by adjusting 1983 and 1984 data for inflation; actual 1984 expenditures averaged 19% less; 1983 expenditures 46% less.

necessitating a minimum of five weedings before seedlings are able to shade out competition.

Supervision and management costs of the company are significant because of the very close monitoring PICOP maintains over the plantation establishment process. Evaluation teams are sent to plantation sites nearly every week to monitor the progress of contractors, and strict compliance with specifications is demanded before contractors are paid.

PICOP's practice of incentive payments is especially innovative. Contractors are paid a sizeable sum (about ₱1.25) for each sapling greater than 2 meters in height at the time the established plantation is turned over to PICOP (i.e., 18 months after planting falcata, 24 months for bagras, 36 months for pines). Payments often total over ₱1,000 per hectare. PICOP has found the system of rewards greatly improves the quality of plantations developed by contractors.

Lessons from the PICOP experience relevant for the RRDP and the MNR include the importance of close monitoring and strict evaluation of contractors' performance. Additionally, USAID and MNR planners should consider incorporating an incentive system similar to PICOP's to encourage contractors to perform above minimum standards.

D. National Electrification Administration

The NEA, in cooperation with rural electric cooperatives, is developing biomass plantations at more than 40 locations throughout the country. Wood from the plantations provides the basic fuel supply for electric power plants the agency is constructing under the Dendro Thermal Development Program.

Ipil-ipil was planted almost exclusively at all the dendro thermal project sites until recently when NEA began more diversified planting. Trees are spaced 1 m x 1 m (10,000/ha) at most sites. Where conditions allow, direct seeding is used.

The NEA and the rural electric cooperatives employ a modified contract approach for reforestation. Farmer cooperatives are essentially given control of blocks of land (averaging 100 hectares per 10-member cooperative) and partially compensated (in the form of low-interest loans) for the cost of developing plantations. Farmers are allowed - even encouraged - to plant food crops within the plantation area at the time of site preparation and through the first year of plantation growth. This provides some immediate economic benefit and enhances fire protection. Payments are made according to accomplishment. The major incentive for farmers is that they retain economic interest in the plantations for a minimum of 25 years and benefit from the sale of wood which is harvested. Technical assistance and

logistical support are provided by the NEA and the rural electric cooperatives.

Tables 11 and 12 provide details of the costs of establishing plantations at two representative NEA sites. Actual expenditures from 1980 to 1984 are adjusted to 1985 values for comparative purposes.

The site in Camarines Sur has good growing conditions and favorable soil. The area is very mountainous, however, and access is extremely limited. The favorable soil and climatic conditions allow farmers to successfully plant ipil-ipil seeds directly in the field, thus eliminating the cost of nursery operations. The major costs at the Camarines Sur site are for maintenance and supervision and management. Supervision and management are relatively costly because of the isolated location of the site and the lack of roads and trails within the plantation area.

The Ilocos Norte site is extremely adverse for plantation establishment. The area is very steep, rocky, and highly eroded. Rainfall is concentrated in a 4-month period. Fire is a major threat to young plantations. Access is limited. Seedlings must be potted to improve the chances of survival. Moreover, maintenance costs are substantial since numerous weedings are necessary and frequent fire patrols are required.

Table 11. National Electrification Administration costs for establishment, maintenance, and protection of biomass plantations in Camarines Sur (1 x 1 spacing).
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook					
3. Roads & trails					
4. Field office/bodega				405.31	5.6
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
8. Site preparation					
labor			23.6 (est)	826.09	
materials				22.60	
subtotal				848.69	11.8
9. Soil conservation					
10. Planting	direct seeding				
labor			6.4 (est)	225.30	
seeds				232.84	
subtotal				458.14	6.3
11. Maintenance					
labor			75.8 (est)	2,651.39	
fertilizer				111.26	
subtotal				2,762.65	38.3
12. Supervision & mgn't					
salaries				1,702.71	
operating exp.				1,020.57	
subtotal				2,723.28	37.7
13. Tools & misc.				18.36	0.3
GRAND TOTAL				7,216.43	100.0

Source: National Electrificatoin Administration (derived from actual expenditures incurred from 1981-1984, adjusted for inflation).

Notes:
1. Labor costs are derived from actual expenditures; worker-days of labor are estimated.
2. Costs do not include all expenditures for technical assistance provided by the NEA central office, foreign consultants, or the cost of constructing access roads.

Table 12. National Electrification Administration costs for establishment, maintenance, and protection of biomass plantations in Ilocos Norte (1 x 1 spacing).

Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation					
2. Project logbook					
3. Roads & trails					
4. Field office/bodega				251.41	2.7
5. Laborers' quarters					
6. Nursery house					
7. Nursery operations					
labor			23.8 (est)	833.40	
seeds				98.78	
plastic bags				366.15	
fertilizer				18.30	
pesticide				7.68	
subtotal				1,324.31	14.2
8. Site preparation			32.5 (est)	1,136.14	12.2
9. Soil conservation					
10. Planting			18.1 (est)	631.89	6.8
11. Maintenance					
labor			134.3 (est)	4,701.79	
fertilizer				127.35	
subtotal				4,829.14	51.8
12. Supervision & mgn't					
salaries				590.81	
operating exp.				511.05	
subtotal				1,101.86	11.8
13. Tools & misc.				46.07	0.5
GRAND TOTAL				9,320.82	100.0

Source: National Electrificatoin Administration (derived from actual expenditures incurred from 1980-1984, adjusted for inflation).

Notes:
1. Labor costs are derived from actual expenditures; worker-days of labor are estimated.
2. Costs do not include all expenditures for technical assistance provided by the NEA central office, foreign consultants, or the cost of constructing access roads.

In general, NEA reforestation operations are inexpensive when considered on the basis of costs per hectare planted (e.g., ₱7,216/ha at Camarines Sur and ₱9,321/ha at Ilocos Norte). This is because compensation made to farmers is in the form of loans based on "pakyao" (piece work) rates for specific activities. Therefore, payments may be well below legislated wage rates.

The "effective" costs of reforestation at NEA's Camarines Sur and Ilocos Norte sites are presented in Table 13. Dividing expenditures by the number of hectares of plantations successfully established indicates the effective costs of reforestation are ₱16,173 and ₱24,197 at Camarines Sur and Ilocos Norte, respectively. For all NEA sites combined, the effective cost of reforestation is ₱15,481 per hectare in 1985-1986 values.

The NEA's experiences emphasize the potential for reducing costs by liberal use of pakyao labor and the importance of creating economic incentives for workers involved with reforestation projects. Less successful NEA projects highlight the need for careful site selection, intensive protection against fire, and competent, experienced field technicians.

Table 13. National Electrification Administration accomplishments and expenditures, 1980-1984.

Year	Area planted	Area surviving	Expenditures (actual)	Expenditures (1985 values)
	ha		pesos	
Camarines Sur				
1980	55			
1981	300	39	509,237	1,142,947
1982	104	87	686,205	1,396,974
1983	151	139	871,139	1,612,407
1984			108,482	133,557
Total		265	2,175,063	4,285,885

Average development cost per hectare (1985 value).....P16,173

Ilocos Norte				
1980	406	74	1,580,606	4,012,395
1981	571	91	1,718,433	3,856,903
1982	303	257	746,695	1,520,119
1983	266	33	778,830	1,441,551
1984			145,092	178,629
Total		455	4,969,656	11,009,597

Average development cost per hectare (1985 value).....P24,197

All NEA Sites			million pesos	
1980	1,469	257	5.83	14.80
1981	6,065	1,763	23.67	53.13
1982	6,183	2,980	16.20	32.98
1983	3,771	2,304	8.21	15.20
1984	357	279	1.04	1.28
Total		7,583	54.95	117.39

Average development cost per hectare (1985 value).....P15,481

Source: National Electrification Administration, 1985.
Note: 1985 values calculated by adjusting actual expenditures according to changes in the Consumer Price Index as reported in the Philippine Statistical Yearbook, 1985.

IV. REQUIREMENTS AND COSTS OF PROPOSED RRDP REFORESTATION

MNR officials and consultants to the RRDP are in the process of defining standards and specifications for contractors wishing to bid on reforestation jobs (released under the title, "Upland Productivity Program Guidelines for Contract Reforestation"). The guidelines describe the basic requirements of contractors for all sites and outline specific requirements to be met when reforesting steeper sites. Contractors will still be given a great deal of flexibility, however, in developing site-specific planting designs. Contractors will be urged to submit innovative proposals that reflect the development capability of the firm and combine cost-effective characteristics with technically sound concepts.

A. RRDP Basic Development Assumptions

The basic requirements and development assumptions for RRDP contracts are identified below:

1. Detailed control maps and planting designs must be developed and approved by an MNR review team.

2. Site preparation will be very thorough, including contour plowing wherever possible, to improve seedling survival and growth and reduce the risk from fires.

3. Interceptor canals, hedgerows, soil traps, and check dams are required on all sites.

4. Road construction, site preparation, nursery operations, soil conservation activities, and planting are completed within the first 2 years of development.

5. Roads and trails:

   1 km access road/250 ha

   1 km project road/100 ha

   1 km trail/50 ha

6. Most unskilled labor needs will be hired on a "pakyao" basis; labor costs are estimated using an average of ₱35/day.

7. 400 climax species trees established per hectare.

8. 2,000 nurse trees established per hectare.

9. Fruit trees/firebreaks established in 10 meter (minimum) wide border around planting blocks averaging 6.5 hectares in size.

10. Maintenance of seedlings, roads, soil conservation structures, and buildings continues throughout the 5-year development phase.

