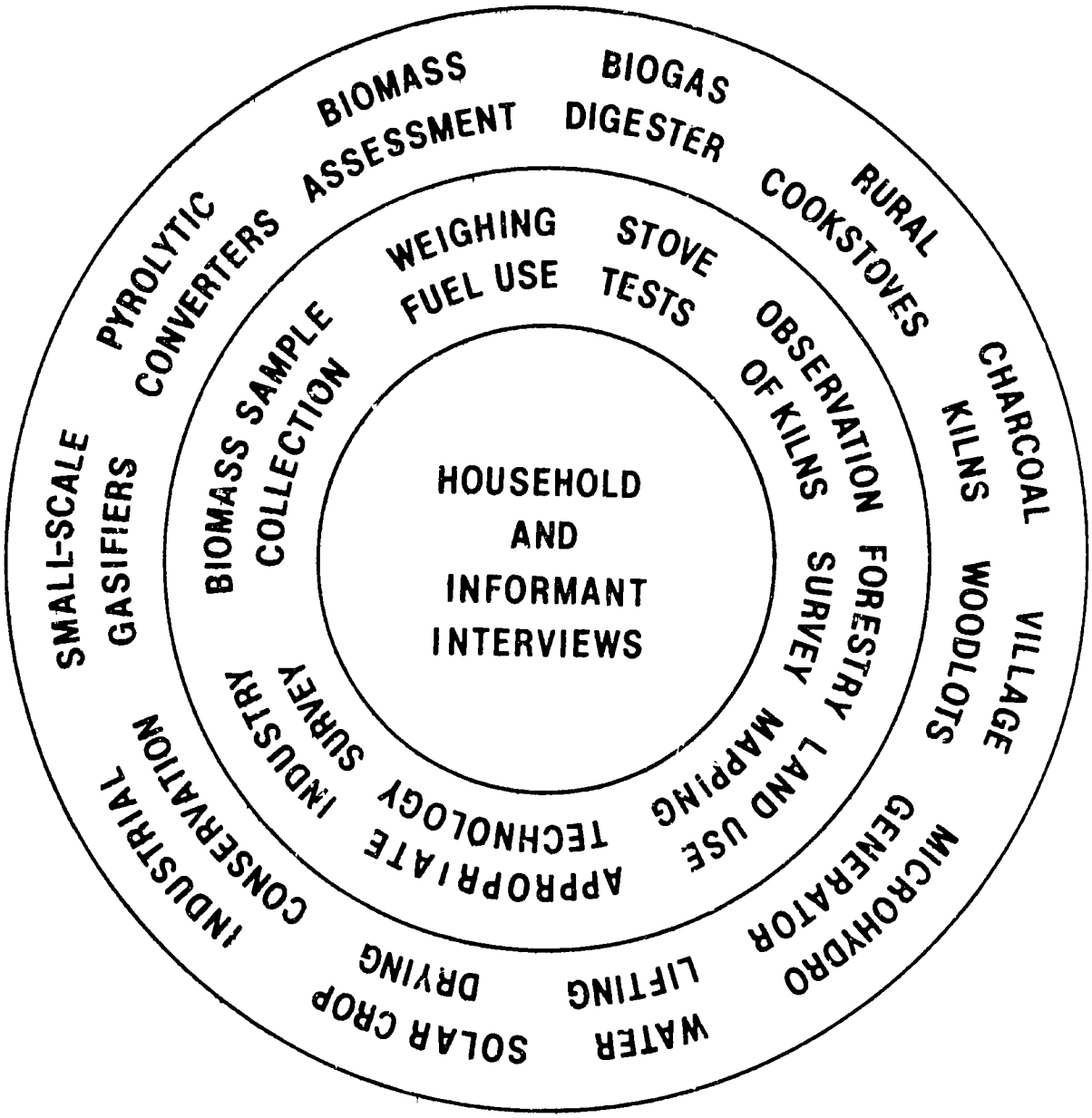

TREES

META SYSTEMS INC THAI GROUP

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TREES: PRODUCTION, USES AND NEEDS

BY

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Author's Note

The results presented herein are meant for use by researchers working on the Renewable Nonconventional Energy Project. Use of any of the data in this report should be made with the approval of U.S. Agency for International Development, Bangkok (Rod MacDonald) or Asia Bureau, Washington (Robert Ichord) before quoting any part of this report.

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Errata Sheet

LIST OF CHANGWAT OF THAILAND

In this report a variety of spellings have been used for the survey Changwat and village. The correct spelling and some of the variants are shown below.

