

Employment Effects of Reforestation Programs

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EMPLOYMENT EFFECTS OF REFORESTATION PROGRAMS

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Chapter 1

INTRODUCTION

1.1 Background and Objectives

This report is prepared under commission from Thailand Development Research Institute. The objectives of the study are as follows:

1. (a) to estimate the areas to be cultivated with forest-trees by governmental agencies and private enterprises over the next 15 years.

(b) to assess employment in wood-related industries, including rubber trees but not fruit trees.

2. to establish the employment profile of reforestation undertaken by different enterprises, in terms of selected indicators.

3. to indicate how the upcoming reforestation programs could respond to

(1) problems of population growth.

(2) the potential employment generation corresponding to the national forest policy of designating 25% of the total land area as "economic forest".

The present study is based on secondary sources. No fieldwork is attempted. Interviews with selected resource persons supplement the information from the published sources.

The remainder of the study is organised ~~into~~ 4 chapters. Chapter 2 deals with reforestation plans of the various agencies and presents data on employment in wood-related industries. Chapter 3 analyses the employment profiles of the reforestation plans.

Chapter 4 analyses two aspects of the role of reforestation in rural development: firstly, the employment impact of reforestation in relation to population growth; secondly, the employment effect of implementing the national forest policy of designating 25% of the country's land area as "economic forest". Chapter 5 brings together the main findings of the study.

1.2 Definition of Terms

1.2.1 Reforestation

Julian Evans(1983) defines a forest plantation as follows:

" A plantation is defined as "A forest crop or stand raised artificially, either by sowing or planting". ...Five forest types can be identified according to their origins.

1. Afforestation of bare land where there has been no forest for at least 50 years

2. Reforestation of land which has carried forest within the last 50 years but where the previous crop is replaced by an essentially different one.

3. Reforestation of land which has carried forest within the last 50 years by renewal of essentially the same crop as before.

4. Forest established by natural regeneration with deliberate silvicultural intervention and assistance by man.

5. Forests which have regenerated naturally without assistance from man."

The term "plantations" refers to type 1 - 3 forests defined above. (Evans,1983,p.12)

1.2.2 Types of Forest Plantations

Forest plantations can be classified into 3 types on the basis of the planter and the land on which the plantation is established. These are:

- (1) government planting on government land
- (2) private planting on government land
- (3) private planting on private land

In Thailand, the case of government planting on private land is not found in practice and will not be further considered.

Details of each type are presented below.

(1) Government planting on government land: this case refers to planting done by government agencies such as the planting by RFD in reserve forests and national parks and watershed areas. Three divisions within RFD are responsible for reforestation. The Silviculture Division is responsible for the maintenance of the forest conditions and undertake improvement planting in the forest for general purposes. The Watershed Division carries out planting for the protection of watersheds. Finally, the Forest Land Management Division carries out reforestation on degraded forest land, as well as being responsible for work relating to the management and control of settlements established within forest areas under projects such as the STK.

(2) Private planting on government land There are two main types of private plantation on government land. The first is the case of planting by timber concessionaires in designated areas in fulfilment of the concession requirement. Much of the reforestation of FID falls within this definition. The second type of private planting on government land is the planting by private

persons in reserve forest land by renting the land from the RFD in accordance with Articles 16 or 20 of the Forest Law. The essential feature of this kind of planting is that the RFD has the authority to control the details of the planting -- including site selection, species choice, tending and harvesting methods. The problem with this kind of planting is usually the difficulty in finding the site which is free from problems with squatters and other claimants to the land. However, there has been an upsurge of interest in, and actual implementation of, the private non-concessionaire forest plantation in recent years.

(3) Private planting on private land This type of plantation can be regarded as an agricultural crop. The planter has full control over his planting operations. The difficulty lies in the utilisation of the harvested trees, which are subject to the provisions contained in the forest laws, such as transportation, processing and exports. However, where the wood concerned does not belong in the reserved species, some of the rules have been modified by the government in an effort to encourage more private plantation.

With respect to private plantation on both public and private land, a draft bill, titled the Forest Plantation Act, was prepared by the Ministry of Agriculture and Cooperatives and was considered by the National Forest Policy Committee and was reported to the cabinet in 1985 (Bhichai, 1988). According to the draft, areas designated "forest plantations" will be subject to the provisions of the act, which will relax most of the controls currently in force on logging and transportation of trees from

the natural forest. It remains to be seen if the bill will be re-submitted to Parliament after the ban on logging imposed in January 1989, or if it will be modified before a new submission.

The present study has as its main focus the systematic planting of forest trees on an extensive land area for commercial purposes. This definition includes the following:

(1) reforestation by timber concessionaires as part of the concession agreement. Planting by FIO is included under this heading.

(2) planting of trees by private persons or enterprises for commercial purpose, without the need to fulfil the timber concession agreement.

However, the definitions above exclude planting of trees in the form of village woodlots, farm forestry and tree planting for other purposes such as environmental protection and amenity uses.

CHAPTER 2

REFORESTATION PLANS AND PROGRAMS

2.1 Area to be Reforested

2.1.1 Current Status of Reforestation

As recently as 1961 (or less than 30 years ago), Thailand had 53 per cent of its land area under forest. For this reason, the majority of plantation of forest trees in the country has been mostly reforestation type 2, replacement of a crop by forest trees, and type 3, reforestation of land with the same crop, rather than type 1, planting of land which has been without forest for over 50 years. Taken all reforestation together, the rate of reforestation has been far less than the rate of loss of forest cover. Table 2.1 shows the status of reforestation as of 1987.

Table 2.1 Reforestation As of 1987

Government Planting

<u>Planting Organisation</u>	<u>Type</u>	<u>Area</u> unit=rai
Silviculture Division(1)	teak	654,325
	mixed	768,050
Watershed Division(1)		658,275
Forest Land Management Div.(1)		719,056
Concession Replanting(2)	teak	424,082
	mixed	418,705
Non-budgetary Replanting(2)	teak	11,683
	mixed	3,688
<u>Private Planting(3)</u>		650,652
Total		----- 4,308,516 =====

Sources:(1) Silviculture Division,1988. Species not indicated.
(2) Forest Management Division, personal communications.
(3) Office of Private Sector Reforestation Extension,1988

2.1.2 Government Programs for Reforestation

RFD is the main agency implementing government reforestation programs. Within the department, three divisions are responsible

for the reforestation, namely the Silviculture Division, the Watershed Division and the Forest Land Management Division. The fund for the work is provided from the annual government budget. The objectives of each program are different.

Silviculture Division The Division undertakes reforestation work in forest reserve land, to maintain the forest's productive capacity for timber production.

Watershed Division undertakes reforestation in upper watershed areas to provide environmental protection against soil erosion and generally to maintain the watershed.

Forest Land Management Division undertakes reforestation of degraded forest land.

According to the Sixth National Economic and Social Development Plan, the government intends to establish 300,000 rai of forest plantations annually. However, actual budget allocation has fallen short of the planned target. For example, for the 1989 budget year, RFD is given a budget to establish ^{about} 150,000 rai of forest plantation of which 62,250 rai are to be planted by the Silviculture Division, 38,620 rai by the Watershed Division and 48,820 rai to be planted by the Forest Land Management Division (Silviculture Division, 1988).

The plantation by RFD suffers from a limitation of budgetary resources. The standard rate of 1,000 baht per rai is allowed for in the planting, which is less than that elsewhere (see more details in following sections). Other problems encountered in implementing the plan are (1) resistance from farmers occupying

the land earmarked for reforestation and (2) seasonality factors affecting the survival of the planted seedlings. (Silviculture Division, 1988)

2.1.3 Private Reforestation Programs

Planting by Timber Concessionaires

As part of the timber concession, the loggers are required to pay a sum of money to RFD for the purpose of reforestation. The current practice as laid down by the RFD is as follows:

(1) Payment of royalty and reforestation fees. The reforestation fees are twice the royalty payment for mixed hardwood species, and four times the royalty payment for teak. The payments are to be deposited in the Reforestation Fund Account at a bank on the same day the royalty payment is paid.

(2) Calculation of the area to be reforested. Based on the actual amount of the paid reforestation fee, the area to be reforested is calculated in accordance with the RFD rates:

Teak	2,630 baht per rai
Mixed hardwood	2,820 baht per rai.

It can be seen that the area to be reforested will vary according to the amount of royalty paid, and therefore on the amount of logging that has been allowed. There is thus an element of uncertainty in the plan for reforestation by timber concessionaires with regard to the amount of reforestation they will have to undertake in each year.

(3) Site selection. A regulation in 1982 stipulated that a committee be set up to determine the area to be replanted. This is so that the area is appropriate for the purpose and to avoid

problems with the villagers or community over the site to be reforested.

(4) Permit Issue Once the site has been determined, the planter will have to file a request to use the site for reforestation under Article 20 of the Forest Act, or to clear the site under Article 54 of the same Act for the purpose of establishing a forest plantation.

(5) Approval of Workplan The planter is required to submit his workplan for approval by the RFD.

(6) Payment from the Reforestation Fund. The planter will receive payment from the reforestation fund after the work has been inspected and approved by a committee.

(7) Withdrawal of Interest from the Reforestation Fund.

The planter is allowed to withdraw interest accruing to the Reforestation Fund for the purpose of meeting expenses arising from the reforestation work.