11. Weeding:

    8 ringweeding cycles/climax tree

    5 ringweeding cycles/nurse tree

12. One patrolman/guard dispatched/250 ha.

The major differences between the RRDP proposed procedures and most previous reforestation practices are:

1. More and better preparation of maps and planting designs; and better recordkeeping.

2. Development and maintenance of a complete road and trail network (independent of the MPWH or other agencies, if necessary).

3. Greater emphasis on thorough site preparation.

4. Development of erosion control structures on all sites.

5. Greater focus on diversified planting schemes.

6. Inclusion of fruit trees along the borders of planting blocks.

B. <u>Costs of Proposed RRDP Activities</u>

The estimated costs of reforestation under the RRDP guidelines for sites with slopes of 18 to 30 percent are

presented in Table 14. Estimated costs of developing protection forests on sites with slopers greater than 50 percent are shown in Table 15. These estimates are derived from more detailed cost estimates (attached as Appendix A) made by Patrick C. Dugan and William G. Granert, Agroforestry Specialists with the RRDP.

The priorities listed above are reflected in the cost estimates presented in Tables 14 and 15. More money is allocated for roads and trails under the RRDP than by any of the case study groups, with the exception of PICOP's expensive harvesting roads. Site preparation costs under the RRDP guidelines are also more than for any of the case study groups, except for MSBF which uses costly mechanical site preparation. Furthermore, no other groups surveyed spend money on erosion control measures, while the RRDP proposals call for up to ₱1 000 per hectare to be spent for erosion control.

Investments in roads, trails, and extensive site preparation are expected to reduce the costs of post-planting maintenance relative to the management costs incurred by MSBF, MADECOR, PICOP, and NEA. Roads and trails will allow patrolmen to monitor the area more easily, help prevent fires, and make firefighting less difficult if a fire does occur. Thorough site preparation will hasten the growth of seedlings and reduce the amount of competing vegetation, thus making the task of weeding more manageable.

Table 14. RRDP projected costs for establishment, maintenance, and protection of reforestation areas (500 hectare contract, 18-30% slope)
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
			worker-days	pesos	
1. Map preparation				63.27	0.5
2. Project logbook	10 min/day			1.40	0.0
3. Roads & trails	incl. maint.			1,804.22	15.0
4. Field office/bodega	40 sq m/500 ha			115.20	1.0
5. Laborers' quarters	440 sq m/500 ha			252.00	2.1
6. Nursery house	20 sq m/500 ha			57.60	0.5
7. Nursery operations					
labor			26.2	917.82	
water supply	1 unit/500 ha			40.00	
potting shed	2/500 ha			2.42	
germination boxes	1/50 ha			0.50	
plastic bags		1,550 pcs.		395.00	
seeds & supplies				100.00	
subtotal				1,455.74	12.1
8. Site preparation					
labor			31.7	1,455.00	
tools & supplies				200.00	
subtotal				1,655.00	13.7
9. Soil conservation					
labor			19.3	675.00	
seeds				15.00	
subtotal				690.00	5.7
10. Planting					
labor			24.5	857.00	
stakes		2,500 stakes		250.00	
fertilizer	30 gm/sdlg	72 kg.		360.00	
survival survey	by prof. for.			37.50	
subtotal				1,504.50	12.5
11. Maintenance					
labor	weeding, patrol		56.4	1,975.00	
fertilizer	30 gm/climax 15 gm/nurse	42 kg		210.00	
subtotal				2,185.00	18.1
12. Supervision & mgn't					
salaries				1,764.00	
operating exp.				300.00	
subtotal				2,064.00	17.1
13. Tools & misc.				200.00	1.7
GRAND TOTAL				12,047.93	100.0

Table 15. RRDP projected costs for establishment, maintenance, and protection of reforestation areas (500 hectare contract, greater than 50% slope)
Costs per Hectare

Activity	Assumptions	Material requirements	Labor requirements	Cost/ha	% of total
1. Map preparation				63.27	0.5
2. Project logbook	10 min/day			1.40	0.0
3. Roads & trails	incl. maint.			1,952.00	14.0
4. Field office/bodega	40 sq m/500 ha			115.20	0.8
5. Laborers' quarters	440 sq m/500 ha			252.00	1.8
6. Nursery house	20 sq m/500 ha			57.60	0.4
7. Nursery operations					
labor			26.2	917.82	
water supply	1 unit/500 ha			40.00	
potting shed	2/500 ha			2.42	
germination boxes	1/50 ha			0.50	
plastic bags		1,550 pcs.		395.00	
seeds & supplies				100.00	
subtotal				1,455.74	10.4
8. Site preparation					
labor			64.6	2,301.45	
seeds	covercrop seeds	2 kg.		100	
fertilizer	for covercrop	5 kg.		25	
tools & supplies				200.00	
subtotal				2,626.45	18.8
9. Soil conservation					
labor			28.2	995.23	
seeds		.4 kg		15.00	
subtotal				1,010.23	7.2
10. Planting					
labor			31.5	1,102.00	
stakes		2,500 stakes		250.00	
fertilizer	30 gm/sdlg	72 kg		360.00	
survival survey	by prof. for.			37.50	
subtotal				1,749.50	12.5
11. Maintenance					
labor	weeding, patrol		62.4	2,185.00	
fertilizer	30 gm/climax 15 gm/nurse	42 kg		210.00	
subtotal				2,395.00	17.2
12. Supervision & mgn't					
salaries				1,764.00	
operating exp.				300.00	
subtotal				2,064.00	14.8
13. Tools & misc.				200.00	1.4
GRAND TOTAL				13,942.39	100.0

The total costs of development (about ₱12,000 to ₱14,000 per hectare) under the RRDP proposals are well within the range of costs experienced by other groups in the country (Table 16). Even though more is being required by contractors than is normally performed by reforestation groups, RRDP planners feel these requirements can be met by liberal utilization of pakyao employment and by savings from reduced maintenance needs.

C. Related Costs

In addition to the direct costs estimated for RRDP activities in Tables 14 and 15, contractors are expected to demand a minimum of 10 percent markup as profit. Planners may also want to consider a 5 percent contingency allowance for unforseen expenses. Adding 15 percent to the direct costs estimates increases costs to about ₱14,000 per hectare for moderate sites and ₱16,000 for steeper sites.

USAID and MNR planners also should also not fail to consider the costs of managing and monitoring the program at the central level. Considerable expenses will be incurred for site surveys, preparation of bid invitations, evaluation of bid proposals, maintenance of budgets and accounts, and auditing the performance of contractors. Many of these expenses are unique to contract reforestation and may increase the costs of central administration far beyond those incurred for overseeing more traditional reforestation programs.

Table 16. Description of Conditions and Development Costs at Selected Reforestation Sites in the Philippines.

Developer	Site	Site Conditions	Development Scheme	Development Cost/ha. (1985 values)
MSBF	La Mesa	moderate: ralling; low pH	625 climax trees/ha; 2,500 nurse trees/ha; densely stocked fire-breaks; good roads; fuelwood, charcoal, leafmeal production.	P 19,867
MADECOR	Western Pangasinan	moderate	833 mahogany/ha. (3 x 4 spacing)	13,470
MADECOR	Western Pangasinan	harsh: rocky; difficult access	100 mango/ha. (10 x 10 spacing)	14,500
MADECOR	Western Pangasinan	harsh: rocky; steep; difficult access	625 cashew/ha. (4 x 4 spacing)	15,070
PICOP	Eastern Mindanao	favorable: good growing conditions; good soil; excellent existing road system	1,111 falcata/ha. (3 x 3 spacing)	12,070
NEA	Camarines Sur	moderate: good growing conditions; very steep; limited access	10,000 ipil-ipil/ha. (1 x 1 spacing); direct seeding; biomass production.	7,216 (effective cost 16,173)
NEA	Ilocos Norte	harsh: steep; rocky; eroded; limited access	10,000 ipil-ipil/ha. (1 x 1 spacing); biomass production.	9,320 (effective cost 24,197)
BFD	nationwide	variable	625 climax trees/ha. (4 x 4 spacing)	11,409 (effective cost 22,818 ??)
RRDP (proposed)		moderate: less than 50% slope	production forest; 400 climax trees/ha.; 2,000 nurse trees/ha.; fruit trees planted along borders of planting blocks; soil conservation measures.	12,048
RRDP (proposed)		moderate to harsh: greater than 50% slope	protection forest; mixed species permanent trees; fruit trees along borders; soil conservation measures.	13,942

V. CASH FLOW ANALYSIS OF CONTRACT REFORESTATION

A. Annual Cash Flows

Table 17 presents the annual cash flows (per hectare basis) likely to result under a 500-hectare RRDP production forest (less than 50 percent slope) contract. Assumptions supporting the estimates of costs and revenues are attached as Appendices A and B. All road and trail construction, site preparation, infrastructure development, erosion control measures, and planting are to be completed in the first 2 years of the contract. Maintenance of the seedlings then continues for 3 more years.

At the end of 5 years, a long-term lease agreement is assumed to grant utlization privileges to a company in exchange for maintaining and protecting the area and a share of the revenues. Fuelwood thinnings are anticipated 5 years and 7 years after planting. A harvest of poles is also expected 10 to 12 years after planting. Harvest of sawtimber trees is anticipated for years 20 and 30 of the project.