Changwat

Buri Ram: Buriram, Burirum

Chanthaburi: Chantaburi

Chiang Mai: Chiangmai, Chaing Mai, Cheing Mai

Chon Buri: Chonburi

Kamphaeng Phet: Kampangphet, Kampaengpet, Kamphangphet, Kampangphet

Khon Kaen

Lampang

Nakhon Ratchisima: Korat

Nan

Phetchaburi: Petburi, Petchbura, Petchaburi

Roi et: Roi-et, Roi-Et

Si Sa Ket: Srisaket, Sisaket

Udon Thani: Udorn Thani, Udornthani

Villages

Bang Rahong: Bangrahong

Maikan Sangkan: Mailand Sangan

Pa Bhu: Pabhu

Wang Chapou: Wangchapoo

Klong Bon: Klongbon

Nong Wangyao: Nongvangyao

Pa Woe: Paver, Pawer

Pa Han: Pahan

Pa Nai: Panai

Si Chiengmai: Srichiengmai, Srichaiangmai

San Pa Tong: San Pa Toung

Samkhasantisuk: Sam Kha San Tisuk

Mai Ho Phra: Mae Ho Pra

Nong Buaeng: Nongbuadeang

OTHER TERMS

Household - Related individuals living in a house and eating together

House compound - Area around the house which is owned by members of the household and is often demarcated by a fence

Head of household - Male or female leader of the members of the household, usually the owner of the house

Head of village - Phuyaiban

Head of sub-district - Kamnan

Village - Muban

District - Amphoe

Province - Changwat

Errata Sheet (continued)

Phase I - Survey in Petchaburi, Korat, Srisaket, Kampangphet, and Lampang

Phase II - Survey in Songkla, Chantaburi, Roe-et, Udorn Thani, and Chiang Mai

Phase III - Survey in Nan, Burirum, and Chiang Mai

Delivered heat - The amount of energy content in the fuel burned

Captured heat - In cooking the amount of heat which is transferred to the cooking vessel

Moisture content - On a wet basis, weight of water as percentage of total sample weight

Heat or energy content - The high heat content of a substance at 0% moisture as measured in a bomb calorimeter

1 Unit of electricity - 1 kilowatt-hour, a billing unit used by the Provincial Electric Authority

6 1/4 rai = 2 1/2 acres = 1 hectare

jar lamp - small wick lamps

wick lamp - chimney or hurricane lamps

Rice Products - Straw residue in field,
- Stalk residue from threshing,
- Husk shell residue from milling
- Bran edible residue from milling

NEA - National Energy Administration of Thailand

NSO - National Statistics Organizationof Thailand

PEA - Provincial Electricity Authority

1. Introduction

1.1 Purpose

The survey data presented in this report was collected in support of the woodlots component. This survey of trees has four purposes: to identify the existing sources of wood, to identify the species grown in different areas of the country, to learn how people use the different species, and to locate areas in which there is a shortage of wood and a potential site for woodlots. The survey and data preparation were done with the help of faculty and students of the Faculty of Forestry at Kassetsart University. The analysis of the data has been limited to general observations by the authors' limited knowledge of forestry. It is hoped that the data presented in the appendix will be sufficient to stimulate the interest of research personnel involved in the woodlots programs.

1.2 Field Measurements

A wide range of information was collected in the baseline survey about the supply of and demand for fuelwood (including wood for making charcoal). The supply of wood was physically measured by performing a land use survey in the villages and by measuring tree size and density of growth in wooded areas. The current land use was surveyed on a one-half by one kilometer grid and drawn on a map of the village. These maps are included in a separate report. The measurement of tree size included the diameter at breast height (dbh), the height, and the species for all trees in a 20X20 meter plot within the wooded areas being surveyed. These data were used to compute the average density of standing biomass and the estimated annual average increment. Since the equipment used for these measurements was not very sophisticated (compasses, measuring tapes, rulers), the accuracy of these measurements is probably $\pm$ 20 percent. In Srisaket additional data was collected on the number and species of trees grown in the rice fields through direct inspection of the fields owned by the survey households.

1.3 Interview Data

The demand for and use of different species of wood was determined by the survey forestry assistants. They discussed the uses and usefulness of different species of trees with the "village botanists". In the household interviews, the enumerators asked about the number and species of trees in orchards and within the household compound. They were also asked about the species of wood used for fuelwood and charcoal.

1.4 Participant Observations

The experience and observations of the survey enumerators and forestry assistants were recorded in essays discussing the need for additional fuel sources, especially woodlots, and the resources available to establish these sources.

2. Existing Sources

The sources of fuelwood used by the survey villages vary considerably. In wood-scarce areas the villagers may travel as far as 10 kilometers to collect fuelwood from forested areas. For wood plentiful areas, villagers obtain fuelwood from wooded areas around their fields and along the boundary of the village or from cuttings and replantings of tree crops. These basic sources of wood are usually supplemented with cuttings or collection of dead wood from the house compound, from areas planted with tree crops, or from trees in the agricultural fields. The villagers were asked how far they travelled to obtain their fuelwood. Their responses are summarized in Table 1 for each changwat. The average values for each village are listed in Table 2.

The wood sources available to the villagers were examined in greater detail by estimating four primary resources: forested areas, areas cultivated with tree crops, trees within the household compound and trees left standing in the agricultural fields.