(8) Monitoring and Evaluation. A sub-committee will monitor and evaluate the progress of the reforestation work by the planter.

It will be seen that the RFD exercises strict control over the reforestation work by the timber concessionaires. The control extends from site selection to the technical aspects of plantation, such as choice of species, spacing, weeding, etc. In this respect, the role of the RFD is both that of a technical adviser and a controller of the activity.

With regard to the cost of planting, according to an account by a timber concessionaire (Banyong, 1988), the budget allowed for plantation establishment is inadequate. In his estimation, the

amount needed for the establishment of a plantation is 2,780 baht per rai, and if tending costs are included, 3,580 baht per rai. If the fixed costs of office building and workers' housing, interest on working capital are included, the cost would reach 5,999.30 baht.

In an attempt to introduce an element of forward planning into the reforestation by concessionaires, the RFD now requires the regional forestry offices to prepare rolling 5 year plans for reforestation in their areas of responsibility to minimise the delay in finding appropriate sites for reforestation. The success of this measure remains to be evaluated. Yet, if the plan is still based on the amount of royalty payment received, which is in turn based on the level of logging activity carried out in the previous year, the variability of the concession fees will still lead to variability in the area designated for reforestation by the concessionaires.

With the growing public resistance to logging, even within legally prescribed limits, this type of forest planting is likely to decline in importance, as the logging activity comes increasingly under pressure by local communities and environmental interest groups to stop all logging activities.

Furthermore, with regard to the area to be planted, if the current logging ban^{is} in force, then under the present regulations, there would be no more planting by the concessionaires in future.

Forest Industry Organisation's Reforestation Plan

The Forest Industry Organisation, which is a public enterprise, is treated as a timber concessionaire, so it is included in

this section as a private planter. In contrast to other timber concessionaires, however, the FIO appears to have a more systematic approach to its reforestation activity than the others. This is probably because it is technically more qualified to prepare such a plan, and also that its status as a public enterprise requires that it prepares such a plan to accompany budget requests. In any case, the role of the FIO in reforestation is an important one. According to Amnuay (1987), FIO reforestation activities fall under three projects. Project I is the planting to supply FIO with timber for the future. Project II is planting by FIO to fulfil its concession obligations and Project III is reforestation on behalf of other timber concessionaires. In terms of financing, FIO pays for the planting under Project I from its own operating profit, after 50% of which has been remitted to the government. For Project II, the money comes from the Reforestation Fund which the RFD provides from the logging charges. The same applies to planting under Project III. Since 1981, the activities under Project III were discontinued by the decision of the FIO Board of Directors.

As of 1987, FIO has a total of 387,474 rai of plantation, of which 232,150 is teak and the rest mixed hardwood.

The future plan of FIO, with regard to teak plantation, is to achieve a total of 333,500 rai of teak plantation within the next 15 years (year 2002). This will comprise the 232,000 (rounded figure) rai of existing teak plantation and 101,500 rai of new plantation. The new plantations will be located in existing plantations which still have land for expansion, mostly in the north where teak is the natural vegetation. It is planned that 77,500

rai will be planted with teak. In the Northeast, teak will be planted on 15,000 in Loei Province, and in the West, 9,000 rai in Tongphapoum Forest Plantation. The rotation periods will vary from 15 to 45 years.

Table 2.1 Forest Industry Organisation's Plan for Teak Plantation

<u>Rotation</u>	<u>Total Area</u> (rai)
15 years	30,000
25 years	45,000
45 years	26,500

Total	101,500

Source: Amnuay, 1987.

Other Private Reforestation Programs

The focus of interest in recent times has been on the intentions of various private enterprises to plant fast-growing trees, especially **Eucalyptus camaldulensis** on a large scale to produce, among other possibilities, wood chips for export. The Board of Investment has designated Industrial Plantations as an activity eligible for investment incentives. The conditions set by BOI for investment promotion are (1) the plantation should be more than 1,000 rai and (2) that the promoted firm should have at least 60% of the capital held by Thai nationals. The BOI-promoted plantations are shown in Table 2.2.

**Table 2.2 BOI-Promoted Eucalyptus Plantations
Eucalyptus Cultivation**

No. Name	Location	Year Approved	Area (rai)	Export (%)	Investment (million baht)	Employment
1 Kian Chunprasert	Kanchanaburi	1988	1,500	0	55.00	190
2 Suan Siam Kitti Reforestation Co.,Ltd.	Rayong Chachoengsao Prachinburi Cholburi	1988	20,000	80	120.00	257
3 M.R. Eucalyptus Agriculture Co.ltd	Petchburi	1987	15,000	0	110.00	170
4 Siam Forestry Industrial Co.Ltd	Chachoengsao	1986	3,000	0	23.15	0
5 Siam Yana Forestry Industrial Co.	Kampaengpetch	1986	3,000			
6 Suan Siam Kitti Reforestation Co.,Ltd.	Chachoengsao	1986	10,000	20	70.00	240
7 Rich Forest Co.Ltd.	Nakornnayok	1984	10,000	0	200.00	67
8 Siam Agrotex Co.Ltd	Chachoengsao Ayuthaya Patuntani	1984	5,200	0	97.00	242
9 Vanapan Co.Ltd.	Chachoengsao	1984	3,000	0	46.00	
10 Vanapan Forestry Co.Ltd.	Yala	na	3,000	0	46.00	na

Source: BOI, approvals upto July 31, 1988.

There are also others, who have already or are intending to establish plantations for commercial purposes, though they have not received, or are not seeking BOI incentives. Among these, the major planters who have made public their plans are Thai Shell Co.Ltd., (125,000 rai) and the Thai-Japan Reforestation Project (1.2 million rai). The problems facing these projects are well known: access to land in degraded reserve forest for planting, or the high cost of land acquisition if the plantation is located on privately-owned land. The exception is Suan Siam Kitti Reforestation Co.Ltd. which is planting on private land which it buys from the farmers.

The following gives summary accounts of some of the major plantation projects mentioned above.

Plan of Thai Shell

The plantation will occupy an area of 125,000 rai, to be planted with **Eucalyptus camaldulensis** using a 5 year rotation. This means 1/5 of the area, or 25,000 rai, will be planted in any one year. The project is expected to produce one million green trees annually, or 500,000 tons dry weight. Total investment will be 1,200 million baht. Employment generated is expected to be more than 1,000 jobs, giving a household income of 30,000 baht per year, and also creating jobs in related services such as driving.

Plan of Siam Cement Co.Ltd.

The company plans to plant **Eucalyptus camaldulensis** for feeding its pulp mill. The area for planting is 30,000 rai, using a 7 year rotation or 4,000 rai annual planting.

Plan of Thai-Japan Reforestation Project

A major project which has been on the drawing board for some time is the Thai-Japan Reforestation Project. The project aims to plant 1.2 million rai of eucalyptus over a period of 6 years, with an establishment of 200,000 rai plantation annually. The output of the project will be wood chips for export to Japan. The location of the project will be in 28 districts of the central region. In this scheme, farmers will be given bank loans to carry out tree planting in 20 rai of their land for three years at a rate of 2,500 baht per rai. At present, the project is under consideration by the Ministry of Agriculture.

Plan of Suan Siam Kitti Reforestation Co.Ltd

Suan Siam Kitti Reforestation Co.Ltd., otherwise known as Soon Hua Seng, plans to establish 350,000 rai of **Eucalyptus** plantations in four provinces - Prachinburi, Chachoengsao, Rayong and Chonburi, by the year 1992. The output from the plantation will be used in a pulp mill being planned, to have a capacity of 330,000 tonnes per year, which is scheduled to start operation in 1994. (The Nation, Dec.12,1988)

In addition to investment in plantations, BOI also gives investment incentives to firms using fast growing trees as raw material input. The major uses are (1) **wood chip**, mainly for the export market, (2) **particle board** manufacture, using chipwood as raw material and (3) **paper pulp** manufacture, which also uses chipwood as raw material. If these firms were to operated at their full planned capacities, the demand for trees to feed the factory operation would also lead to forest plantations on an extensive scale.