If only woodlands operations are included in the contract scheme, positive cash flows are experienced only in the years when wood is harvested. Including a fruit tree component (i.e., fruit trees planted as part of border firebreaks), enhances the likelihood of positive cash flows every year after

Table No. 17 Cash Flow Model (per hectare) for Typical Contract Reforestation Project -- Production Forest
500 Ha. Contract Size, 18 1 - 38% Slope
(amounts in pesos)

Years	1	2	3	4	5	6	7	8	9	10	11	12	13-19	20	21-29	30
DEVELOPMENT COSTS																
Map preparation	64															
Project logbook	1	1	1	1	1											
Roads, trails, bridges	657	718	123	123	123											
Field office/quarters/bodega	64	13	13	13	13											
Laborers' barracks	140	28	28	28	28											
Nursery house	32	6	6	6	6											
Nursery operations	763	693														
Site preparation	754	917	227	87	87											
Soil conservation	246	288	84	84	84											
Planting & replanting	713	752	40													
Maintenance	590	940	485	135	35											
Supervision & management	413	413	413	413	413											
Tools & misc.	40	40	40	40	40											
Development costs subtotal	4,477	4,809	1,460	930	830											
FIXED MAINTENANCE COSTS																
Project logbook						1	1	1	1	1	1	1	1	1	1	1
Road maintenance						123	123	123	123	123	123	123	123	123	123	123
Building maintenance						50	50	50	50	50	50	50	50	50	50	50
Fire control & protection						100	100	100	100	100	75	75	75	75	75	75
Supervision & management						413	413	413	413	413	413	413	317	413	317	413
Tools & misc.						40	40	40	40	40	50	50	20	100	20	100
Fixed maint. subtotal						727	727	727	727	727	712	712	586	762	586	762
WOODLANDS OPERATIONS COSTS																
Harvesting						125	125	350	350		250	250		400		750
Skidding						250	250	700	700		500	500		1,600		3,000
Trucking						1,125	1,125	3,150	3,150		4,500	4,500		7,200		13,500
Woodlands costs subtotal						1,500	1,500	4,200	4,200	0	5,250	5,250	0	9,200	0	17,250
WOODLANDS REVENUES																
Fuelwood thinnings						2,500	2,500	7,000	7,000							
Pole thinnings											15,000	15,000				
Sawtimber harvest														72,000		135,000
Woodlands revenue subtotal						2,500	2,500	7,000	7,000	0	15,000	15,000	0	72,000	0	135,000
ANNUAL CASH FLOW (woodlands only)	(4,477)	(4,809)	(1,460)	(930)	(830)	273	273	2,073	2,073	(727)	9,038	9,038	(586)	62,038	(586)	116,988

Table No. 17 Cash Flow Model (per hectare) for Typical Contract Reforestation Project -- Production Forest
500 Ha. Contract Size, 18.1 - 30I Slope
(Amounts in pesos)

Years	1	2	3	4	5	6	7	8	9	10	11	12	13-19	20	21-29	30
FRUIT TREE COMPONENT																
COSTS																
Mango maint. & harvesting		50	50	50	50	84	134	134	234	234	234	234	301	435	435	435
Jackfruit maint. & harvest		15	15	15	15	49	34	34	67	67	67	67	134	134	134	134
Cashew maint. & harvesting						5	5	5	20	20	20	20	30	81	81	81
Coffee maint. & harvesting				31	31	94	94	94	157	157	157	157	157	157	157	157
Fruit tree mgn't subtotal		65	65	96	96	232	267	267	478	478	478	478	622	807	807	807
FRUIT TREE REVENUES																
Mangoes						168	168	168	670	670	670	670	1,005	1,675	1,675	1,675
Jackfruit						168	168	168	335	335	335	335	670	670	670	670
Cashew						25	25	25	67	67	67	67	151	402	402	402
Coffee				155	155	469	469	469	787	787	787	787	787	787	787	787
Fruit tree revenue subtotal				155	155	830	830	830	1,859	1,859	1,859	1,859	2,613	3,534	3,534	3,534
ANNUAL CASH FLOW (incl. fruit trees)	(4,477)	(4,874)	(1,525)	(871)	(771)	871	836	2,636	3,454	654	10,419	10,419	1,405	64,765	2,141	119,715
INTERCROP COMPONENT																
COSTS																
Radios production costs	400	700	500	200												
Canotes production costs	50	88	63	25												
Cassava production costs	15	26	19	8												
Corn production costs	10	18	13	5												
Malunggay production costs	50	88	63	25												
Squash production costs	10	18	13	5												
Banana production costs	50	50	100	100	100	100										
Intercrop mgn't costs sub.	585	988	771	368	100	100										
INTERCROP REVENUES																
Radios	1,200	2,100	1,500	600												
Canote	200	350	250	100												
Cassava	100	175	125	50												
Corn	40	70	50	20												
Malunggay	100	175	125	50												
Squash	150	263	188	75												
Banana		500	500	500	500	500										
Intercrop revenues subtotal	1,790	3,633	2,738	1,395	500	500										
ANNUAL CASH FLOW (incl. intercrops)	(3,272)	(2,229)	442	156	(371)	1,271	836	2,636	3,454	654	10,419	10,419	1,405	64,765	2,141	119,715

the 5-year development period. The greatest improvements in the cash flow, however, occur when cash crops are incorporated into the model. Intercropping, until trees are 3 years old, provides an opportunity to realize positive cash flows for the project already in the third year, and also reduces the net costs of establishment in the first 2 years of operation. Other innovations, such as incorporating a livestock component, would further enhance the financial viability of projects.

From the perspective of USAID and MNR planners, investment in the project occurs in the first 5 years, and is essentially limited to the establishment of timber and fruit trees. The difficulty of monitoring the inputs and revenues of small intercropping plots, makes management of such activities at the central level impractical. Intercropping of cash crops in the first 3 years should be encouraged, however, for purposes of better site preparation, fire prevention, and providing food and income for local people. Rather than attempting to strictly monitor intercropping activities, RRDP officials should use intercropping as an incentive to contractors. By incorporating intercropping, innovative contractors can either produce cash crops to help offset development expenditures (thereby increasing their profit), or allow laborers the privilege of producing food crops (thereby encouraging better support for the project).

Table 18 shows the annual cash flows (per hectare basis) likely under the RRDP model for development and maintenance of protection forests (greater than 50 percent slopes). Protection forest development differs from production forests in that no harvesting of trees is allowed. Revenue is generated only by harvesting secondary products. Assumptions supporting the estimates of costs and revenues are attached as Appendices A and C.

Because revenues are limited, net cash flows for protection forest development remain negative until about year 12. Including a fruit tree component improves the model somewhat, but net cash flows still are not likely to exceed ₱3,000 in any given year.

B. Investment Analysis

Table 19 summarizes the expected annual cash flows under various development models and provides initial financial analysis of the investments.

Analysis indicates highly satisfactory rates of return for production forests. Even without including fruit trees or intercropping, production forests are expected to average greater than 15 percent real rates of return. Including the fruit tree component increases the expected internal rate of return to about 18.5 percent. Because intercropping partially offsets investment

Table No. 18 Cash Flow Model (per hectare) for Typical Contract Reforestation Project -- Protection Forest
500 Ha. Contract Size, greater than 50% slope
(amounts in pesos)

Years	1	2	3	4	5	6 - 11	12	13 - 17	18 - 19	20	21 - 22	23 - 27	28	29 - 30
DEVELOPMENT COSTS														
Map preparation	64													
Project logbook	1	1	1	1	1									
Roads, trails, bridges	724	796	144	144	144									
Field office/quarters/bodega	63	13	13	13	13									
Laborers' barracks	140	28	28	28	28									
Nursery house		32	6	6	6									
Nursery operations		763	693											
Site preparation	1,033	1,212	258	118	118									
Soil conservation	300	351	102	102	102									
Planting & replanting		835	875	40										
Maintenance	35	590	940	485	135									
Supervision & management	413	413	413	413	413									
Tools & misc.	40	40	40	40	40									
Development costs subtotal	2,813	5,074	3,513	1,390	1,030									
FIXED MAINTENANCE COSTS														
Project logbook						1	1	1	1	1	1	1	1	1
Road maintenance						144	144	144	144	144	144	144	144	144
Building maintenance						50	50	50	50	50	50	50	50	50
Fire control & protection						100	100	100	100	100	100	100	100	100
Supervision & management						317	317	317	317	317	317	317	317	317
Tools & misc.						20	20	20	20	20	20	20	20	20
Fixed maint. subtotal						632	632	632	632	632	632	632	632	632
PROTECTION FOREST OPERATIONS COSTS														
Rattan maint. & production							250			250			250	
Sigid maint. & production						13	13	13	[illegible]	13	13	13	13	13
Bamboo maint. & production						75	75	75	75	75	75	75	75	75
Pili maint. & production						17	50	100	150	150	150	200	200	200
Anahaw maint. & production						2	2	2	2	2	2	2	2	2
Lanzones maint. & production							50	58	100	100	100	150	200	200
Production costs subtotal						107	440	240	340	590	340	440	740	490

Table No. 18 Cash Flow Model (per hectare) for Typical Contract Reforestation Project -- Protection Forest
500 Ha Contract Size, greater than 50% slope
(amounts in pesos)