The forested areas were surveyed directly by the enumerators and forestry technical assistants. A sample plot 20 meters square within each area was selected for measurement. The weight of standing biomass was estimated using the data on tree diameter at breast height (D) and tree height (H) in the equation $\log wt = .97309 \log D^2H - 1.17469$ for each tree within the plot.* The average annual increment was estimated by taking two and one-half percent of the standing biomass.

In those villages where there were one or more wooded areas within the village, an estimate of the area was computed from the village maps and this was multiplied by the estimated annual increment. The area required to supply the village cooking needs was estimated using the data on local population, average household fuel consumption and the conversion efficiency of local charcoal-making activities.

The areas planted with trees crops, fruit orchards and rubber smallholdings, and the trees within household compounds were studied as part of the household survey. Each household was asked about the number and species of trees planted both within and outside their family compound. The data was summarized first by village and then by changwat, and average values per household and per species were computed.

The data on trees left standing in the agricultural fields was collected for only one changwat, Srisaket. The enumerators made a physical survey of the trees in the fields of each household surveyed. The results were translated into statistics on both the density of trees and the percentage of species.

2.1 Standing Biomass in Wooded Areas

The quantity of standing biomass in each survey village that had a source or sources of fuelwood within its boundaries is estimated in

*D is in centimeters and H in meters.

Table 1

Distance to Primary Renewable Fuel Source

(Number of Households)

CHANGWAT \ Distance (Kilometers)	No Response	≤ 1	2	3	4	5	6-10	11-20	20
PETCHABURI	26	37 (7)	23 (4)	24 (2)	13 (1)	13 (3)	32 (2)	8 (3)	16
KORAT	39	45 (12)	33 (5)	30(4)	16 (2)	6	17 (2)	3 (1)	7
SRISAKET	12	113 (50)	37 (19)	17 (8)	9 (4)	3 (2)	2	-	6 (1)
KAMPANGPHET	81	33 (2)	15 (2)	8	1	5	12	12	4
LAMPANG	73	57 (5)	28 (1)	21 (1)	8	8	5	-	1
CHAINGMAI	33	45 (2)	34 (2)	24 (1)	10 (1)	17	14	-	-
SONGKLA	6	58 (6)	61 (6)	27 (3)	9 (4)	12 (3)	6	-	-
CHANTABURI	14	84 (21)	32 (2)	20	8 (1)	11 (2)	8 (1)	4	-
ROI-ET	1	104 (63)	41 (25)	11 (7)	3 (1)	1	-	1 (1)	-
UDORNTHANI	8	33 (21)	59 (27)	33 (19)	11 (5)	13 (7)	8 (5)	6 (2)	3 (1)

Note: secondary sources in paretheses

Table 2

Average Distance to Fuel Source
(Kilometers)

Changwat	Village	First Source Average
Petchaburi	1	5.9
	2	5.9
	3	10.7
	4	28.6
	5	3.3
Korat	1	4.8
	2	5.0
	3	3.1
	4	6.3
	5	9.0
Srisaket	1	7.9
	2	1.2
	3	1.9
	4	1.3
	5	2.4
Kampangphet	1	15.5
	2	1.6
	3	2.4
	4	9.6
	5	7.3
Lampang	1	1.8
	2	2.5
	3	5.0
	4	2.6
	5	2.4

Table 2

Average Distance to Fuel Source
(Kilometers)

Changwat	Village	First Source Average
Chiang Mai	1	2.0
	2	3.0
	3	4.9
	4	2.6
	5	2.0
Songkla	1	1.7
	2	2.4
	3	2.5
	4	3.1
	5	1.9
Chanthaburi	1	2.3
	2	2.6
	3	2.2
	4	1.9
	5	3.5
Roi-Et	1	1.2
	2	1.4
	3	1.4
	4	2.4
	5	1.5
Udorn Thani	1	2.2
	2	2.3
	3	2.5
	4	4.5
	5	8.2

Table 3. Although the species of trees in these areas were recorded, no attempt was made to use species-specific formulas for calculating the weight of standing biomass or the average sustainable yield. Instead, The standard ratio of 2 1/2% was used to calculate annual sustainable yield.*

In the dry dipterocarp forests the quantity of standing biomass per hectare ranged from a low of about 10 tons dry weight per hectare to a high of slightly over 230 tons. In the disturbed dry dipterocarp forests this number dropped below 10 tons per hectare. In the mangrove forest areas the range of standing biomass was between 19 and 185 tons dry weight per hectare. In the disturbed mangrove forests the quantity of standing biomass dropped to as low as five and one-half tons per hectare. The highest productivity was recorded for the mixed deciduous forests without teak. Here the range of standing biomass was between 93 and 500 tons dry weight per hectare. Clearly there are considerable differences in wooded areas, primarily between changwat but also within changwat and even within individual villages. The wide variation in density of standing biomass is attributable not only to the conditions of the soil and weather in each village but also the extent to which these wooded areas have previously been cut for fuelwood. Although the data in Phase I was collected by the enumerators and that in Phase II by forestry students, the range of standing biomass recorded for both phases is comparable. The data is thought to be fairly reliable with the variations caused primarily by differences in the quality and density of wooded areas in the different villages. Some loss of accuracy resulted from the method of estimation. For each species surveyed within a plot, the average values for the diameter and height were used in the calculation of the standing biomass. Since the relationship between the standing biomass and the diameter and height is not linear, the averaging of these values would tend to produce incorrect estimates where the trees of any one species had a wide range of diameters and heights.