Table 2.3 Firms with BOI Privileges for Wood Chips and Particle Board Production

No.	Name	Location	Year Approved	Capacity	Unit	Export (%)	Investment (million baht)	Employment
Wood Chip								
1	Siam Vana Forestry Industrial Co.	Chachoengsao	1986	510,000	Tons/year	100	70.02	45
2	Siam Agrotex Co.Ltd.	Chachoengsao	1986	561,000	Tons/year	100	77.94	34
3	Thai Wittawat Corp.	Surin	1988	65,280	Tons/year	100	65.00	100
4	N.R. Eucalyptus Agriculture Co.ltd	Petchburi	1987	65,000	Tons/year	80	50.00	94
5	Thai United Chipwood Corp.	Cholburi	1988	100,000	Tons/year	100	53.26	82
6	C.Makorn International	Cholburi	1986	150,000	Tons/year	100	29.25	40
7	Siam Forestry Industrial Co.Ltd	Chachoengsao	1986	255,000	Tons/year	100	40.02	31
8	Thai Wood and Pulp Co.Ltd.	Makornratchasima	1988	46,000	Tons/year	100	15.44	114
9	Kitti Garden Co.Ltd.	na	na	65,000	Tons/year	na	70.00	na
10	V.P.Eucalyp Chipwood	Chachoengsao	1987	240,000	Tons/year	na	185.00	na
Particle Board								
1	Thai Cane Board Co.Ltd.	Kanchanaburi	1988	18,000	Tons/year	100	67.00	100
2	Sahachai Particle Board Co.	Monthaburi	1987	1,650,000	sheets	0	280.00	80
3	Haadyai International Trading Co.Ltd	Songkhla	1987	528,000	sheets Tons/year	50	105.00	74
4	Amporn Euwongcharoen	Songkhla	1988	1,500,000	sheets	80	500.00	150
5	Uthes Lilavivat	Songkhla	1988	53,760	cu.m.	80	360.00	141
6	Siam Agrotex Co.Ltd	Chachoengsao	1986	66,000	Tons/year	0	415.00	180
7	Assachan Osharos	Monthaburi	1986	210,000	sheets	0	70.00	78
8	Vichai PattanaPaisalchai	Rayong	1986	1,378,640	sheets	0	140.00	158
9	Thai Cane Board Co.Ltd.	Kanchanaburi	1977	1,200,000	sheets	0	16.93	52
10	Thai Chip Board	Samutprakarn	1969	1,000,000	sq.m.	0	135.59	259
11	Khon Kaen MDF Board Co.Ltd.	na	1986	396,000	pieces	na	345.00	na
12	Son Thai Wood Co.Ltd	na	n/o	246,000	pieces	na	182.00	na
13	Wood Composition Board Industry Co.Ltd.	na	n/o	1,379,040	sheets	na	140.00	na

Source: BOI, as of December 1988.

Note: n/o=not in operation. na=not available

Table 2.4 BOI-Promoted Pulp Manufactures

No.	Name	Location	Year Approved	Capacity (tons)	Investment (million baht)
1	Kimberley-Clark	Samutprakarn	1984	5,952	18.00
2	Panjapon Pulp and Paper	Bangkok	1978	50,000	235.00
3	Phech Paisal Industry	Samutprakarn	1984	5,952	50.00
4	Phoenix Pulp&Paper	Khonkaen	1982	50,000	735.00
5	Siam Pulp and Paper	Ratchaburi	1979	na	500.00

Source:BOI,as of December 1988.

Though the raw materials for pulp manufacture can be varied, ranging from kenaf, bamboo, grass, to used paper, woody materials can also be used. The establishment of the domestic pulp manufacturing industry is therefore an added incentive to the potential investor in forest plantation.

2.2 Employment in Wood-related Industries

2.2.1 Industrial Survey Data

The use of forest products for industrial processing ranges from producing simple tools for farm use, construction materials, to furniture. Paper made from pulp can be made into containers, printing materials, and so on.

Due to the large variety of end uses of wood, therefore, the estimation of employment in wood-related industries cannot be exact, being dependent on the definition which is adopted for the purpose of the tasks at hand.

Generally, wood-related industries range from the logging of trees in natural forests which until recently were the main source of wood, though this is expected to change to harvesting of wood from plantations (Niwat, 1988), to the transportation of the logs to the sawmills, or the processing of the logs into

sawnwood **in situ**, in case the mobile saw mill is used. The sawnwood is then available for further uses, from construction, furniture making, chipping or veneering to make wood-based boards, or pulping for making paper. The cycle is completed with reforestation to establish a source of future wood supply.

For this study, the wood-related industries are defined as those that correspond to the Thailand Standard Industrial Classification Order 33 and 34, including the manufacture of charcoal. The definition is made to conform with the availability of data from the National Statistical Office's Industrial Surveys, which are the main data source for the following discussion.

The summary data from the NSO Industrial Surveys for 1979 and 1984 are shown in Table 2.5 .

**Table 2.5 Summary Statistics of Industrial Establishments
In Wood-related Industries, from NSO 1980, 1985 Industrial Survey**

code	Industry	No of establishment	total employment	value added (1,000 baht)	Fixed Asset (1,000 baht)	Value Added per worker (baht)	Fixed Asset per worker (baht)
<u>Year 1979</u>							
<u>10-19 workers</u>							
33111	saw mill	137	2,902	190,969	88,785	65,806	30,594
33112	veneer,plywood	5	40	15,874	402	396,850	10,050
33113	builders' woodwork	68	1,008	20,169	13,411	20,009	13,305
33190	wood&cork products	51	917	35,057	969	38,230	1,057
34112	fibreboard	3	118	2,118	1,663	17,949	14,093
	Total	264	4,985	264,187	105,230	52,996	21,109
<u>20 persons or more</u>							
33111	saw mill	523	34,382	2,633,010	1,473,697	76,581	42,862
33112	veneer,plywood	29	13,187	1,378,286	1,284,435	104,519	97,402
33113	builder's woodwork	45	1,128	167,721	97,996	148,689	86,876
33120	containers	10	93	1,353	2,457	14,548	26,419
33190	wood&cork	41	1,768	56,118	59,779	31,741	33,812
33201	furniture&fixtures	149	8,193	351,149	446,956	42,860	54,553
33202	furniture(rattan)	3	425	26,794	12,427	63,045	29,240
34111	pulp&paper	40	15,906	2,490,875	5,674,407	156,600	356,746
34190	paper products	20	1,516	249,183	407,027	164,369	268,487
35112	charcoal	95	2,493	51,044	51,590	20,475	20,694
	Total	955	79,091	7,405,533	9,510,771	93,633	120,251
	Total	1,219	84,076	7,669,720	9,616,001	91,224	114,373
<u>year 1985</u>							
<u>10-19 workers</u>							
33111	saw mill	144	1,803	171,451	173,408	95,092	96,177
33120	containers	7	105	3,346	11,550	31,867	110,000
33190	wood&cork products.	45	195	7,862	1,826	40,318	9,364
33201	furniture	39	446	13,610	28,252	30,516	63,345
34112	fibreboard	2	not disclosed				
34190	paper products	16	96	23,889	15,148	248,844	157,792
	Total	253	2,645	220,158	230,184	83,236	87,026
<u>20 persons or more</u>							
33111	saw mill	370	27,269	1,902,737	1,806,977	69,777	66,265
33112	veneer,plywood	27	14,211	1,793,009	2,524,690	126,171	177,657
33120	containers	10	610	70,874	12,339	116,187	20,228
33201	furniture&fixtures	120	10,950	1,346,120	685,809	122,933	62,631
33202	furniture(rattan)	3	1,227	83,663	107,335	68,185	87,478
34111	pulp&paper	31	13,128	4,207,983	6,005,749	320,535	457,476
34120	paper containers	35	12,480	824,520	697,410	66,067	55,882
34190	paper products	18	5,850	2,285,300	2,462,515	390,650	420,943
35112	charcoal	83	5,477	215,100	71,954	39,273	13,137
	Total	697	91,202	12,729,306	14,374,778	139,573	157,615
	Total	950	93,847	12,949,464	14,604,962	137,985	155,625

According to the NSO Industrial Surveys, employment in the wood-related industries have increased, even though the number of establishments declined during the period 1979 to 1984. The decline is most pronounced in the saw-milling sector, where the number of sawmills employing 20 persons or more fell from 523 in 1979 to 370 in 1984.

Despite the fall in the number of establishments, total employment increased from 84,076 in 1979 to 93,847 in 1984. Value added for the sector as a whole also increased, from 7.6 billion baht in 1979 to 12.9 billion baht in 1984.

In terms of productivity, the data show clearly that labour productivity has increased, from 91,224 baht per person employed, to 137,985 baht, during the period 1979-1984. The increase is due in part to the rise in the capital/labour ratio, which rose from 114,373 baht per person employed to 155,625 baht. But another contributing factor, and probably the more important one, is the shift into larger-scale production which also has higher value-added per person employed.

In sum, the NSO data show that the wood-related industry as a whole has been a strong economic sector, expanding in both employment and income generation. The continued growth of the sector will be the main contributor to the demand for forest products from the future industrial tree plantations. Conversely, the lack of an adequate wood supply base will inhibit the growth of the sector. The need to rely on imported wood supply in the future, with the attendant problems of supply uncertainty and high prices, is likely to prove a constraint in the continuation and further development of the industry.

2.2.2 Other Wood-related Employment

The NSO Industrial Survey does not cover establishments below 10 persons employed. However, it is well-known, though data are not available to substantiate the assertion, that small-scale forest-based industries exist in many areas where the wood supply is available. Cottage industries can be found making carved wood products for the tourist industry, small-scale workshops producing window and door-frames for the local construction markets and small furniture makers can be found in most urban centres. In addition, the urban demand for charcoal, in industries, restaurants and households, also supports an industry employing a substantial number of people in the cutting of trees, making of the charcoal, and in the transportation of both the wood and the charcoal. For all these activities, the availability of wood is the basis of continued operation. (Opart et al,1987)

In the light of the employment generated by wood-related activities, and in the context of declining natural supply of wood, the role of reforestation in meeting the growth in demand and to sustain the growth of employment and income generation in the wood-related industry is highly significant.

CHAPTER 3

EMPLOYMENT EFFECTS OF REFORESTATION

In this chapter we analyse the impact of reforestation in terms of employment and income generation. The direct labour requirements are considered in section 3.1. The other characteristics of employment in reforestation activities are considered in section 3.2. The returns from alternative crops, including fast growing trees, are compared in section 3.3.