Years	1	2	3	4	5	6 - 11	12	13 - 17	18 - 19	20	21 - 22	23 - 27	28	29 - 30
PROTECTION FOREST REVENUES														
Rattan							1,250			1,250			1,250	
Sigid						50	50	50	50	50	50	50	50	50
Bamboo						150	150	150	150	150	150	150	150	150
Pili						83	250	500	750	750	750	1,000	1,000	1,000
Anahaw						8	8	8	8	8	8	8	8	8
Lanzones							250	250	500	500	500	750	750	1,000
Forest revenues subtotal						291	1,958	958	1,458	2,708	1,458	1,958	3,208	2,206
ANNUAL CASH FLOW (protection forest operation)	(2,813)	(5,074)	(3,513)	(1,390)	(1,000)	(448)	886	86	486	1,486	486	886	1,836	1,086
FRUIT TREE COMPONENT COSTS														
Mango maint. & harvesting			38	38	38	109	176	216	226	226	326	326	326	326
Jackfruit maint. & harvest			11	11	11	33	50	91	101	101	101	101	101	101
Cashew maint. & harvesting						7	15	21	23	23	61	61	61	61
Coffee maint. & harvesting			23	23	71	102	118	118	118	118	118	118	118	118
Fruit tree mgn'T subtotal			72	72	120	251	359	446	468	468	606	606	606	606
FRUIT TREE REVENUES														
Mangoes						154	335	469	503	503	838	838	838	838
Jackfruit						96	168	302	335	335	335	335	335	335
Cashew						23	56	71	76	76	202	202	202	202
Coffee					78	249	393	393	393	393	393	393	393	202
Fruit tree revenue subtotal					78	522	946	1,235	1,307	1,307	1,768	1,768	1,768	1,577
ANNUAL CASH FLOW (incl. fruit trees)	(2,813)	(5,074)	(3,585)	(1,462)	(1,042)	(177)	1,473	875	1,325	2,325	1,648	2,048	2,998	2,057

Table 19. Annual Cash Flows and Investment Analysis (per hectare basis) of RRDP Production and Protection Contract Reforestation (amount in pesos)

Year	Production Forest (18 - 30% slope Cash Flows			Protection Forest (greater than 50% Slope) Cash Flows	
	Woodlands only	Fruit trees included	Intercrop included	Protection forest operations only	Fruit trees included
1	(4,477)	(4,477)	(3,272)	(2,813)	(2,813)
2	(4,809)	(4,874)	(2,229)	(5,074)	(5,074)
3	(1,460)	(1,525)	442	(3,513)	(3,585)
4	(930)	(871)	156	(1,390)	(1,462)
5	(830)	(771)	(371)	(1,000)	(1,042)
6	273	871	1,271	(448)	(177)
7	273	836	836	(448)	(177)
8	2,073	2,636	2,636	(448)	(177)
9	2,073	3,454	3,454	(448)	(177)
10	(727)	654	654	(448)	(177)
11	9,038	10,419	10,419	(448)	(177)
12	9,038	10,419	10,419	886	1,473
13	(586)	1,405	1,405	86	875
14	(586)	1,405	1,405	86	875
15	(586)	1,405	1,405	86	875
16	(586)	1,405	1,405	86	875
17	(586)	1,405	1,405	86	875
18	(586)	1,405	1,405	486	1,325
19	(586)	1,405	1,405	486	1,325
20	62,038	64,765	64,765	1,486	2,325
21	(586)	2,141	2,141	486	1,648
22	(586)	2,141	2,141	486	1,648
23	(586)	2,141	2,141	886	2,048
24	(586)	2,141	2,141	886	2,048
25	(586)	2,141	2,141	886	2,048
26	(586)	2,141	2,141	886	2,048
27	(586)	2,141	2,141	886	2,048
28	(586)	2,141	2,141	1,836	2,998
29	(586)	2,141	2,141	1,086	2,057
30	116,988	119,715	119,715	1,086	2,057
NPV @ 5%	51,132.23	72,027.93	79,065.76	(10,221.07)	(2,408.69)
NPV @ 10%	13,344.23	23,123.46	29,651.80	(11,662.12)	(8,147.98)
NPV @ 15%	502.56	5,637.74	11,732.91	(11,599.29)	(9,836.68)
IRR	15.34%	18.55%	26.36%	-1.09%	3.92%

requirements and provides some early returns, the internal rate of return is greatly enhanced (increased to 26 percent) by the inclusion of an intercropping component. Since, as noted earlier, intercropping is virtually impossible to monitor financially, contractors and laborers stand to benefit most from the financial advantages of intercropping.

Not surprisingly, the expected cash flows for protection forest areas (greater than 50 percent slope) produce much less favorable returns on investment. Investments in protection forests are not likely to be offset by revenues from secondary products alone. Even by including a fruit tree component, only a modest 4 percent rate of return appears possible.

A logical conclusion is that investments in protection forests must be justified on the basis of other less-quantifiable benefits (e.g., watershed protection, aesthetics, micro-climate stabilization) rather than strict financial criteria.

C. Sensitivity Analysis

With an objective of recovering part or all money invested in production forest establishment, it may be worthwhile to consider the ramifications of conditions other than those used for computing the investment criteria presented in Table 19.

Table 20 indicates the sensitivity of the internal rate of return to changes in costs and yields. The "base case" is considered to be a production forest with fruit trees included. Original cost and revenue estimates are used for the base case.

If investment and operating costs increase by 25 percent, the internal rate of return falls to 15 percent from 18.5 percent. A decrease of 25 percent (below initial estimates) in forest product and fruit tree yields has a slightly less severe impact, reducing the rate of return to 15.5 percent. If yields are 25 percent above original estimates, the rate of return is boosted to 21 percent.

It should be noted that, even if estimates of costs or yields are off by as much as 25 percent, at least partial recovery of investment costs should still be possible.

D. Timing of Investments

It is important for USAID and the MNR to recognize the timing of payments that will need to be made to contractors. The amount and timing of payments for "mobilization" are policy issues which must still be resolved. Similarly, allowable markups for profit and contingencies must be established.

Table 20. Sensitivity Analysis of Internal Rate of Return to Changes in Costs and Yields for Production Forests (including fruit tree component)

Year	Base case	Costs increase by 25 %	Yields decrease by 25 %	Production Yields increase by 25 %
	pesos/ha.			
1	(4,477)	(5,596)	(4,477)	(4,477)
2	(4,874)	(6,093)	(4,874)	(4,809)
3	(1,525)	(1,906)	(1,525)	(1,460)
4	(871)	(1,128)	(836)	(856)
5	(771)	(1,003)	(786)	(756)
6	871	256	472	1,271
7	836	213	445	1,227
8	2,636	1,338	1,795	3,477
9	3,454	2,103	2,409	3,477
10	654	353	309	999
11	10,419	8,809	7,636	13,202
12	10,419	8,809	7,636	13,202
13	1,405	1,103	907	1,903
14	1,405	1,103	907	1,903
15	1,405	1,103	907	1,903
16	1,405	1,103	907	1,903
17	1,405	1,103	907	1,903
18	1,405	1,103	907	1,903
19	1,405	1,103	907	1,903
20	64,765	62,073	46,082	81,147
21	2,141	1,793	1,459	2,823
22	2,141	1,793	1,459	2,823
23	2,141	1,793	1,459	2,823
24	2,141	1,793	1,459	2,823
25	2,141	1,793	1,459	2,823
26	2,141	1,793	1,459	2,823
27	2,141	1,793	1,459	2,823
28	2,141	1,793	1,459	2,823
29	2,141	1,793	1,459	2,823
30	119,715	114,058	89,596	149,834
IRR	18.55%	14.92%	15.49%	20.92%

The figures in Table 21 (partially derived from Table 17 cash flows) illustrate rough estimates of the investments required for typical 500-hectare reforestation contracts. A 5 percent increase for contingencies has been added to all costs and a final payment for profit (representing a 10 percent markup) is included in year 5.

Because production forest areas are assumed to be planted in the first 2 years, payments will be highest in years 1 and 2 for contracts covering production forest land of generally moderate slopes.

Site preparation is expected to dominate first-year activities at protection forest sites, with planting completed in years 2 and 3. Therefore, payments covering these sites are spread more evenly.

Perhaps the most realistic schedule of payments to contractors is presented in the final two columns of Table 21. These figures assume a contract area comprised of approximately one-half production forest and one-half protection forest.

E. Cost Recovery Options

As Table 17 clearly shows, there will be definite opportunities to recover some or all of the money invested in production forests. Revenues from thinnings and sales of fruit

Table 21. Timing of Payments Required for 500-hectare Reforestation Contracts during Initial Establishment Period

Year	Production Forest		Protection Forest		50% Product.+50% Protect.	
	Payment/ ha.	Total Payment	Payment/ ha.	Total Payment	Payment/ ha.	Total Payment
	pesos					
1	4,701	2,350,425	2,954	1,476,625	3,827	1,913,625
2	5,118	2,558,850	5,328	2,663,850	5,223	2,611,350
3	1,601	800,625	3,689	1,844,325	2,645	1,322,475
4	1,026	513,000	1,460	729,750	1,243	621,375
5	2,263	1,131,600	2,498	1,249,050	2,381	1,190,325
Total	14,709	7,354,500	15,929	7,963,800	15,319	7,659,150

already exceed the costs of maintenance and protection by the sixth year of the project. Full recovery of the 5-year establishment investment (excluding the cost of capital) is theoretically possible within 6 years after the maintenance/production phase of the project begins. Even if profits are shared with a maintenance contractor, on a 50-50 basis, recovery is possible within 7 years.

Under the proposed RRDP concept, reforestation contractors would be given the option to manage the areas they successfully establish under a long-term lease arrangement. This option can be used as a further incentive to promote improved performance during the 5-year establishment phase, since contractors can expect greater profits during the maintenance/production phase.

Several revenue sharing alternatives are possible which would provide income for the contractor/lease-holder while helping the government recover the initial reforestation investment. Possible cost recovery/revenue sharing options are discussed below:

1. <u>Annual payments of pre-established amounts</u>. Under this option, the MNR would negotiate with the contractor to establish a schedule of payments which allows the government to recover its investments. The contractor could produce the income

needed to cover the payments by any means he/she desires (within the scope of approved management plans). The advantage of this alternative is that the MNR knows the amount of payment in advance and can plan additional activities based on the incoming revenue. Another advantage is that recordkeeping and accounting are kept simple. One disadvantage is that the contractor may not be able to meet the agreed schedule of payments (possibly because of lower-than-expected yields or greater-than-expected costs of management or harvesting). The MNR would then be faced with having to terminate the contract or renegotiate the payment schedule.