For each village in which wooded areas were surveyed, an estimate was prepared of the average sustainable yield of that wooded area. The size of the wooded area was determined from planimetry measurements of the land use map for each village. Where more than one plot within a village was surveyed the total land use was computed and the average value of the sustainable yields for each plot was computed. The results of this calculation are summarized in Table 4. The estimates of average sustainable yield were compared with the population of the village to determine a per capita sustainable yield.

The wood requirements for village cooking were computed based on the per capita fuel consumption for each village and the typical charcoal conversion ratios. The area required to meet this demand, assuming an average annual sustainable yield comparable to the wooded areas in the village, is shown in Table 4. This value is compared with the area requirements assuming a high yield variety were planted with an average annual sustainable yield of 10 tons dry weight per hectare.

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*This number and the regression formula are applicable to the yield of usable wood from a forester's perspective. The quantity of biomass fuel available from these wooded areas is greater than the calculations indicated but no empirical studies had been made of this higher yield.

Table 3

STANDING BIOMASS IN VILLAGE FOREST AREAS

CHANGWAT	VILLAGE	PLOT	AREA (M)	SPECIES/ TREES	FOREST TYPE	TOTAL STANDING BIOMASS.	
						TONS/RAI	TONS/HECTARE
Korat	Non Ngue	1	20x20	6/30	Dry Dipterocarp Forest	7.9	49.1
"	"	2	"	5/20	" " "	17.4	108.8
"	"	3	"	7/13	" " "	4.2	26.0
"	Non Leum	1	"	7/31	" " "	6.9	43.1
"	"	2	"	5/21	" " "	6.6	41.4
"	"	3	"	8/14	" " "	5.8	36.0
Srisaket	Maikan - sangkan	1	"	4/10	Mixed Deciduous Forest without Teak.	31.3	195.6
"	Kok	1	"	6/6	Forest in paddy Field.	7.5	46.6
"	Pran	1	"	4/5	" "	4.0	25.3
Kampangphet	Wangchapoo	1	"	4/7	Mixed Deciduous Forest without Teak.	3.7	23.3
Lampang	Pao	1	"	1/10	Dry evergreen Forest	83.5	522.0
"	"	2	"	3/15	Dry Dipterocorp Forest	5.1	31.6
"	Lai-Hien	1	"	8/25	Mixed Deciduous Forest without Teak.	14.9	93.0
Songkhla	Pabhu	1	"	1/3	Mangrove Forest	3.9	24.6
"	"	2	"	1/4	" "	6.6	41.5
"	"	3	"	1/4	" "	6.9	43.0
Chantaburi	Bangrahong	1	"	1/26	" "	7.6	47.6
"	"	2	"	1/17	" "	6.0	37.5

STANDING BIOMASS IN VILLAGE FOREST AREAS

CHANGWAT	VILLAGE	PLOT	AREA (M)	SPECIES/ TREES	FOREST TYPE	TOTAL STANDING BIOMASS.	
						TONS/RAI	TONS/HECTARE
Chantaburi	Bangrahong	3	20x20	1/8	Mangrove Forest	3.0	19.0
"	Naza	1	"	4/6	Secondary Forest	1.7	10.4
"	"	2	"	4/10	Moist Dipterocarp Forest	4.4	27.7
"	"	3	"	1/55	Mangrove Forest	7.9	49.5
"	Grog	1	"	1/70	" "	6.6	41.0
"	"	2	"	1/54	" "	12.7	79.2
"	"	3	"	1/36	" "	29.6	185.0
"	Klongbon	1	"	1/12	Disturbed mangrove Forest	2.0	12.3
"	Paktapon	1	"	1/20	" " "	1.5	9.1
"	"	2	"	1/15	" " "	0.9	5.5
"	"	3	"	3/3	Disturbed moist evergreen Forest	11.7	73.1
"	"	4	"	4/6	" " " "	27.3	170.7
"	"	5	"	5/5	Moist Dipterocarp Forest	7.8	48.6
Roi-et	Nongvangyao	1	"	5/9	Dry Dipterocarp Forest	29.7	185.7
"	Paver	1	"	4/7	" " "	28.8	180.0
"	Ban Ko	1	"	5/8	" " "	37.1	232.1
"	Pahan	1	"	2/10	" " "	4.2	26.0
Udorn Thani	Ban Men	1	"	9/23	" " "	19.4	121.2