3.1 Labour Requirement for Reforestation

3.1.1 Labour Requirement

The steps involved in plantation establishment and operation can be systematically described in an annual cycle. The practice according to FIO is shown in Table 3.1.

Table 3.1 Annual Labour Requirement for Reforestation
unit=man-day per rai

Activity	:labour/rai	:teak	:mixed
Prelim.survey	0.32	0.32	0.32
inspection path	1.32	1.32	1.32
seedling preparation	n.i.	n.i.	n.i.
preparing stakes	0.26	0.26	0.26
land clearing	3.16	3.16	3.16
felling of small trees	3.16	3.16	3.16
burning	3.16	3.16	3.16
staking	0.53	0.53	0.53
planting	0.50	2.00	2.00
replacement planting	0.20	0.50	0.50
fertiliser application	0.53	1.05	1.05
weeding	6.00	6.00	6.00
survey	0.13	0.13	0.13
fire prevention	0.66	1.18	1.18
Total labour requirement	19.91	22.76	22.76

Source: After Monthee, 1985.

Note:n.i.=not included.

In a typical FIO plantation, the total requirement for

labour over a whole year in establishing a new plantation is 19.9106 man-days per rai for a teak plantation and 22.7632 man-days per rai for a mixed dipterocarp plantation, the difference arising from a slightly higher requirement for remedial planting, fertilizer application and fire prevention for the latter. After the first year of establishment, the plantation requires maintenance in the form of weeding, fertilizing and fire prevention. Table 3.2 shows the annual cycle of maintenance activities.

Table 3.2 Labour Requirement for Maintenance of a Plantation
unit=man-day per rai

Plantation Type: Teak

Activity	Year	2	3	4	5	6	7	8	9	10
replacement planting		0.3	0.2							
weeding		4.7	4.0	4.0	4.0					
fertilising		0.5	0.3							
groundcover planting		0.4								
preventive burning		0.5	0.5	0.5	0.5					
boundary making		0.1								
survival survey		0.1	0.1	0.1	0.1					
repair of road		0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
thinning						1.6	1.6	1.6	1.6	1.6
Total		7.2	5.5	5.1	5.1	2.0	2.0	2.0	2.0	2.0

Plantation Type: Dipterocarp

Activity	Year	2	3	4	5	6	7	8	9	10
replacement planting		1.0	0.5							
weeding		5.2	4.0	4.0	4.0					
fertilising		0.5	0.2							
groundcover planting		0.3								
preventive burning		1.3	1.3	0.5	0.5					
boundary making		0.0								
survival survey		0.1	0.1	0.1	0.1					
repair of road		0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
thinning						1.6	1.6	1.6	1.6	1.6
Total		9.2	6.6	5.0	5.0	2.0	2.0	2.0	2.0	2.0

Source: Monthee, 1985.

In summary, the total requirement for labour in a plantation of teak or dipterocarp trees will be:

Table 3.3 Labour Requirement for a 10 Year Rotation Plantation: Establishment and Maintenance

Unit : Man-days per rai

	Type of Plantation	
	Teak	Dipterocarp
Plantation establishment	19.9106	22.7632
Maintenance year 2	7.2104	9.2894
Maintenance year 3	5.5001	6.6712
Maintenance year 4-5	2x5.0790	2x5.0790
maintenance year 6-10	4x2.0000	4x4.0000
Total	50.7791	64.8818

Source: Monthee, 1985.

Note: not including labour requirement for seedling preparation

It will be seen that the labour requirement for the plantation on a per rai basis is quite low. Over the ten years period, one rai of teak plantation provides employment for 50.78 man-days. If the species planted is dipterocarp, employment is slightly increased, to 64.88 man-days, due to greater requirement for tending. Thus, to maintain a stable labour force in a plantation, careful management of the planting area will be required to provide year round employment. The plantation will also need to be of a substantial area.

In contrast to FIO practice, the recent trend in forest tree plantation has centred on fast-growing tree species, such as **Eucalyptus camaldulensis** and **Acacia spp.**. Data on the planting of these species are scanty, being based on experimental works in research sites, or unsystematically collected, if they refer to private planting. For instance, the following is an account of the labour employed in one private plantation in Chachoengsao province.

Employment Required in a Eucalyptus Plantation:

- (1) Filling bags with soil, 100 bags 4 baht, each person can fill 1,000 -2,000 bags (per day), earning 40-80 baht per person (per day).
- (2) Transplanting seedlings, 100 seedlings for 2 baht. 3,000 - 7,000 seedlings per person, 60-140 baht per person.
- (3) Hiring workers for watering and weeding
- (4) Ploughing of site, 270 -500 baht/rai.
- (5) Planting, 70-80 baht per rai. Each person can plant 1-2 rai.
- (6) Weeding, twice a year, 70-100 baht/rai.
- (7) Harvesting 20 baht per ton, and transporting to factory, 50 baht per ton for loading on trucks.
- (8) Trucking to factory, 80-100 baht per ton.
- (9) Pruning as required after coppicing.

Source: Akom, Who gets the income from tree planting? , in Thatchai Amprai, 1987.

=====

In the following section, we compile an estimate of labour requirement for a plantation. The data are drawn from various sources. A principal data source is the report of the Research and Training in Re-Afforestation Project, located in Pakthongchai District, Nakornratchasima Province. This is supplemented by data from other sources where appropriate.

3.1.2 Labour Requirement in Short-Rotation Tree Plantation

The labour requirement for a typical pattern of activities and labour use in a short period rotation(5 years) in Thailand under the existing conditions follows the typical work pattern, which may be described as follows:

-
- Year 1 nursery work and seedling production, site preparation and planting
 - Year 2 Replacement planting, tending
 - Year 3 Tending
 - Year 4 Tending
 - Year 5 Clearfelling
-

The direct labour requirement for each activity is estimated

below.

Nursery Work

From the study carried out at the Reafforestation Research and Training Centre, RFD, in Pakthongchai District, Nakornratchasima Province, we have the following schedule of work in a nursery.

" Mixing planting soil with a simple machine, 3 men can discharge 2 cu.m. of soil per day. In the filling station, 12 persons can fill bags 4x6 inches at the rate of 2,000 bags per day. The bags are then laid out at the rate of 4,000 bags per man-day. Then the seedlings are placed into bags. A well-trained worker, usually female, can do the work at the rate of 3,500 -4,000 seedlings per person-day. for small seedlings, the work is more time-consuming, and the rate of work may fall to 2,500 - 3,000 seedlings per person-day. "(Paisal et al, 1986)

The seedling production data from the Centre shows the following:

Table 3.4 Production of Seedlings

<u>Year</u>	<u>No. of Seedlings</u>	<u>Direct Employment</u> (man-days)
1983	272,210	8,693
1984	583,850	13,662
1985	830,110	15,105
1986	906,822	13,899
Total	2,592,992	51,359

Source: Paisal, 1986.

From this data it can be deduced that the rate of seedlings production is 50.48 seedlings per man-day. For producing 400 seedlings for planting in 1 rai, at 2x2 metre spacing, the labour required is therefore $400/50.48 = 7.9$ man-days.

Planting

The data from the Reafforestation Centre shows that for planting activities, the following work efficiency was obtained

during 1986.

Table 3.5 Labour Requirement for Establishment of Forest Plantation

Activity	Work Done	Unit	Cost per rai (baht)	Labour cost per rai (baht)
1. Plot Survey	79.34	sq.m/man-day	6.38	6.38
2. Site preparation				
2.1 Weeding				
clearing, manual	0.20	rai/man-day	204.00	204.00
machine cutting	8.11	rai/machine-day	87.79	7.52
hand-held cutter	0.56	rai/man-day	166.98	166.98
tractor(D60A)	16.94	rai/machine-day	75.72	3.60
2.2 Burning				
manual	0.49	rai/man-day	81.16	81.16
tractor	32.00	rai/machine-day	25.31	1.91
farm tractor	20.00	rai/machine-day	63.00	3.05
2.3 ploughing				
deep ploughing	8.38	rai/machine-day	199.23	7.28
shallow ploughing	15.50	rai/machine-day	0.00	3.94
3. Staking	250	piece/man-day	81.25	81.25
4. Transport of seedlings	979	seedlings/man-d	29.21	29.21
5. Planting	83	seedlings/man-d	123.73	123.73
6. Weeding				
handheld cutter	0.60	rai/machine-day	146.88	101.67
manual	0.24	rai/man-day	167.66	167.66
7. Remedial planting	46	seedlings/man-d	80.85	80.85
8. Plot layout, data recording, soil survey			69.70	69.70
Total planting cost			1,608.85	1,139.88

Source: Paisal et al, 1986.

The labour cost component of the work done by machine, such as machine weeding, is computed by assuming that one man is required for one machine for the work done. The labour requirement per rai is then computed, then multiplied by the daily wage rate, at 61 baht per day.

Summing the labour cost components only we can derive the labour requirement in man-days by dividing with the average rate per man-day. At the daily wage rate of 61 baht, this amounts to

the employment of 18.68 man-days per rai for planting.

Harvesting

The labour requirement for harvesting is computed from data from plantations in Chachoengsao Province. From the account of Dr. Arkhom Duangdej, the labour costs for harvesting a **eucalyptus** plantation are as follows:

Cutting	20 baht/ton
Loading on to trucks	50 baht/ton
Total cutting cost	70 baht/ton.