2. Sharing of net profits by the contractor and the MNR. This is the option being used in the agreement between the MWSS and MSBF at La Mesa. Under such an arrangement, the MNR and the contractor would share net income on a 50-50 basis, or some other agreed ratio. The advantage of this system is that it accommodates unexpected costs and revenues with equity between the contractor and the MNR. Risk is shared equally by the two parties. Payments are always manageable because they are a function of net income. The disadvantages are that detailed and accurate records of costs and revenues are required, the annual payments to the MNR might be highly variable, it would be easy for contractors to pad their expense records in order to increase profits.

3. Sharing of gross profits by the contractor and the MNR. This option is very similar to the one just discussed, but provides more advantages to the MNR. Less recordkeeping, accounting, and auditing are required, and the contractor has less opportunities to manipulate records to his/her advantage.

4. Additional reforestation by the contractor. Under this alternative, contractors would be required to reforest areas adjacent to their initial contract site (or in other locations, if no additional land is available near the first contract area). Accomplishment targets would be escablished, which the contractor must meet in order to continue the option. Failure to meet scheduled target accomplishments would result in the contractor being forced to enter into one of the alternative revenue sharing/cost recovery schemes described above, or outright cancellation of the maintenance lease for the original area. A contractor should be expected to reforest an area equal in size to the original tract within 6 to 7 years after assuming the maintenance lease for the original tract. Further incentive could be offered by granting the contractor all revenues from both sites after the firm has successfully doubled the size of the plantation area.

F. Related Policy Issues

1. Contingency plans for payments in the event of plantation failure resulting from uncontrollable disasters. This issue is certain to surface the first time a contractor fails. Even if the failure is due to the contractor's negligence, the firm is sure to claim contributing events were beyond their control. USAID and the MNR should begin developing a policy on how the evaluation of such cases will be made. Settlement of claims is sure to be a difficult issue.

If the contractor is found to have been lax in protecting or developing its area, no further payments should be made and the contract should be terminated. If, however, the plantation fails because of natural disasters (e.g., typhoons, floods), armed conflict in the area, or other forces beyond the control of the contractor, USAID and the MNR must be prepared to pay the contractor additional fees to replant areas destroyed. When development efforts cannot be salvaged, a financial settlement must be reached with the contractor to compensate the firm for its well-intended, but ill-fated efforts.

The real test of conscience and diplomacy will come when a plantation is destroyed by fire. The evaluation team will need strong perceptive skills to ascertain if the contractor had complied with fire prevention and control measures specified in the contract. Their decision will be especially difficult since payment of several thousand pesos could rest on the judgment.

2. Adjustment of payments to compensate for inflation. Inflation of prices and labor costs is virtually impossible to predict with any degree of accuracy. Price levels have been especially erratic in recent years. Reforestation contracts should therefore include escalator clauses that provide for yearly adjustments for inflation. Adjusting payments yearly will ensure contractors have adequate funds to accomplish the tasks specified in their contracts. Budget officers will need to be cognizant of price adjustments and anticipate increasing budget requirements, however, so that payments to contractors will not be delayed or inadequate.

3. Maximize incentives for contractors. To increase the probability of success, USAID and the MNR should maximize the incentives for contractors. Planners should consider tying profit incentives to superior performance a' la PICOP's approach in Mindanao. If acceptable performance is assumed to warrant a profit margin of 10 percent for the contractor, superior performance could possibly be rewarded by an additional 2 to 5 percent markup. This could be awarded on the basis of the number of saplings taller than a specified height, or the number of percentage points with which seedling survival surpasses 85 percent, at the end of the 5-year establishment contract. A second incentive for contractors is in the area of cash crop intercropping in the early years of the contract. Such intercropping should be encouraged, both to improve the financial

position of contractors and reduce the risk of fire in the plantation area. The final area of incentives concerns the long-term management leases negotiated with contractors. Terms should be generous, so as to make the management lease a highly-desirable reward for satisfactorily completing the establishment phase.

4. <u>Funding of additional reforestation by issuing management contracts for existing BFD reforestation areas</u>. Although this proposal concerns many foresters who worked hard to establish the plantations, planners should seriously consider the option. A substantial amount of valuable timber is available which could be partially liquidated to help fund additional planting. Many BFD reforestation plantations are, in fact, overstocked and would benefit significantly from thinning. Careful monitoring of thinning operations would be necessary to avoid overcutting, but the potential benefits of such operations justify taking the associated risks. In the words of USAID Forester Jerry Bisson, "If people can't be taught proper utilization of the forest, they can't be taught proper reforestation."

VI. SUMMARY

Contract reforestation offers opportunities to improve on the dismal record of reforestation posted by the public and private sectors in past years. Recent experiences of the MSBF, MADECOR, PICOP, and the NEA demonstrate the feasibility of contract reforestation. Analysis of their costs, however, illustrate that contract reforestation is not necessarily inexpensive. Quality performance still demands adequate compensation.

Standards for contract reforestation proposed by USAID and MNR planners emphasize improved development designs, access, site preparation, erosion control measures, and diversified planting. Costs are still expected to fall within an acceptable range, however. Furthermore, utilization provisions should enable the government to recover part or all of its development investments.

As with any new program, setbacks and failures should be expected as the contract apprdach evolves. While developing its contract program, for example, PICOP eventually reduced its list of acceptable contractors from 23 to only 5. Maximum tolerance is therefore necessary in order to develop the contract concept.

The immediate advantage of implementing reforestation by contract is the creation of a performance-oriented system. The real beauty of the contract approach, however, will be realized in future years, after enough private contractors are established to generate true competitive bidding. With this in mind, USAID and the MNR should proceed by maximizing the incentives to the fledgling industry in order to spur its growth. The task of reforesting the Philippines is massive enough to support the growth of the contract reforestation industry -- with all its associated employment, economic, and environmental benefits -- for decades.

VII. REFERENCES

Bucad, Armando V. 1978, Private reforestation for the Philippines. Canopy 4 (5): 1, 11-12.

Bucad, Armando V. and L. A. Donaso. 1985. A better approach to contract reforestation. Canopy 11(3): 6-13.

Bulletin Today. 1984. Reforestation rate dwindles. December 7, 1984. Manila, p.30.

Ministry of Natural Resources/Bureau of Forest Development. 1984. 1984 Annual Report. Manila

National Environmental Protection Council. 1978. Second annual report on the Philippine environment. Manila.

Revilla, A.V. Jr. 1985. A 50-year forestry development program for the Philippines. Paper presented at NEDA Forestry Forum, August 9, 1985, Makati, Manila.

Serrano, Rogelio C. 1984. Reforestation in the Philippines: an evaluation. FESAM Bulletin. March-April, 1984, p.4-5.

VIII. INDIVIDUALS CONSULTED AND PERSONS PROVIDING ASSISTANCE DURING PREPARATION OF THIS STUDY

Bureau of Forest Development

Milagros C. Castro, Supervising Chief, Accounting Division

Jose Gallanos, Budget Officer, Budget Division

Lina Manalaysay, Senior Forester, Reforestation and Afforestation Division

Bayani Nera, OIC, Planning and Evaluation Division

Sofio B. Quintana, Senior Forester, Reforestation and Afforestation Division

Development Alternatives, Inc.

Eugene N. Babb, Chief of Party

Patrick C. Dugan, Agroforestry Specialist

William G. Granert, Agroforestry Specialist

Zorayda Legaspi, Secretary

Guillerma Sanchez, Accountant

Urbano Victorio, Jr., System Programmer

Hodam and Associates, Inc.

Ernesto Cadaweng, Forester

Mandala Agricultural Development Corporation

Valerio B. Mendoza, Senior Forestry Consultant, Vice President

Eduardo C. Sison, Chairman

Manila Seedling Bank Foundation, Inc.

Crisostomo V. Arenas, Manager, Reforestation Operations

Lucito M. Bertol, Vice President

Leonardo D. Ligeralde, Assistant Manager - Accounting

Benjamin D. Malto, Head, Planning and Evaluation Department

Ministry of Natural Resources

Lisette S. Gamboa, Consultant, RRDP

Paula de los Reyes, Chief Development Project Evaluator

Elvira Javier, Clerk-Typist, RRDP

Noel M. Recillo, Development Project Evaluator, RRDP

Vilma H. Recuenco, Project Planning Specialist, RRDP

Briccio Tamparong, Jr., Special Assistant to the Deputy Minister, Project Director, RRDP

National Electrification Administration

Lea Bedano, Chief, Agroforestry Division

National Irrigation Administration

Jose A. Galvez, Project Manager, Watershed Management and Erosion Control Project

Philippine Wood Products Association

Eulogio T. Tagudar, Executive Secretary (former Manager, Forestry Division, PICOP)

U.S. Agency for International Development

Jerry Bisson, Forester

Ernesto Guiang, Forester

APPENDIX A

CONTRACT REFORESTATION
DETAILED COMPUTATION OF COST ESTIMATES
(One Hectare Model)

ASSUMPTIONS

1. The average size of a contract reforestation project will be 500 hectares.

2. The average duration of a contract will be five (5) years.

3. Road and trail construction costs will increase approximately 5% for each change in slope category.

4. Land development costs will be vary with the degree of slope.

ABBREVIATIONS

ha.	-	hectare
km.	-	kilometer
LM.	-	linear meter
M2	-	square meter
M3	-	cubic meter
o.d..	-	one person day (one workday)
M & AD	-	one man and animal day (e.g. plowing)
pc.	-	piece (i.e. one unit)