STANDING BIOMASS IN VILLAGE FOREST AREAS

CHANGWAT	VILLAGE	PLOT	AREA (M)	SPECIES/ TREES	FOREST TYPE	TOTAL STANDING BIOMASS.	
						TON/RAI	TONS/HECTARE
Udorn Thani	Ban Men	2	20x20	4/7	Dry Dipterocarp Forest	2.7	16.9
"	Kha Wua	1	"	6/10	" " "	1.8	11.3
"	NongBuadeang	1	"	6/11	" " "	4.6	28.7
"	Khok Srichiengmai	1	"	9/20	" " "	6.2	39.0
"	Sam Kha San Tisuk	1	"	10/22	" " "	14.1	87.9
Chiang Mai	Mai Ho Pra	1	"	5/15	" " "	7.8	49.0
"	"	2	5x5	2/11	" " "	8.0	49.6
"	"	3	20x20	8/16	" " "	6.2	38.7
"	KeelekLuang	1	"	3/4	" " "	6.5	40.5
"	"	2	5x5	5/9	Disturbed Dry Dipterocarp Forest	4.8	26.2
"	"	3	20x20	10/20	Dry Dipterocarp Forest (Undisturbed)	8.4	52.8
"	"	4	5x5	4/5	Dry Dipterocarp Forest	4.8	25.6
"	Tong Guy	1	20x20	4/7	" " "	9.8	61.1
"	Ban Hong	1	"	2/18	" " "	16.5	103.0
"	San Pa Toung	1	"	2/4	Disturb Dry Dipterocarp Forest	4.4	27.5
"	"	2	"	8/10	Deciduous Forest	69.5	434.5
"	"	3	5x5	4/5	" "	1.6	10.8

Table 4

WOODED AREAS : DEMAND CALCULATIONS - SELECTED SURVEY VILLAGES*

CHANGWAT	VILLAGE	WOOD AREA (RAI)	STANDING BIOMASS (TON/ HECTARE)	AVERAGE SUSTAIN-ABLE YIELD (TONS/YEAR/ HA)	POPULATION	AVERAGE SUSTAIN-ABLE YIELD TON/ CAPITA YEAR
KORAT	NON NGUE	919	61.3	1.5	850	0.26
SRISAKET	MAIKAND-SANGKAN	1029	195.6	4.9	582	11.39
LAMPANG	LAI-HIEN	125	93.0	2.3	1857	0.02
SONGKHLA	PABHU	188	36.4	0.9	300	0.09
CHANTABURI	KLONGBON	170	12.3	0.3	420	0.02
ROI-ET	NONG VANGYAO	159	185.7	4.6	658	0.18
	PAWER	28	180.0	4.5	462	0.04
	BAN KO	93	232.1	5.8	917	0.09
	PANAI	48	26.0	0.7	532	0.01
UDORN THANI	BAN MEN	365	69.1	1.7	568	0.17
	KHA WUA	232	11.3	0.3	631	0.02
	NONGBUADEANG	385	28.7	0.7	1019	0.04
	KHOK SRICHIANGMAI	33	39.0	1.0	1440	-
	SAMKASANTISUK	92	87.9	2.2	953	0.03
CHIANGMAI	MAI HO PRA	459	30.3	0.8	731	0.08
	KEELEKLUANG	437	24.2	0.6	700	0.06
	BAN HONG	974	103.0	2.6	535	0.76
	SANPATOUNG	629	154.3	3.9	600	0.65

* villages having significant wooded areas

Table 4 (Cont.)

SUPPLY CALCULATIONS - VILLAGE WOODED AREA

CHANGWAT	VILLAGE	FOREST TYPE[1]	ASY[2]	FUEL[3] DEMAND	EQUIVALENT WOOD DEMAND TON/YEAR	DEMAND-SUPPLY RATIO
KORAT	NON NGUE	DD	0.26	0.28C	0.34	0.93
SRISAKET	MAIKAN . SANGKAN	DM	0.39	0.53W	0.19	2.15
LAMPANG	LAI-HIEN	DE	0.02	0.52W	0.19	0.04
SONGKHLA	PABHU	M	0.09	0.20C	0.24	0.45
CHANTABURI	KLONGBON	M,ME	0.02	0.34C	0.41	0.06
ROI-ET	NONG VANGYAO	DD	0.18	0.75W	0.27	0.24
	PAWER	DD	0.04	0.75W	0.27	0.05
	BAN KO	DD	0.09	0.75W	0.27	0.12
	PANAI	DD	0.01	0.75W	0.27	0.01
UDORN THANI	BAN MEN	DD	0.17	0.36C	0.44	0.47
	KHA WUA	DD	0.02	0.36C	0.44	0.06
	NONGBUADEANG	DD	0.04	0.36C	0.44	0.11
	KHOK SRICHIANGMAI	DD	-	0.36C	0.44	-
	SAMKASANTISUK	DD	0.03	0.36C	0.44	0.08
CHIANGMAI	MAI HO PRA	DD	0.08	0.50W	0.19	0.16
	KEELEKLUANG	DD	0.06	0.50W	0.19	0.12
	BAN HONG	DD	0.76	0.50W	0.19	1.52
	SANPATOUNG	DD,DM	0.65	0.50W	0.19	1.30