Source: Akom, in Thatchai, 1987.

The harvesting cost per rai depends on the yield of the trees. According to Chachoengsao data, the yield depends on the spacing. Assuming 2x2 m. spacing, the yield per rai is 8 tons/rai, or at 3x3 planting, the yield is 17 tons/rai at 4 years (Thatchai, 1987).

In view of the variation of yield with spacing and other factors, an average value of the yield of 15 tons per rai is assumed for the purpose of analysis. On this assumption, the employment for cutting and loading per rai is $15 \times 70 / 61 = 17.2$ man-days per rai.

Total Labour Requirement

The labour requirement for one rai of **Eucalyptus** planting for the period of 5 years for the whole rotation is therefore as follows.

Table 3.6 Labour Requirement for Planting one rai of Eucalyptus, 5 year Rotation

Activity	labour requirement(man-day/rai)				
Year	1	2	3	4	5
Nursery Work	7.9				
Planting	18.6				
Tending		7.2	5.1	5.1	
Harvesting					17.2
Total	26.6	7.2	5.1	5.1	17.2

Note: Assume 1 rai, 2x2 spacing and yield of 15 tons per rai.

It will be observed that the labour requirement is highest in the first year, when the planting takes place. After that, tending operations require less labour. The labour requirement increases again for the harvesting of the trees. According to accounts of farmers/planters in Chachoengsao Province, each planter can carry out as much as 100 - 200 rais annually. At the other end of the scale, planting on a small farm basis can be 5 rai per household.

The question is whether the data from the small farm planting will be valid for large-scale plantations as described in Chapter 2.

Information obtained from large-scale commercial planters indicates that the work in the plantation is likely to be subcontracted to labour gangs. This indicates that the planting method is likely to be labour-intensive, since small labour groups would be unwilling to invest in expensive capital equipment, which may not be available at low cost as yet. Therefore, it is probably safe to assume that the labour requirements for plantation work will remain in line with the observed practice as indicated above. However, for a large plantation, the area for planting will be

large enough to warrant a well managed labour force, even if it is based on contract. It may therefore be reasonable to assume that the planting area will be managed to maintain a stable level of employment. At the end of the 5 year period, the plantation will reach an equilibrium level of activity, in which 1 rai is felled, 1 rai is planted, and the remaining 3 rais are under maintenance. For a 5 rai plantation, therefore, the labour requirement may be as follows:

Table 3.7 Labour Requirement for Activities in Reforestation Plots, 5 year rotation on 5 Rai

Plot 1	Planting (incl. nursery)	26.58	man-day
Plot 2	Felling	17.20	man-day
Plot 3-5	tending	17.36	man-day
Total		61.30	man-day

The average annual labour requirement per rai is therefore 12.26 man-days per rai. It will be seen that the employment provided by forest plantation activities is small relative to the available labour time.

Assuming that the total working days in a year is 240 days, it will require a tree plantation of 19.57 rais (=240 days/12.26 man-days per rai) to keep one man in full-time employment for a whole year.

3.2 Employment Profile

3.2.1 Full or Part-time Employment

Given the relatively low labour requirement for a tree plantation, how can this demand for labour be met? Can a person be fully employed by working in a tree plantation? or is it necessary to find supplementary occupation to support a livelihood? To consider these questions, we look at the experience of the forest villages which were established by the FIO and the RFD.

According to Monthee, a forest village will accommodate 100 households. Each household will be given 10 rai of land. The land will be used for both tree planting in accordance with FIO instructions, and for cash-cropping between the planted trees. The farmers will be allowed to keep the benefits from the cash crops, but he is required to perform various tasks in connection with the trees planted. A graduated payment scheme provides an incentive to maintain the trees. The farmers are paid in stages on the basis of how well the trees are doing on the land, from survival of the seedlings to the bonus payment if the household has worked with the FIO for over 3 years. Thus, the idea of the forest village is meant to provide full time employment for the farmers in the scheme, both through plantation activities and through individual cropping activities.

Pisit(1984) compares forest villages with non-forest villages. In terms of land-holding, forest village households have less land than non-forest village households, 11.1 rai compared with 15 rai in the north, and 17.9 rai compared with 20 rai in the northeast.

The conclusion with regard to the question whether reforestation provides full time employment is that, since land allocated for a farmer in the forest village is less than the amount that would keep him occupied for the whole year, reforestation is a part-time activity. However, this is so by intention, because the forest village scheme is designed to take advantage of the farmers' concern with his agricultural crop to take care of the trees which he planted also.

3.2.2 Seasonality of Employment

From Table 3.1, it can be seen that the work involved in the first year of a new plantation is spread throughout the year. However, the level of labour requirement is quite low, as can be seen from the following Table 3.8, which gives the monthly labour requirement on a per rai basis.

Table 3.8 Monthly Labour Requirement for a New Plantation

Month	Activity	Labour Required (man-day per rai)
January	Making inspection path)
	Seedling preparation	) 1.6
	land clearing)
February	making firebreaks)
	making inspection path)
	seedling preparation)
	preparing stakes	) 1.8
March	land clearing)
	burning scrubs	) 2.7
	making firebreaks)
April	burning)
	staking	) 2.2
May	making firebreaks)
	planting seedlings)
	planting groundcover plants	) 0.4
June	fertiliser application)
	fire prevention)
	planting)
	planting groundcover plants)
July	applying fertiliser	) 1.2
	weeding)
	applying fertiliser	) 0.9
August	weeding)
	applying fertiliser	) 0.9
September	weeding)
	applying fertiliser	) 0.9
October	weeding)
	weeding	) 0.9
November	weeding)
	preliminary survey	) 1.0
	survey of planting site)
December	weeding)
	preliminary survey	) 1.5
	survey of planting site)
	making inspection path)

Source: Monthee, 1985.

This estimate shows that between 0.4 - 2.7 man-days are required on a monthly basis to carry out the various tasks in one rai of the plantation. This means that in order to provide for employment for 26 days in one month, the farmer is able to work the maximum area of 8.8 rai in March, the month of peak labour

demand without needing additional labour. During the rainy season, from May to October, he would have time to attend to other on-farm activities such as growing of annual crops.

In an established plantation, with seedlings more than 1 year old, the only labour required would be for weeding and fire prevention. This can be a low demand for labour also. In addition, cropping on this land would be difficult due to shading of the growing trees on new crops.

The overall conclusion is that a forest plantation is a low-labour intensity activity. In this sense, it allows one person to take care of an extensive area. There is a small variation in the demand for labour over the wet months, from May to October, and the dry months, from November to April. However, given a small size of land, say 10 rai as in a forest village, the labour required for tree planting could be easily accommodated with the rest of the farming activities. The low labour requirement also necessitates the provision of alternative employment opportunities, either within the plantation itself, or outside, in order to maintain the income of the forest workers, as proposed in the Thai-Shell Reforestation Scheme.

3.2.3 Local or Migrant Labour

Given that areas designated for reforestation are often encroached forest land, usually with the encroachers or others laying claim to the occupation of the land, the reforestation effort could be regarded as a means to provide employment to the encroachers, who would become a legitimate occupier of the land in the reforestation programme. It is interesting, therefore, to

examine the experience of the forest villages to see how their members have been recruited. Are the members local people, or are they recruited from elsewhere? and if so, from where? The study by Pisit gives details about the origins of the households in forest villages studied, and compares them with the findings from non-forest villages.

With regard to migration, the interesting points to consider are the origin of the members of forest villages and the out-migration of members of forest village households.

On the question of origin, the study found that the proportion of migrants in the forest villages was 31 % (10 years period) or 97% (ever migrated), compared with 8% (10 years period) and 47% (ever migrated) for villages in the north. For the northeast, the 25% (10 year period) and 84% (ever migrated) of households in forest villages were migrants, compared with 8% (10 year period) and 55% (ever migrated) in nearby villages. The high proportion of migrants in forest villages may be explained by the fact that forest villages are communities which have been purposely organized, and not a spontaneously-formed community, so it need to draw its population from elsewhere. The surprising finding is that this population is not drawn from the population of the prior occupants of the reforested area. As much as 25 - 31% of the households being migrants within the last 10 years, compared with eight per cent (10 year period) in the case of non-forest villages in both the north and the northeast. Given the importance of access to land in rural areas, the importation of migrants to occupy the reforested area could be a source of resistance to the reforestation

effort, as has been the case in recent RFD reforestation programmes in the northeast (Mangkorn,1988), as well as a cause of social conflicts between the "old" population and the "new", though cases of these have not been documented in the specific context of reforestation.

The high level of labour mobility is also reflected in the data for out-migration from the villages. For forest villages, the rate of permanent out-migration per 1,000 population during the 5 years prior to the study was 70 compared with 60 for nearby villages and 40 in distant villages. So the conclusion is that forest villages do not appear to reduce the migration of the rural population relative to non-forest villages.

As for the direction of out-migration, the study found that for the northern forest villages, the highest number of migrants moved within the region, 63 persons per 1,000, while Bangkok accounted for 38 persons per 1,000 out-migrants. In contrast, the migrants from the northeast forest villages to other locations in the northeast numbered 60 persons per 1,000, compared with 111 persons per 1,000 to Bangkok. The central region was also a major destination for migrants, accounting for 44 persons from the north and 138 persons from the northeast for each 1,000 migrants from forest villages. The interesting feature to note here is that for nearby non-forest villages, the number of out-migrants was lower in all cases.