1.0 MAP PREPARATION

1.1 Control Map

Procurement of topographic map from B.C.& G.S.	₱ 10.00
a. Cartographic work to prepare 500 ha. map (enlargement to 1:10,000 scale, overlay of slope categories, rivers, vegetative cover, legal status, etc.)	
5 person days (p.d.) at ₱75	375.00
b. Drafting supplies and blue printing	250.00
c. Field work to determine vegetative cover and extent of adverse claims	
- 10 p.d. x ₱75	750.00
- travel & miscellaneous inspection costs	500.00
TOTAL for 500 has.	₱ 1,885.00
Ave. cost/ha. 1/	₱ 3.80

1.2 OPERATIONS MAP (by planting block)

a. Cartographic work to prepare an average of 75 planting block operations maps covering 500 has.	
- 3 p.d./map x 75 maps x ₱75/p.d.	₱16,875.00
b. Drafting supplies and blue printing: ₱125/map x 75 maps	9,375.00
c. Fieldwork to verify vegetative cover and occupancy data indicated on the control map, plus site inspection to determine appropriate species and gather other information required for preparation of planting design	

1/ ₱ 1,885 ÷ 500 has. = ₱ 3.80/ha. (₱3.77)

- 20 p.d. x P75	1,500.00
- travel and misc. inspection costs	1,000.00
- soil analysis: aver. of 50 samples x P20	1,000.00
TOTAL for 500 has.	P29,750.00
Average cost/ha. 2/	P 59.50

2.0 PROJECT LOGBOOK

a. Cost of record book	P 50.00
b. Entry of data:	
10 minutes/day x365 days/year ÷ 60 minutes/hr.	
- 8 hrs./day x P75/day	570.00
c. Miscellaneous costs	80.00
TOTAL for 500 has.	P 700.00
Average cost/ha. 3/	P 1.40

3.0 ROADS, TRAILS AND BRIDGES

3.1 Feeder Roads

Construction Average of 2 kms/project ÷ 500 has. = .004 kms/ha. .004 kms/ha. x P80,000/km.	P 320.00	
Maintenance Annual expenditure of 10% of original investment cost P320/ha x 10% x 4 yrs. (yrs. 2 - 5, inclusive)	128.00	
	448.00	P 448.00/-

2/ P29,750 ÷ 500 has. = P59.50/ha.

3/ P700 ÷ 500 has = 1.40/ha.

3.2 Project site roads:

Construction
Average of 1.0/km/100 has.
500 has. ÷ 100 = 5 kms.
5 kms. ÷ 500 has. = .01/kms/ha.
0.1 kms/ha x P60,000/km. P 600.00

Maintenance
Annual expenditure of 10% of original
investment cost. P600/ha x 10% x 4 yrs.
(yrs. 2 - 5, inclusive) 240.00

940.00 P 940.00/ha

3.3 Trails:

Average of one (1) km/50 has.
500 has. ÷ 50 = 10 kms.
10 kms. ÷ 500 has. + .02 kms/ha.
0.2 kms/ha x P2,500/km
Maintenance: P50 x 10%/yr x 4 yrs
(yr. 2 - 5, inclusive) P 50.00
20.00

70.00 P 70.00/ha

3.4 a) Footbridges (animal cart traffic):

Average of 10 LM/km of trails
.02 kms of trails/ha x 10 LM/km = .2 LM/ha.
.2 LM/ha x P200/LM P 40.00

b) Footbridges (for laborers traffic):

Average of 20 LM/km of trails
.02 kms of trails/ha x 20 LM/km = 4 LM/ha.
.4 LM/ha x P20/LM 8.00

Sub-Total (48.00)

c) Maintenance:

Annual expenditure of 10% of original
investment cost. P48 x 10% x 4 yrs.
(yrs. 2 - 5, inclusive) 19.20

67.20 P 67.20/ha.

3.3 Vehicle Bridges

a) On feeder roads:

Average of 5 LM/km x 2 kms
(see 3.1 above) = 10 LM
10 LM ÷ 500 has. = .02 LM/ha.
.02 LM/ha x P2,500/LM — P 50.00

Maintenance:
P50 x 10%/yr x 4 yrs. — 20.00

70.00 — P [illegible]

b) On project site roads:

Average of 5 LM/km x .01 kms/ha.
(see 3.2 above) = 0.5 LM/ha.
.05 LM/ha x P2,500/LM — 125.00
Maintenance: P125 x 10%/yr x 4 yrs. — 20.00

145.00 — P [illegible]

4.0 FIELD OFFICE/QUARTERS/BODEGA

Average floor space of 40 M2
40 M2 x P800/M2 = P32,000.00
P32,000 ÷ 500 has. — P [illegible]

5.0 LABORERS BARRACKS

Average floor space/unit of 110 M2
110 M2 x 4 units/500 ha. project = 440 M2
440 M2 x P160/M2 = P70,400
P70,400 ÷ 500 has. — P [illegible]

6.0 NURSERY HOUSE

Average floor space of 20 M2
20 M2 x P800/M2 = P16,000
P16,000 ÷ 500. has. — P 32.00/ha.

7.0 NURSERY OPERATIONS

7.1 Water Supply:
Approx. P20,000 ÷ 500 has. — P 40.00/ha

7.2 Germination Boxes:
10 x P25 ÷ 500 has. — P 0.50/ha

7.3 Germination Beds:
30 M2/ha. to be planted
30 M2 ÷ 3
(each bed will be used 3 times during the life of the project) = 10 M2/ha.
10 M2 x P2/M2 — P 20.00/ha

7.4 Potting Medium:
Approx. 2.0 M3/ha. to be planted
2 M3 x P20/M3 — P 40.00/ha

7.5 Potting Shed:

8 posts x P20	P 160.00
5 pcs. bamboo (4 m long) x P15	75.00
20 bundles cogon x P10	200.00
Tying material and nails	30.00
Construction labor: 4 p.d. x P35	140.00

	P 605.00

P605 x 2 (rebuilt twice during the life of the project) ÷ 500 has. — P 2.42/ha
(P 2.42)

7.6 Compost Production:
One (1) M3/ha. to be planted x P20/M3 — P 20.00/ha

7.7 Sterilization of Potting/Germination Medium:
2 M3 x P15/M3 — P 30.00/ha

7.8 Rearing Beds:

a) Seedling requirement (including 20% allowance for mortality)

Climax trees	500 seedlings
Nurse trees	1,250 seedlings
	1,750 seedlings

(NOTE: 50% of nurse trees would be direct-seeded)

b) Space requirement

1750 seedlings x average of 100 cm2/seedling ÷ 10000 cm2/M2

17.5 M2/ha x P5/M2 — ₱ 87.50/ha

7.9 Preparation of Schematic Diagram and Laying Out the Nursery:

5 p.d. x P35 p.d. ÷ 500 has. = 0.42 — ₱ .42/ha

7.10 Multiplication plots:

a) Plowing: 10 M2 for every hectare to be planted x 500 has. = 5000 M2 or 0.5 ha.

1st Plowing: 10 man-animal days (M & AD)/ha x P50/M & AD x .5 ha.	P 250
2nd Plowing: 5 M & AD/ha x P50 x .5 ha.	125
1st Harrowing: 4 M & AD/ha x P50 x .5 ha.	100
2nd Harrowing: 4 M & AD/ha x P50 x .5 ha.	100
	P 575

P575 ÷ 5000 M2 = P.115 x 10 M2/ha. — ₱ 1.15/ha.

7.11 Pathways:
Estimate 0.25 p.d./ha x P35 — P 8.75/ha

7.12 Plastic Bags:

a) Approximate requirements by size and price:

50 pcs.	12"x18"x.003x	P1.50	P 75
150 pcs.	10"x12"x.003x	1.00	150
100 pcs.	8"x10"x.003x	.45	45
1250 pcs.	4"x 6"x.002x	.10	125
1550 pcs			P 395

P 395.00/ha

(NOTE: Balance of trees will be planted as base-root or direct seeded)

b) P395 ÷ 1550 = average price of P.26/pc.

7.13 Lifting and seedling transfer to plastic bags and/or rearing beds

7.14 Root pruning

7.15 Hardening

7.16 Culling

- and routine maintenance -

a) 10 laborers x 25 p.d./mo. x 6 mos. — 1,500 p.d.

5 laborers x 25 p.d./mo. x 12 mos. — 1,500 p.d.

Total — 3,000 p.d.

b) 3000 p.d. ÷ 500 has. — 6 p.d./ha.

c) 6 p.d./ha x P35/p.d. — P 210.00/ha.

7.17 Transfer to and care in recovery areas:

a) Labor for movement from nursery to recovery areas: 1750 potted & base root seedlings/ha. x P0.10/seedling	P 175	
b) Transport via bullcart: sub-contract @ P.10/seedling x 1750 seedlings	175	
c) Care, maintenance and security in recovery areas sub-contracted @ P.05/seedling x 3000 seedlings	150	
	P 500	P 500.00/ha.

7.18 Seedling and nursery supplies P 100.00/ha.

8.0 SITE PREPARATION

Plowing and Harrowing:

1st Plowing: 10 M & AD/ha x P50	P 500.00	
2nd Plowing: 5 M & AD/ha x P50	250.00	
1st Harrowing: 4 M & AD/ha x P50	200.00	
2nd Harrowing: 4 M & AD/ha x P50	200.00	
	P1,150.00	

8.1 0-30 slopes P 1,150.00/ha.

8.2 30.1 - 50% slopes (P1150 plus 10% additional cost ÷ 2 since only 50% of the area will be plowed) P 632.50/ha.