1. DD - dry dipterocarp,
   M - Mangrove
   DM - deciduous mixed, no teak
   ME - moist evergreen
   DE - dry evergreen
   MD - moist dipterocarp

2. ASY average sustainable yield tons/capita/yr

3. per capita fuel consumption, kg/day primary fuel, median value, C - charcoal
   W - wood

2.2 Trees Outside of the Family Compound

The planting of orchards is most significant in Srisaket, Songkhla, Chantaburi, Udorn Thani, and Roi-et. In Srisaket a wide variety of trees are grown outside the family compound for use as fuel. About thirteen species were commonly grown, but another 66 were mentioned. The average household had 70 trees. In Songkhla the major tree species is rubber. The large scale replanting program currently underway in Songkhla has produced a glut of rubber wood. Since trees other than rubber are preferred for use as a cooking fuel, the rubber wood is used by small industries such as brickmaking. A number of fruit trees are also grown in Songkhla. About one-quarter of the survey houses had cashew nut trees, while almost one-fourth had durian and coconut trees and more than one-eighth had rambutan and jack fruit.

In Chantaburi, rubber trees were grown outside the family compound by about 45 percent of the survey families. This tree is less important than in Songkhla; about 43 percent of the households in Chantaburi have plantings. Chantaburi is famous for its fruits, and in the survey villages between one-sixth and one-fourth of the households had plantings of coconut, mango, rambutan and durian trees. Of the trees used for fuel, Lagerstroemia spp. and Melaleuca Leucadendra, Linn were the most common. In Roi-et all of the trees grown outside of the household compound were used for fuel. The prominent species used for fuelwood were tamarind, Barringtonia, Pterocarpus, Shorea, Dillenia, and Cratoxylon. Although tree crops are rarely sold, many are used for household consumption including Mangifera, Ceiba, Acasia, Cassia, Cocos, and Psidium.

In Udorn Thani, the most common fuelwood species grown outside of the household compound are Barringtonia, Shorea siamensis, Pterocarpus, Combretum and Canarium. Few tree crops were sold but many were consumed at home including banana, mango, tamarind, and Pterocarpus. In Chiang Mai, five species of tree crops were mentioned. The most common were coconut, longan, and banana, which were grown outside of the compound by about one-eighth of the survey households and used for income or home consumption.

In the other four provinces the average numbers of trees owned by households having trees outside their compound were 31, 57, 34, 64, respectively, for Petchaburi, Korat, Kampangphet, and Lampang. Only in Kampangphet did the percentage of families having trees exceed 27 percent of those surveyed. Mango was the most frequently mentioned species. Trees were used as sources of fuel, income, and for home consumption in all four changwat. The popularity of growing trees outside of the compound is summarized by changwat in Table 5. A more detailed description is given in the appendix, Section A.1.

2.3 Trees Inside Family Compound

Another area in which trees are grown is inside the family compound. Eighty-eight percent of the households surveyed grew trees within the family compound. The lowest response rate was in Chantaburi with 78 percent. In one village in Chantaburi, only 55 percent of the households grew trees inside the family compound. The highest response rate was in

Table 5

TREES OUTSIDE THE FAMILY COMPOUND

Changwat	% of household possessing trees	average number of trees/ household	most popular species			
			in total number		in number of households	
			1st	2nd	1st	2nd
Petchburi	27%	31	Dipterocarpus tuberculatus,	Afzelia xylocarpa	Afzelia xylocarpa	Diospyros rhodocalyx
Korat	21%	57	Mangifera caloneura	Cocos nucifera	Mangifera caloneura	Cocos nucifera
Srisaket	84%	70	Irvingia malayana	Dipterocarpus obtusifolius	Irvingia malayana	Dipterocarpus obtusifolius
Kampangphet	49%	34	Musa sapientum	Mangifera caloneura	Irvingia malayana	Mangifera caloneura
Lampang	20%	64	Musa sapientum	Samanea saman / Dimocarpus longan	Samanea saman	Dimocarpus longan
Songkla	88%				Para rubber	Cocos nucifera
Chantaburi	78%				Para rubber	Cocos nucifera
Roi-et	85%				Shorea obtusa	Erythrophloeum succirubrum
Udorn Thani	84%				Shorea obtusa	Shorea siamensis
Chiang Mai	37%				Musa sapientum	Cocos nucifera