The motives for out-migration, as shown in the study, was looking for work. The number of migrants who gave looking for a job as the cause of migration was 96 per 1,000 for forest villages, 97 for nearby non-forest villages and 107 for distant non-

forest villages.

Thus, in spite of the availability of land and employment in the forest plantation, the establishment of forest villages has not succeeded in holding the population to the villages more than a non-forest village would have done. The reason why this is so is inherent in the way the forest village is set up. With a fixed scheme of planting and a rotation within the forest plantation, there is a limit to the number of households and workers who can be employed within the plantation. When the household population expands it is therefore necessary to adjust the population by migration of some household members to seek employment elsewhere. In this regard, the opportunity to develop new occupations within the forest villages is also probably more limited than in a non-forest villages. So the rate of out-migration from forest villages is higher.

The preceding discussion is not intended to suggest that forest villages have not been beneficial. In terms of the standard of living of the individual members, joining a forest village has led in many cases to an improvement over the situation before they became members. In a recent study (Faculty of Forestry, 1987), the comparative conditions of the members of 13 forest villages were reported for before and after joining (Table 3.9).

The study found that the proportion of households in forest villages who had previously been resident in the forest village area ranges from none at all in the case of a forest plantation in Kanchanaburi, to 84 per cent in Chiangmai. This indicates the variability in the ability to incorporate the resident population

into the forest villages.

Table 3.9 Forest Village Data, 1986/1987

Location	Province	Number of household	Income/household < 10,000 b/yr before	Income/household > 10,000 b/yr after	Land Holding before resident	Land Holding before landless	Land Holding before <10 rai
				(per cent of households)			
Chomtong3		450	84	76	84	40	36
Chiangmai							
Mae Chang		58	99	53	0	13	0
Lampang							
Mae Moh		83	86	48	9	28	28
Lampang							
Bo Kaew		107	89	77	57	61	11
Phrae							
Wang Chin		59	100	83	5	39	28
Phrae							
Somdech		234	91	34	20	63	35
Kalasin							
Dong Cham		124	70	47	20	60	20
Khonkaen							
Dong Lan		496	100	67	13	67	26
Khonkaen							
Khao Luang3		270	47	4	58	13	34
Nakornratchasima							
DankhunTod		25	100	na	8	68	8
Nakornratchasima							
Tongphaphoum		73	60	24	0	64	8
Kanchanaburi							

Source: Faculty of Forestry, 1987

Note: Resident = occupying area before becoming forest village

3.2.4 Gender Issues

The role of gender with reference to forest activities has been little studied. In other countries, the division of labour between the sexes has been found to fall heavily on women (Morse, Tingsabath, Vergara, Vidyarthi et al., 1987) : in the collection of fuelwood and cooking, for instance. With respect to planting of trees and agricultural work, women also play a prominent part. The issue here is whether the division of labour is equal or not. On the basis of observations, since published studies on this subject are not available, the employment opportunities for women are

found in tasks such as nursery work and planting of seedlings. This is the case in forest villages where there is a quota of 2 persons per household who will be employed in plantation work. It has been observed that these quota are often filled by women. The men often find work as agricultural labour in farms outside the plantation areas.

3.3 Wage and Renumeration

3.3.1 Income from Reforestation Employment

In terms of income generation, reforestation can give the planter income in form of wages, if he is employed as a worker in a plantation. In addition, if he owns the trees planted, timber and other products can be sold to provide an income. The income from reforestation employment can therefore be compared with income from annual cropping to assess its profitability.

Pisit (1984) found that, in terms of household income, forest village households earned an average income of 8,070 baht per year, compared with 7,990 baht for a household in a nearby village and 12,830 baht for a household in a distant village. This suggests that there is little difference for a household whether it is a member of a forest village or not in an area of reforestation. In any case, the income earned in the area is less than if the household is situated in an agricultural village, which is likely to have better soil and other farming conditions. The finding also suggests that there may be little incentive in joining a forest village, since the income opportunity is not different from not joining.

However, it would be premature to make this conclusion,

since the above comparison does not take into account the historical pattern of households. This can be of some importance, since we know that there is a high level of migration among the forest village households. It is possible that by joining a forest village, the household can improve on its position.

The Faculty of Forestry Survey lends support to this interpretation. Table 3.9 shows that forest village residents improve their household income after joining the forest village. For instance, at Mae Chang Forest Village, 99 per cent of the residents had income less than 10,000 baht per year before joining, while the number after joining was reduced to 53 per cent. In other words, 46 per cent of the households have improved their income after joining the forest village.

The improvement in income for the forest village households may be largely due to the fact that the households now have greater access to land for cropping within the plantation area than they had before. The most severe case of landlessness was found at Dankhunted Forest Village, where 68 per cent of the sample households were landless before joining the village. However, there was no income data for this village to indicate how the households improved in terms of household income.

At Donglan Forest Village, where as much as 67 per cent of the sample had no land before joining the forest village, and as much as 26 per cent of the households had less than 10 rai of land, all of the households had less than 10,000 baht income before joining the forest village. After joining, this proportion was reduced to 67 per cent. So at least the forest villages contributed to increased household income, and in the sense that

they also reduced the number of the low-income households, the forest villages also help to improve the overall income distribution within the rural area.

3.3.2 Comparison With Cropping

In this section, the returns to planting various crops are compared with those of planting eucalyptus. The yield and prices figures are average yields based on 1986/87 crop year. The results are shown in tables 3.10 to 3.12.

Table 3.10 : Returns to Annual Crops, 1987 prices

Crop	Yield per rai (kg) (1)	Costs Baht/rai (2)	Costs Baht/ton (3)	Average Price Baht/ton (4)	Average Profits Baht/ton (5)= (4-3)	Profit per rai Baht (6)= (5X1)/1000
Rice,main crop	328	873	2,663	2,408	(255)	(83)
Rice,second crop	563	1,441	2,559	2,493	(66)	(37)
Maize	380	715	1,882	1,600	(282)	(107)
Cassava	2,283	872	382	950	568	1,297
Sugar Cane	7,521	1,780	237	293	56	423
Soy bean	202	1,077	5,333	6,150	817	165
Groundnut	217	1,277	5,887	4,990	(897)	(195)
Mung bean	98	653	6,665	5,890	(775)	(76)
Sorghum	184	403	2,188	1,470	(718)	(132)
Cotton	188	537	2,855	12,030	9,175	1,725
Kenaf	179	887	4,956	3,270	(1,686)	(302)

Source: Data on yields, cost per rai and average farmgate prices are from Agricultural Statistics of Thailand 1986/87 Crop Year.

Note: Brackets indicate negative values.

As for tree crops, we consider a cashew plantation and a eucalyptus with a 4-year rotation.

Table 3.11 Cost and Return for Planting Cashew Nuts

discount rate = 15 per cent

Year	Cost baht/rai	Yield kg/rai	Price baht/kg	Income baht/rai	NCF baht/rai	NPV baht/rai	B/C Ratio
1	1,300	0	12	0	(1,300)	(1,130)	0.00
2	400	0	12	0	(400)	(1,433)	0.00
3	540	0	12	0	(540)	(1,788)	0.00
4	560	45	12	540	(20)	(1,799)	0.15
5	670	135	12	1,620	950	(1,327)	0.46
6	1,170	180	12	2,160	990	(899)	0.69
7	1,230	225	12	2,700	1,470	(346)	0.90
8	1,300	270	12	3,240	1,940	288	1.08
9	1,300	270	12	3,240	1,940	839	1.20
10	1,300	270	12	3,240	1,940	1,319	1.29

Source: Tree Farmers Association of Thailand, 1987.

Note: NCF = net cash flow

The return from planting eucalyptus in a 4-year rotation is given below. The assumptions are that the average yield is 15 tons per rai, and the price is 600 baht per ton.

Table 3.12 Cost and Return for Planting Eucalyptus

discount rate = 15 per cent

Year	Eucalyptus Costs baht/rai	Yield Kg/rai	Price baht/kg	Income baht/rai	NCF baht/rai	NPV baht/rai	B/C Ratio
1	1,904	0	0.60	0	(1,904)	(1,656)	0.00
2	300	0	0.60	0	(300)	(1,882)	0.00
3	100	0	0.60	0	(100)	(1,948)	0.00
4	3,900	15,000	0.60	9,000	5,100	968	1.23
5	1,904	0	0.60	0	(1,904)	21	1.00
6	300	0	0.60	0	(300)	(109)	0.98
7	100	0	0.60	0	(100)	(146)	0.97
8	3,900	15,000	0.60	9,000	5,100	1,521	1.23
9	1,904	0	0.60	0	(1,904)	980	1.14
10	300	0	0.60	0	(300)	906	1.13
11	100	0	0.60	0	(100)	884	1.12
12	3,900	15,000	0.60	9,000	5,100	1,837	1.23
13	1,904	0	0.60	0	(1,904)	1,528	1.19
14	300	0	0.60	0	(300)	1,485	1.18
15	100	0	0.60	0	(100)	1,473	1.18
16	3,900	15,000	0.60	9,000	5,100	2,018	1.23

Source: Tree Farmers' Association Thailand, 1987.