8.3 50.1% and up slopes (P1150 plus 15% additional cost ÷ 10 since only 10% of the area will be plowed) P 132.25/ha.

8.4 Marking Contour Lines:

a) 0-30% slopes: 2 p.d./ha x P35/p.d.	P 70.00/ha.
b) 30.1 - 50% slopes: 3 p.d./ha x P35/p.d.	P 105.00/ha.
c) 50.1% and up slopes: 4 p.d./ha x P35/p.d.	P 140.00/ha.

8.5 Fire Prevention:

8.5.1 Grass control (elimination)

a) 0-50% slopes (NOTE: already accomplished by plowing and harrowing per 8.1 & 8.2 above)

b) 50.1% and up slopes (FASTER System)

1st Cutting:	Sub-contract @	P 350/ha.
2nd Cutting:	Sub-contract @	200/ha.
3rd Cutting:	Sub-contract @	150/ha.
4th Cutting:	Sub-contract @	150/ha.
5th Cutting:	Sub-contract @	150/ha.

		1,000

P 1,000.00/-

8.5.2 Firebreak establishment & Maintenance

a) Approximate perimeter of an average planting block of about 6.5 has. 1,020 LM

b) 1020 ÷ 6.5 has. 157/LM/Ha.

c) 157 LM/ha x 5 M width 784 M2

d) 784 M2 x 0.02 M2 per cutting cycle x 15 cutting cycles (over a period of 5 years) P [illegible]

8.6 Manual Cultivation:

a) 100 covercrop planting spots/ha x P1.00 planting spot P 100.00/ha

8.7 Composting in the field:

a) Digging approximately 75 pits/ha x P5/pit P 375.00/ha.

8.8 Covercrop:

a) Planting costs: 1 p.d./ha x P35/p.d. — 35.00

b) Seeds: 2 kgs/ha x 90/kg — 180.00

c) Fertilizer: 100 planting spots x 50 grams ÷ 1000 grams/kg x 5.00 kg. — 25.00

c) Pressing after covercrop begins to overtop the grass: 4 p.d./ha/pressing x 2 pressings x P35/p.d. — 280.00

440.00 — ₱ 440.00/-

8.9 Tools — ₱ [illegible]

9.0 SOIL CONSERVATION

9.1 Interceptor Canals:

a) Average of 1/ha x 100 LM canal = 100 LM
100 LM x P2.00/LM — ₱ [illegible]

9.2 Erosion Control Hedgerows

a) Seeds:
Average of 3 hedgerows/ha. x 100 M long x .5 M wide x 20 seeds/M2 ÷ 3000 viable seeds/kg x P40/kg. — 15.00

b) Planting labor: 2 p.d./ha. x P35/p.d. — 70.00

85.00 — ₱ 85.00/ha.

9.3 Soil Traps

a) Average of 1 per interceptor canal x 1 interceptor canal 1

b) Average of 2/ha. in natural drainages 2

3

c) 3 soil traps x 1 M3/soil trap x P5.00 M3 ₱ [illegible]

9.4 Check Dams:

a) One (1) for each soil trap in natural drainages (9.3 b): 2/ha x P20/checkdam ₱ [illegible]

9.5 Maintenance:

2 p.d./ha/yr x 5 yrs x P35/p.d. ₱ [illegible]

10.0 PLANTING AND REPLANTING

10.1 Planting Design (see 1.0-b "Map Preparation - Operations Map") [illegible]

10.2 Staking

<u>0-30% Slopes (straight line staking)</u>

a) 2500 stakes/ha x P.10	250.00	
b) 5 p.d./ha x P35/p.d.	175.00	
	425.00	₱ [illegible]

<u>30.1-50% Slopes (contour staking)</u>

a) 2500 stakes/ha x P.10	250.00	
b) 8 p.d./ha x P35/p.d.	280.00	
	530.00	₱ 530.00/ha.

<u>50.1% Slopes and up (contour staking)</u>

a) 2500 stakes/ha x P.10	250.00	
b) 12 p.d./ha x P35/p.d.	420.00	
	670.00	₱ 670.00/ha.

10.3 Holing:

a)	400 holes for climax trees x P.40/hole	160.00	
b)	1000 holes for nurse trees x P.20/hole	200.00	
	(balance of 1000 nurse trees will be direct seeded)	360.00	P 360.00/-ha.

10.4 Seedling transport (from recovery areas to planting spot):

a)	400 climax tree seedlings x P.10	40.00	
b)	1000 nurse tree seedlings x P.05	50.00	
		90.00	P 90.00/-ha.

10.5 Planting Labor:

a)	400 climax tree seedlings x P.20	80.00	
b)	1000 nurse tree seedlings x P.10	100.00	
c)	1000 direct seeded nurse trees x P.01	10.00	
		190.00	P 190.00/-ha.
c)	P110 ÷ 2000 nurse trees = average of P.055/tree		

10.6 Fertilizer:

a)	Materials: 30 grams/tree x 2400 trees ÷ 1000 grams/kg. x P5.00/kg.	360.00	P 360.00/-

10.7 Survival Survey Sampling:

a)	0.5 [illegible]./ha x P75		P 37.50/-ha

10.8 Replanting:

(10% of original seedling transport and planting costs: 10.4 & 10.5)

10.4	-	₱ 140.00
10.5	-	280.00
		₱ 420.00 x 10%

11.0 MAINTENANCE

a) Climax trees:

1st Year -	3	ringweeding cycles 4/
2nd Year -	3	ringweeding cycles
3rd Year -	2	ringweeding cycles
	8	ringweeding cycles

8 ringweeding cycles/tree
x ₱.25 cycle/tree = ₱2.00/tree x 400 trees/ha.

b) Nurse trees:

1st Year -	3	ringweeding cycles
2nd Year -	2	ringweeding cycles
	5	ringweeding cycles

5 ringweeding cycles/tree
x ₱.10/cycle/tree = ₱.50
₱.50/tree x 2000 trees/ha.

4/ Includes labor for ringweeding, mulching and fertilizer application

c) Fertilizer:

One (1) application during Year 1 for
400 climax trees x 30 grams/tree
÷ 1000 grams/kg = 12 kgs/ha.
12 kgs x P5.00/kg — P [illegible]

One (1) application during Year 1 for
2000 nurse trees x 15 grams/tree
÷ 1000 grams/kg = 30 kgs/ha.
30 kgs x P5.00/kg — P 15[illegible].00/ha

d) Building Maintenance (Office, Nursery Building, Laborers Barracks)

1. Annual expenditure equivalent to twenty percent (20%) of original investment cost.

2. <u>Original investment/ha. (see 4.0, 5.0 and 6.0)</u>

- Field Office/Quarters/Bodega	P 64.00/ha.
- Laborers Barracks	140.00/ha.
- Nursery House	32.00/ha.

	P 236.00/ha.

3. P236/ha x 20%/yr x 4 yrs. (Yr. 2 - 5) — P [illegible]

e) Guarding, patrol work:

- For 500 has: 2 workers x 250 days/yr x 5 yrs = 2500 o.d.

- For 1 ha: 2500 o.d. ÷ 500 has = 5 p.d.
  5 p.d./ha x P35/p.d. — P 175.00/ha.

12.0 Supervision and Management

11.1 Salaries

a)	Project Manager's salary: P4000/mo x 60 mos.	240,000
b)	Four (4) field foremen x P2000/mo. x 60 mos.	480,000
c)	One (1) Office Manager/Accountant x P3000/mo x 60 mos.	180,000
d)	One (1) Handyman x P700/mo x 60 mos.	42,000
	Sub-Total (Salaries)	882,000 ÷ 500 mas. [illegible]

11.2 Miscellaneous Operating Expenses

a)	Transportation: P1000/mo x 60 mos	60,000
b)	Office Supplies: P500/mo x 60 mos.	30,000
c)	Communications, medicines and incidentals: P1000/mo x 60 mos.	60,000
	Sub-Total (Mis. Oper. Expenses)	150,000 ÷ 500 mas. [illegible]

13.0 TOOLS AND MISCELLANEOUS MATERIALS [illegible]

APPENDIX B

Maintenance/Harvesting/Revenue Assumptions for Production Forest
(typical case: 18-30% slope, moderate growth potential)

1.0 Woodlands Operations:

1.1 Fuelwood thinning:

a. First thinning: 5 years after planting - removal of 900 nurse trees

25 cu m (solid)/ha x P200/cu m	P 5,000
less:	
falling and bucking P10/cu m x 25 cu m	250
skidding P20/cu m x 25 cu m	500
trucking P3/cu m/km x 25 cu m x 30 km	2,250
net income	2,000

b. Second thinning: 7 years after planting - removal of remaining nurse trees

70 cu m/ha x P200/cu m	P14,000
less:	
falling and bucking P10 cu m x 70 cu m	700
skidding P20/cu m x 70 cu m	1,400
trucking P3/cu m/km x 70 cu m x 30 km	6,300
net income	5,600

1.2 Pole thinning: 10-12 years after planting (200 poles)

100 cu m/ha x P300/cu m	P30,000
less:	
harvesting P5 cu m x 100 cu m	500
skidding P10/cu m x 100 cu m	1,000
trucking P3/cu m/km x 100 cu m x 30 km	9,000
net income	19,500

1.3 Sawtimber harvests

a. 100 trees 20 years after planting

80 cu m/ha x ₱900/cu m	₱72,000
less:	
harvesting ₱5/cu m x 80 cu m	400
skidding ₱20/cu m x 80 cu m	1,600
trucking ₱3 cu m/km x 80 cu m x 30 km	7,200
net income	62,800

b. 100 trees 30 years after planting

150 cu m/ha x ₱900/cu m	₱135,000
less:	
harvesting ₱5/cu m x 180 cu m	750
skidding ₱20 cu m x 150 cu m	3,000
trucking ₱3/cu m/km x 150 cu m x 30 km	13,500
net income	117,750