Table 6

TREES IN FAMILY COMPOUND

Changwat	% of households having trees	ave. number of trees	range of species	most frequent species by total number		most frequent species by household occurrence	
				1st	2nd	1st	2nd
Petchburi	90%	17	27	Cocos nucifera	Musa sapientum	Cocos nucifera	Artocarpus heterophyllus
Korat	90%	27	25	Musa sapientum	Ceiba pentandra	Cocos nucifera	Mangifera indica
Srisaket	89%	20	35	Cocos nucifera	Ceiba pentandra	Cocos nucifera	Mangifera indica
Kampangphet	87%	27	29	Musa sppientum	Cocos/ Mangifera	Mangifera/ Cocos	Ceiba pentandra
Lampang	92%	14	30	Mangifera indica	Musa sapientum	Mangifera indica	Artocarpus heterophyllus
Songkla	87%	21	36	Musa sapientum	Cocos nucifera	Cocos nucifera	Cocos/ Dimocarpus
Chantaburi	78%	49	43	Musa sapientum	Cocos nucifera	Mangifera indica	Musa sapientum
Roi-et	83%	25	35	Musa sapientum	Bambusa	Mangifera indica	Cocos nucifera
Udorn Thani	91%	21	32	Musa sapientum	Bambusa	Cocos nucifera	Cocos nucifera
Chiang Mai	91%	9	21	Musa sapientum	Mangifera indica	Mangifera indica	Dimocarpus longan

Lampang with 92 percent overall and 100 percent in one village. The average number of trees per household ranged from a low of nine in Chiang Mai, where most villages are located in wooded areas, to a high of 49 percent in Chantaburi, where the growing of fruit trees is a major source of income. The overall average was 22.5 trees for those households having trees in their compounds. The averages for each changwat are shown in Table 6.

The respondents mentioned a large variety of species. The greatest diversity was in Chantaburi where 43 species were identified. The minimum diversity was in Chiang Mai with 21 species mentioned. The dominant species were fruit trees such as coconut, mango, banana, longan, and jack fruit and cash crop trees such as bamboo and kapok. Coconut and mango trees are the most frequently planted by the households, but banana trees are planted in the largest numbers with coconut second. The details on species, the number of households planting them and the average number of trees planted are listed for each changwat in the appendix, Section A.2. A summary of the most popular species in terms of households planting and total number is shown in Table 6.

The households were asked about the uses of the various species inside the family compound. Four basic uses -- food, fuel, fodder and income -- were mentioned. Very few of the trees were used as fodder whereas nearly all were used as a source of food. The use of the trees as a source of fuel varied with changwat. They were widely used for fuel in Srisaket and Roi-et, were less important as a fuel in Korat, Lampang, Songkla, Chantaburi, Udorn Thani, and Chiang Mai, and were rarely used as a fuel in Petchaburi and Kampangphet. The importance of trees in the household compound as a source of income was explored only in the second phase of the survey. For Songkla, Chantaburi and Roi-et there was very little selling of products from the trees. For Udorn Thani and Chiang Mai, there was some selling but nothing significant relative to alternative uses.

A comparison of the importance of tree crops inside and outside of the family compound is shown for each survey village and changwat in Table 7. Trees inside the compound are more prevalent than outside in Petchaburi, Korat, Kampangphet, Lampang, and Chiang Mai. In Udorn Thani and Srisaket, trees outside the compound are nearly as prevalent as trees inside the compound, and in the other changwat they are more prevalent. In about half the villages, 85 percent or more of the survey households grew trees within the compound. Also in about half the villages, 60 percent or more of the households grew trees outside of the compound.

2.4 Trees in the Rice Fields

In the Northeast it is common for farmers to leave a number of trees standing in their rice fields and to selectively cut part of the trees for fuelwood. In times of stress the trees may be cut down, and if the stress continues the roots may also be removed for use as fuelwood. In one survey changwat, Srisaket, the enumerators inventoried the trees left standing in the agricultural fields for each household that was interviewed. The data is summarized by density of trees per rai in Table 8. Of the 190 households interviewed, 156 indicated that they had

Table 7

SURVEY HOUSEHOLDS HARVESTING TREE CROPS
FROM INSIDE AND OUTSIDE HOUSEHOLD COMPOUND

		% HOUSEHOLDS WITH TREES			
PROVINCE	VILLAGE	INSIDE COMPOUND	OUTSIDE COMPOUND	PROVINCE TOTAL INSIDE	PROVINCE TOTAL OUTSIDE
1	1	88	18		
	2	90	18		
	3	85	30		
	4	98	-		
	5	88	68	90%	27%
2	1	88	-		
	2	88	35		
	3	90	25		
	4	88	20		
	5	95	25	90%	21%
3	1	85	93		
	2	100	93		
	3	93	75		
	4	75	63		
	5	93	98	89%	84%
4	1	90	15		
	2	75	55		
	3	83	55		
	4	100	68		
	5	88	50	87%	49%
5	1	83	8		
	2	98	18		
	3	93	25		
	4	88	10		
	5	100	40	92%	20%
6	1	68	83		
	2	83	80		
	3	83	85		
	4	83	75		
	5	78	75	87%	88%
7	1	78	75		
	2	55	53		
	3	60	80		
	4	88	58		
	5	73	63	78%	78%