In order to compare the returns from various crops with different time periods of harvesting, we use the method of comparing net present values over a 10-year period. Table 3.13 shows the net present value per rai of each crop for each year in the 10 years.

Table 3.13 Net Present Value of Alternative Crops over 10 Years

Crop	1	2	3	4	5	6	7	8	9	10
<u>Annual Crop</u>										
Rice, main crop	(73)	(136)	(191)	(238)	(280)	(316)	(347)	(375)	(398)	(419)
Rice, second crop	(32)	(60)	(85)	(106)	(125)	(141)	(155)	(167)	(177)	(186)
Maize	(93)	(174)	(245)	(306)	(359)	(405)	(446)	(481)	(511)	(538)
Cassava	1,128	2,109	2,962	3,704	4,349	4,909	5,397	5,821	6,190	6,511
Sugar Cane	368	688	967	1,209	1,419	1,603	1,762	1,900	2,020	2,125
Soy bean	144	268	377	471	553	625	687	741	788	828
Groundnut	(169)	(316)	(444)	(556)	(652)	(737)	(810)	(873)	(929)	(977)
Mung bean	(66)	(124)	(174)	(217)	(255)	(288)	(316)	(341)	(363)	(381)
Sorghum	(115)	(215)	(302)	(377)	(443)	(500)	(550)	(593)	(631)	(663)
Cotton	1,500	2,804	3,938	4,924	5,782	6,528	7,176	7,740	8,230	8,656
Kenaf	(262)	(491)	(689)	(862)	(1,012)	(1,142)	(1,256)	(1,354)	(1,440)	(1,515)
<u>Tree Crop</u>										
Cashew Nut	(1,130)	(1,433)	(1,788)	(1,799)	(1,327)	(899)	(346)	288	839	1,319
Eucalyptus	(1,656)	(1,882)	(1,948)	968	21	(109)	(146)	1,521	980	906

Source: Tables 3.10-3.12.

From the above, it can be seen that among the annual crops, cassava, sugar cane, soy bean and cotton provide a higher return than tree crops for all years. The difficulty with tree crops lies with the negative cash flow in the early years before the trees can be harvested. Even when the net present values are positive, the yields are lower than that obtainable from the annual crops.

The implications of the above results are wide-ranging. In the first instance, the analysis shows that under the current assumptions, which are based on historical considerations, the investment in tree-cropping is not as profitable as annual cropping. Secondly, there is a long gestation period before the

investment in tree planting will yield a positive return. For farmers who prefer quick returns, therefore, their choice would be to go for annual rather than tree crops.

With regard to the government policy of encouraging more private tree planting, the analysis shows that more incentives will be required to make tree planting an attractive investment for the farmers. This can be, for example, by increasing the yield of the tree by using improved seedlings and giving better silvicultural management knowledge to the farmer. In addition, financial incentives can be provided to help meet the farmer's consumption needs during the years when the trees are not ready for harvest.

The above analysis should be qualified by certain considerations. In the agricultural sector, price variability is always present, and yields do vary according to soil fertility and the amount of inputs such as fertilisers and irrigation. Where there are unfavourable factors, the yields of annual crops may fall below the levels assumed, which would make the returns from tree crops relatively more attractive. Conversely, when crop prices are favourable, as in 1988/89, the returns from annual cropping would be more attractive than from tree crops.

In conclusion, therefore, the analysis of the returns from reforestation points out the need to further improve the returns to the planter before reforestation becomes an attractive investment in comparison to the planting of selected annual crops. The policy of promoting tree farming would need to take into account factors which are likely to be locality-specific, such as: soil quality, marketing channels for crops.

Annex to Chapter 3

Summary Description of Reference Studies

1. The Impact of Thailand Reforestation Program on Child Mortality and Fertility, Pisit Sukreeyapongse, Chira Hongladarom, Sakda Supapongpichate, Prasert Auwichitr-Aroon, Laddawan Rodmanee, Paitoon Pakdee, February 1984.

Sample Distribution by Region and Type of Village

Type	North		Northeast	
	Village	Household	Village	Household
Forest Village	19	1,024	11	687
Related Village	19	1,152	11	670
Unrelated Village	19	1,162	11	674
Total	57	3,338	33	2,031

The forest villages in the sample include those organised by the Royal Forest Department(RFD) and the Forest Industry Organisation (FIO). However, there are certain differences between the two types of forest villages.

Objective

RFD forest villages are set up with the objective to involve people in the protection of forest and to prevent them from destroying the forest. FIO forest villages are set up as part of the plantation to produce trees for exploitation by the organisation.

Size of Village

RFD has no limit on the size of the village. There can be up to 200-300 households in an RFD village. FIO forest village is limited to 100 households, corresponding to the target area for annual planting of 1,000 rai.

Land Allocation to Residents

RFD villagers receive 15 rai per household on which to cultivate on a permanent basis. The right of occupation is transferable only to descendants. FIO villagers receive a 5 rai plot for use as homestead and kitchen garden. In addition, the household receive 10 rais of forest plantation for intercropping with annual crops for 2-3 years. The location of the 10-rai plot follows the plantation.

Area Selection

RFD forest village sites are located in areas destroyed by the villagers. The villagers are collected together to live in one community. The land is reallocated to give each household some land. 20 per cent of the land is set aside for planting forest trees. With the introduction of the STK Programme, the establishment of RFD forest villages has been discontinued. FIO forest village sites are determined by the rotation of the species planted, to meet the target of planting 1,000 rai per year.

Hiring Condition and Rates

RFD hires villagers to work in forest planting on a daily wage basis. The local rate of pay is used, within the limit of the budget allocated to the plantation. FIO offers to take 2 members from a household to work in the plantation on any given year. It also offers monetary incentives for taking care of the trees.

Origin of Village Members

RFD recruits villagers from the people already living in the area. FIO gets villagers from other places to work on the site which is relatively free from destruction by villagers.

With regard to these differences, the study contains samples of both RFD and FIO villages as shown. No details of the sample villages are provided in the report to enable their identification. The total sample includes 60 non-forest villages, 30 of which were selected from villages which have activities in the forest villages and 30 from villages which have no activities in the forest villages. The former is referred to as the "adjacent" ("related" in the annex table) village, and the latter is the "distant" ("unrelated" in the annex table) village. In each selected village, the 60 sample households were randomly selected.

2. Forest Village, by M.Sc. Students of Silviculture Department, Faculty of Forestry, Kasetsart University. 1987.

The study was carried out as a class assignment for a research course. The field work was done in December 1986 and January 1987. The sample includes 5 RFD forest villages and 6 FIO forest villages.

The villages in the study are:

<u>Village name</u>	<u>Organisation</u>
Chomtong 3, Chiangmai	RFD
Mae Chang, Lampang	FIO
Mae Moh, Lampang	FIO
Boh Geow, Phrae	RFD
Wang Chin, Phrae	FIO
Somdech, Kalasin	FIO
Dong Cham, Khonkaen	RFD
Dong Lan 1, Khonkaen	RFD
Kao Laung 3, Nakornratchasima	RFD
Dan Khun Tod, Nakornratchasima	FIO
Tong Pha Poom, Kanchanaburi	FIO

The study uses data from a sample of households resident in the forest villages above. In general, the sample proportion was about 25 per cent.

Chapter 4

ROLE OF REFORESTATION IN DEVELOPMENT

In this chapter we analyze the implications of the reforestation plans and programs on two aspects of development, namely population growth and the implementation of the "economic forest policy".

4.1 Response to Population Growth

4.1.1 Population and Labour Force Forecasts to 2005

The future population of Thailand, according to forecasts prepared by TDRI (1986), is shown below:

Table 4.1 Population Projection to 2005

	unit=1,000 persons					
Region	1980	1985	1990	1995	2000	2005
<u>Northeast</u>						
rural	15,766	17,254	18,574	19,648	20,721	21,661
urban	668	781	890	1,005	1,123	1,242
total	16,434	18,035	19,464	20,653	21,844	22,903
<u>North</u>						
rural	8,743	9,370	9,957	10,377	10,608	10,773
urban	683	806	955	1,122	1,293	1,473
total	9,426	10,176	10,912	11,499	11,901	12,246
<u>South</u>						
rural	5,167	5,801	6,547	7,299	7,896	8,497
urban	710	845	981	1,132	1,281	1,430
total	5,877	6,646	7,528	8,431	9,177	9,927
<u>Central</u>						
rural	9,116	10,025	10,807	11,442	12,113	12,752
urban	997	1,150	1,315	1,485	1,668	1,863
total	10,113	11,175	12,122	12,927	13,781	14,615
<u>Bangkok</u>						
	4,870	5,693	6,445	7,150	7,853	8,579
<u>Whole Kingdom</u>						
rural	38,792	42,450	45,885	48,766	51,338	53,683
urban	7,928	9,275	10,586	11,894	13,218	14,587
total	46,720	51,725	56,471	60,660	64,556	68,270

Note: The level of urbanisation depends on the definition of "urban" area this is used. If the definition is urban = municipal area only, the rate of urbanisation is 17% in 1980. If the definition is urban = municipal+sanitary districts, the rate of urbanisation is = 26.4% in 1980. The first definition is used in the foregoing table.