2.0 Fruit Tree Component:

Fruit trees planted on block boundaries
Average block size = 6.5 ha
Average perimeter per block = 1,000 m or 150 m/ha
Borders planted to fruit trees also serve as firebreaks
Average width of border = 10 m
Total border area planted to fruit trees = 1,500 sq m

2.1 Mangoes

1000 m ÷ 40 m spacing = 25 trees ÷ 6.5 ha = 4 trees/ha

a. Revenues:

Years 6 - 8 :	100	fruits/tree/yr x	4 trees x	₱.63/fruit	=	₱ 250/yr
Years 9 - 12:	400	"	"	"	=	₱1,000/yr
Years 13 - 19:	600	"	"	"	=	₱1,500/yr
Years 20 - 30:	1000	"	"	"	=	₱2,500/yr

Revenue estimates are reduced by one-third, assuming one had production year out of every three years.

b. Production costs:

₱50/ha/yr for spraying and pruning in years 2 - 6
₱100/ha/yr for spraying and pruning in years 7 - 30
25 % of total revenues for harvesting and sales

2.2 Jackfruit

1000 m ÷ 20 m spacing = 50 trees ÷ 6.5 ha = 8 trees/ha

a. Revenues:

Years 6 - 8 :	5 fruits/tree/yr	x 8 trees	x ₱6.25/fruit	=	₱ 250/yr
Years 9 - 12:	10	"	"	=	₱ 500/yr
Years 13 - 30:	20	"	"	=	₱1,000/yr

Revenue estimates are reduced by one-third, assuming one bad production year out of every three years.

b. Production costs:

₱15/ha/yr for spraying and pruning in years 2 - 6
25 % of total revenues for harvesting and sales

2.3 Cashew

1000 m ÷ 10 m spacing = 100 trees ÷ 6.5 ha = 15 trees/ha

a. Revenues:

Years 6 - 8 :	.25 kg/tree/yr	x 15 trees	x ₱10.00/kg.	=	₱ 37.50
Years 9 - 12:	1.0	"	"	=	₱150.00
Years 13 - 19:	1.5	"	"	=	₱225.00
Years 20 - 30:	4.0	"	"	=	₱600.00

Revenue estimates are reduced by one-third, assuming one bad production year out of every three.

b. Production costs: 25 % of total revenue

2.4 Coffee

1000 m ÷ 4 m spacing x 2 rows = 500 trees ÷ 6.5 ha = 75 trees/ha

a. Revenues:

Years 4 - 5 :	.1 kg/tree/yr	x 75 trees	x ₱31.25/kg	=	₱ 234.38
Years 6 - 8 :	.3	"	"	=	₱ 703.13
Years 9 - 30:	.5	"	"	=	₱1,171.88

Revenue estimates are reduced by one-third, assuming one bad production year out of every three.

b. Production costs: 25% of total revenue

3.0 Intercrop Component

Production is assumed to fall by 25% in the second year, and by half in the third year. No intercropping is anticipated beyond the third year with the exception of bananas.

3.1 Kadios

Year 1:	800 kg/ha x .20 ha	= 160 kg	
	160 kg x ₱15/kg	=	₱2,400.00
	less production cost ₱5/kg x 160 kg		- 800.00
			₱1,600.00
Year 2:	600 kg/ha x .20 ha	= 120 kg	
	120 kg x ₱15/kg	=	₱1,800.00
	less production cost ₱15/kg x 120 kg		- 600.00
			₱1,200.00
Year 3:	400 kg/ha x .20 ha	= 80 kg	
	80 kg x ₱15/kg	=	₱1,200.00
	less production cost ₱15/kg x 80 kg		- 400.00
			₱ 800.00

3.2 Camote

Year 1:	2,000 kg/ha x .10 ha	= 200 kg	
	200 kg x ₱2.00/kg	=	₱ 400.00
	less production cost ₱.50/kg x 200 kg		- 100.00
			₱ 300.00
Year 2:	1,500 kg/ha x .10 ha	= 150 kg	
	150 kg x ₱2.00/kg	=	₱ 300.00
	less production cost ₱.50/kg x 150 kg		- 75.00
			₱ 225.00
Year 3:	1,000 kg/ha x .10 ha	= 100 kg	
	100 kg x ₱2.00/kg	=	₱ 200.00
	less production cost ₱.50/kg x 100 kg		- 50.00
			₱ 150.00

3.3 Cassava

Year 1:	2,000 kg/ha x .05 ha = 100 kg		
	100 kg x ₱2.00/kg =	₱	200.00
	less production cost ₱.30/kg x 100 kg -		30.00
		₱	170.00
Year 2:	1,500 kg/ha x .05 ha = 75 kg		
	75 kg x ₱2.00/kg =	₱	150.00
	less production cost ₱.30/kg x 75 kg -		22.50
		₱	127.50
Year 3:	1,000 kg/ha x .05 ha = 50 kg		
	50 kg x ₱2.00/kg =		100.00
	less production costs ₱.30/kg x 50 kg -		15.00
		₱	85.00

3.4 Corn

Year 1:	800 kg/ha x .05 ha = 40 kg		
	40 kg x ₱2.00/kg =	₱	80.00
	less production costs ₱.50/kg x 40 kg -		20.00
		₱	60.00
Year 2:	600 kg/ha x .05 ha = 30 kg		
	30 kg x ₱2.00/kg =		60.00
	less production costs ₱.50/kg x 30 kg -		15.00
		₱	45.00
Year 3:	400 kg/ha x .05 ha = 20 kg		
	20 kg x ₱2.00/kg =	₱	40.00
	less production costs ₱.50/kg x 20 kg -		10.00
		₱	30.00

3.5 Malungay

Year 1:	200 bundles x ₱1.00/bundle	₱ 200.00
	less production costs ₱.50/bundle	- 100.00

		₱ 100.00
Year 2:	150 bundles x ₱1.00/bundle	₱ 150.00
	less production costs ₱.50/bundle	- 75.00

		₱ 75.00
Year 3:	100 bundles x ₱1.00/bundle	₱ 100.00
	less production costs ₱.50/bundle	- 50.00

		₱ 50.00

3.6 Squash

Year 1:	100 pcs x ₱3.00 each	₱ 300.00
	less production costs ₱.20 each	- 20.00

		₱ 280.00
Year 2:	75 pcs x ₱3.00 each	₱ 225.00
	less production costs ₱.20 each	- 15.00

		₱ 210.00
Year 3:	50 pcs x ₱3.00 each	₱ 150.00
	less production costs ₱.20 each	- 10.00

		₱ 140.00

3.7 Bananas (years 2 - 6)

10 hills/ha x 2 bundles/hill x ₱25/bunch = ₱ 500.00
production costs: ₱50/ha in years 1 - 2
₱100/ha in years 3 - 6

APPENDIX C

Maintenance/Harvesting/Revenue Assumptions for Protection Forest
(typical case: > 50% slope, permanent trees)

1.0 Rattan

50/ha x 10 m/harvest x ₱2.50/m =	₱1,250.00
less production costs ₱.50/m x 500 m	- 250.00
(harvests in years 12, 20, and 28)	₱1,000.00

2.0 Sigid

100/ha x 5 m/harvest x ₱.20/m =	₱ 100.00
less production costs of ₱.05/m x 500 m	- 25.00
(harvests in year 6 and every other year thereafter)	₱ 75.00

3.0 Bamboo

5/ha x 3 poles/harvest x ₱20.00/pole =	₱ 300.00
less production costs of ₱10.00/pole	- 150.00
(harvests in year 6 and every other year thereafter)	₱ 150.00

4.0 Pili

Years 10-12:	5 trees x 500 nuts/tree x ₱.10/nut	₱ 250.00
	less production costs of ₱.02/nut	- 50.00
		₱ 200.00
Years 13-17:	5 trees x 1,000 nuts/tree x ₱.10/nut =	₱ 500.00
	less production costs of ₱.02/nut	- 100.00
		₱ 400.00
Years 18-22:	5 trees x 1,500 nuts/tree x ₱.10/nut =	₱ 750.00
	less production cost of ₱.02/nut	- 150.00
		₱ 600.00
Years 23-30:	5 trees x 2,000 nuts/tree x ₱.10/nut	₱1,000.00
	less production costs of ₱.02/nut	- 200.00
		₱ 800.00

5.0 Anahaw

20/ha x 2 leaves/plant/yr x ₱.20/leaf =	₱	8.00
less production costs of ₱.05/leaf	-	2.00
	₱	6.00

6.0 Lanzones

Years 12-17:	5 trees x 5 kg/tree/yr x ₱10.00/kg =	₱	250.00
	less production costs of ₱2.00/kg	-	50.00
		₱	200.00
Years 18-22:	5 trees x 10 kg/tree/yr x ₱10.00/kg =	₱	500.00
	less production costs of ₱2.00/kg	-	100.00
		₱	400.00
Years 23-28:	5 trees x 15 kg/tree/yr x ₱10.00/kg =	₱	750.00
	less production costs of ₱2.00/kg	-	150.00
		₱	600.00
Years 29-30:	5 trees x 20 kg/tree/yr x ₱10.00/kg =	₱	1,000.00
	less production costs of ₱2.00/kg	-	200.00
		₱	800.00

7.0 Fruit tree (block borders) component

Revenues reduced 50 percent relative to production forest values. Costs of production reduced 25% relative to production forest costs.