Source: TDRI, 1986.

From this forecast, a forecast of the labour force, defined as the population aged 11-65 not at school, is as follows.

Table 4.2 Labour Force Projection to 2005

unit=1,000 persons

Region	1985	1990	1995	2000	2005
<u>Northeast</u>					
rural	9,584	11,037	12,363	13,474	14,326
urban	293	351	419	491	561
total	9,877	11,388	12,782	13,965	14,887
<u>North</u>					
rural	5,574	6,113	6,599	7,011	7,330
urban	360	450	540	634	744
total	5,934	6,563	7,139	7,645	8,074
<u>South</u>					
rural	2,796	3,232	3,677	4,195	4,767
urban	323	397	482	572	664
total	3,119	3,629	4,159	4,767	5,431
<u>Central</u>					
rural	5,036	5,758	6,445	7,091	7,612
urban	475	568	678	774	868
total	5,511	6,326	7,123	7,865	8,480
Bangkok	2,753	3,247	3,842	4,435	4,927
<u>Whole Kingdom</u>					
rural	22,990	26,140	29,084	31,771	34,035
urban	4,204	5,013	5,961	6,906	7,764
total	27,194	31,153	35,045	38,677	41,799

Projection Scenario:

Base case of Population projection

Labour Force = non-school population aged 11 - 65

Source: TDR1, 1986.

The labour force forecasts show that the rural labour force will increase by 12 million persons between 1985 and 2005. Assuming that 80 per cent of this increase will remain in the agricultural sector, the number of the additional jobs required in the sector will be 9.6 million. On an annual basis, this is equal to an increase of 480,000 new jobs to be created each year.

The contribution of reforestation to this increase in

total agricultural employment can now be assessed.

For the sake of argument, let us suppose that there will be reforestation of 2 million rai, based on the realisation of existing reforestation plans and additional plantations, which is maintained perpetually as short-rotation forest plantations. This means that in any particular year, 20% of the forest plantation area will be clearfelled, 20% will be replanted, and the rest being maintained. From our hypothetical example of such a plantation in Chapter 3, we can estimate the total employment generated by the forest plantation effort in total. This is as follows:

The employment generated is, approximately, 1 man-year per 20 rai of plantation. For 2 million rai plantation, the total employment generated will be $2,000,000/20 = 100,000$ man-year annually.

In comparison with the total increase in rural labour force if it will be seen that the direct contribution of forest plantation is relatively small. The total employment created by 2 million rai of forest plantations will account for less than a quarter of the annual increase in the labour force.

To absorb the annual increase in the agricultural labour force, the annual rate of reforestation will need to be 9.6 million rai. This is equivalent to 7.4 per cent of the total farm holding land of 129.8 million rai in 1986.

However, if the employment in forest plantations is considered in terms of income generation, then the contribution

of reforestation employment can be quite substantial. In Chapter 3, it was calculated that the annual labour requirement for 1 rai of forest plantation is 12.26 man-day. The wage income accruing to the worker on one rai would be, at the wage rate of 61 baht per day, 747.86 baht. For a 2 million rai of plantation, total wage income would be 1,495 million baht annually. This amounts to 16 per cent of the value added in the forestry sector in 1988, measured in current prices.

4.2 Response to the Economic Forest Policy

4.2.1 The Economic Forest Policy

As stated in the National Forest Policy, 40% of the land area of the country will be kept as forest. Of this, 25% will be the "economic" forest, located on areas with less than 35 per cent slope, and managed for the purpose of wood production. This area will include both natural forest and forest plantations. The actual forest area as of 1986 was 91.65 million rai. Assuming that the "protective" forest can be maintained at present, the shortfall in the area of the "economic" forest is estimated at 43 million rai in 1986.

The contribution of forest plantation to the economic forest policy lies in the extent to which plantations will make up for the natural forest. This is quite a complex issue, since there are many ways of establishing a plantation, as we have seen. For this analysis, it will be assumed that commercial forest plantation using fast-growing trees such as **Eucalyptus** makes up the shortfall. The employment generation of the reforestation will be 2.15 million jobs, using the annual labour absorption

capacity of reforestation calculated in Chapter 3. In terms of wage income, the total wage created by such a policy would be 32,157 million baht (from 43 million rai x 747.86 baht per rai).

The conclusion from the foregoing analysis is that in terms of employment generation, the total direct impact of forest plantation may be rather limited. To obtain more employment from plantation forest-based activities, it is necessary to promote further processing activities. This ranges from charcoal making, pulp production and wood-based panel.

The gain from forest plantation is more significant in terms of income generation to planters, who can expect a reasonable return to investment compared with investment in other activities. However, as the analysis of income generation indicates, the high return is available to planters who own the trees themselves. If the planters are simply hired-labour, as is likely to be the case based on current trends, it may be expected that the income distribution effect will be highly favourable to the plantation owners, but not so favourable to the plantation workers. It is recommended that the government should consider carefully the distributional implications of large-scale plantation schemes to make certain that the resulting value-added is equitably distributed.

Chapter 5

CONCLUSIONS

The main findings of the study are summarized in this chapter.

5.1 Area to be reforested

We have reviewed the data on planned reforestation projects in the government and private sectors. The findings are at best inconclusive at the present time. In the government sector, RFD plans to undertake reforestation of 150,000 rai annually, on the basis of the budget it is allocated for the work by the central government. In the private sector, reforestation in the future is likely to be undertaken by commercial ^{firms} independently from logging concessions. Reforestation by logging concessionaires is likely to cease, due to the logging ban imposed by the government in January 1989. For commercial reforestation, the trees chosen for planting are likely to be mostly fast-growing species, in particular **Eucalyptus spp.**, for processing into wood chips for export or for the pulp industry in the domestic market. The total area to be planted, according to current plans made public by major commercial concerns, is likely to be around 2 million rai. The area to be planted by small growers and for community uses cannot be estimated at present.

5.2 Employment Profile

We have reviewed data on different aspect of employment created by reforestation projects.

Labour Requirement The labour requirement for reforestation is concentrated in the first and final years of a plantation. The first is when the seedlings are planted, and the final is when the trees are harvested. There is a small variation in labour

requirement according to the differences in the species selected for planting, but the main factor determining the labour requirement for reforestation is the length of the rotation period. For a fast growing tree plantation with a 5-year rotation, the labour requirement is estimated at 12.26 man-day per rai per year. To keep one person fully employed for a whole year requires an area of approximately 20 rai of forest plantation.

Full or Part-time Employment Due to the low labour requirement of reforestation work, our conclusion is that workers in forest plantation need supplementary employment opportunities outside forestry. In existing forest villages, additional work is provided by the practice of agro-forestry or planting of annual crops together with tree crops on the same plot of land. In some proposed reforestation schemes, some form of supplementary income opportunities are also planned.

Seasonality of Employment Work in a plantation follows a definite seasonal pattern, since activities are planned to fit in with the weather conditions to minimize costs. Thus planting is carried out at the beginning of the rainy season, in May to June, while land preparation and other activities are fitted in the program around the planting time.

Local or migrant Labour Existing forest plantation schemes, particularly forest villages, rely on migrant labour to a greater or smaller extent, depending on the conditions of the area in which the forest villages are situated. They are also limited in their ability to hold the rural population in rural areas. The

forest village has a predetermined size and cannot be easily expanded to accommodate the increase in the population of the community members. Out-migration from forest villages is not less than migration from non-forest villages.

Gender Issues Data are inconclusive on the issue of gender with respect to reforestation. In forest villages, there is a division of labour along gender lines, with women working in lighter jobs such as nursery work, while men work on heavier work in the plantation.

Wage and Remuneration It has been found that members of forest villages tend to improve their economic and social conditions after joining. They often improve their land holding status through the provision of land for farming within the reforestation project. With greater access to farm land, the forest villager improves his income, both from wage employment in connection with reforestation activities, as well as from farming his own land. However, compared with ordinary, or non-forest villagers, there is a small difference in the household income level between members of forest villages and ordinary villages in the same locality, but both tend to have lower average household incomes than villagers in more distant areas from the forest village. These are likely to be closer to markets or to have better infrastructure.

In comparison with annual cropping, the returns from planting fast-growing trees in a plantation depends on both yields from crops as well as prices that each crop can obtain in the market. with regard to crop prices, there is a large element of uncertainty due to price fluctuations, as for example from a low

in 1986 to a high in 1987. For this reason, it is not possible to be definitive about the relative merit of planting forest tree crops as against annual crops. However, fast-growing tree crops such as **Eucalyptus camaldulensis** can compare favourably with a number of field crops such as kenaf in a good year such as 1987.

5.3 Response to Population Growth and Economic Forest Policy

It is estimated that the agricultural labour force will increase by 480,000 annually between 1985 and 2005. On the other hand, the employment generation by the 2 million rai of reforestation is estimated to provide around 100,000 jobs on a sustained basis. Thus in terms of job creation, reforestation is likely to play only a limited role. However, within the forestry sector, reforestation is likely to be increasingly important both in terms of employment creation and income generation.

In regard to the economic forest policy, it is estimated that there is a shortfall of 43 million rai of the economic forest in 1986. If the estimated shortfall is used for reforestation with fast-growing species, around 2.15 million jobs would be created, and the wage income generated would amount to about 32 thousand million baht at current prices.

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