PROVINCE	VILLAGE	INSIDE COMPOUND	OUTSIDE COMPOUND	PROVINCE TOTAL INSIDE	PROVINCE TOTAL OUTSIDE
8	1	85	88		
	2	90	90		
	3	80	83		
	4	85	85		
	5	83	83	83%	85%
9	1	90	85		
	2	83	83		
	3	83	65		
	4	90	80		
	5	75	68	91%	84%
10	1	75	33		
	2	93	25		
	3	80	38		
	4	78	23		
	5	83	50	91%	37%

Table 8

Density of Trees in PADI Fields of Srisaket

(Percentages)

TREES	VILLAGE 1 KOA	VILLAGE 2 KOK	VILLAGE 3 PRAN	VILLAGE 4 MAIKAN-SANGKAN	VILLAGE 5 PONG	TOTAL
.1-.5	23					6
.6-1.0	30		3	3	17	11
1.1-1.5	33	3	6	3	11	12
1.6-2.0	10	3	6	17	22	10
2.1-3.0	5	11	27	55	22	22
3.1-4.0		19	21	10	17	13
4.1-5.0		33	9	3		10
5.1-7.0		28	18	7	6	12
7.1-9.0		3	6		6	3
9.1-11.0			3			1
TOTAL SAMPLE SIZE	40	36	33	29	18	156

trees in their rice fields. The tree density for the villages differed. In Koa, the mean density was about one tree per rai whereas in Pong and Maikan-Sangkan the mean was about two and one-half; in Pran and Kok, the mean was nearly four trees per rai. For the total sample of five villages, the density averaged about three trees per rai. The average number of trees owned by families in these villages is shown in Table 8. The total standing biomass was estimated assuming that the trees were six to eight meters in height and 30 to 40 centimeters in diameter. The results are included in Table 9. In the villages of Kok and Pong, the average sustainable yield was in the range of three-fourths ton, whereas for the other two villages the yield was nearer to one-third ton.

There was no particular preference for species in the rice fields. In fact, there was a considerable variety as shown in Table A-21. The seven significant species were:

1. Irvingia malayana Oliv.
2. Sindora siamensis Teysm.
3. Syzygium Cumini Skeels
4. Pterocarpus macrocarpus Kurz
5. Dipterocarpus obtusifolius Teysm.
6. Azadirachta indica Juss. var. siamensis Vateton
7. Combretum quadrangulare Kurz

Together they accounted for 58 percent of all the trees. The twenty-three less significant species accounted for another 36 percent.

The density of trees in the rice fields is low and the species have not been selected for rapid growth. Nevertheless, these trees are an important marginal source of fuel for the household and are carefully husbanded. Indeed, all wood sources in this area are treated carefully. The children are assigned the task of collecting fuel during those seasons when there is adequate dead wood, but when branches must be cut off the tree then it is the adults who must go and choose the proper branch to be cut.

3. Species Preference

3.1 Villagers' Preferences

The villagers were asked during the baseline survey what tree species they prefer to use for their cooking fuel, either as fuelwood or charcoal. In Phase II of the survey, this information was supplemented by the observations of the forestry assistants, who discussed with the local villagers and other village leaders what species of wood are preferred for charcoal making and for firewood and which trees are hardiest, fastest growing, and easiest to coppice (here, coppice refers only to the removal of branches from live trees). The preferences of the villagers are summarized by changwat in Table 10. A more detailed description of the

Table 9

Estimate Wood Yield From Padi Fields

VILLAGE	TREES/ RAI	TREES/ FAMILY	BIOMASS (TONS) */ FAMILY	ANNUAL SUSTAINABLE** YIELD (TONS)
Koa	1.0	24.4	7.0 - 16.7	.17 - .42
Kok	4.3	99.0	28.4 - 67.8	.71 - 1.70
Pran	3.9	67.5	19.3 - 46.2	.48 - 1.16
Maikan - Sangkan	2.7	28.8	8.3 - 19.7	.21 - .49
Pong	2.7	79.6	22.8 - 54.5	.57 - 1.36
Total	2.9	57.9	16.6 - 39.7	.41 - .99

* 6-8 m high 30-40 cm dbh 285-685 kg/tree

** 2.5 % of standing dry weight

Table 10

Species Preference - Survey Response

CHANGWAT	SPECIES	% OF RESPONDENTS
Petchaburi	Diospyros rhodocalyx	15.2
	Combretum quadrangulare	10.7
	Adenanthera pavonina	9.8
	Azandiracta indica var. siamensis	7.2
	Other	57.1
Korat	Shorea	29.8
	Dipterocarpaceae	22.5
	Other	47.7
Srisaket	Irvingia malayana	29.2
	Canarium subulatum	11.3
	Dipterocarpus Obtusifolius	8.9
	Pterocarpus macrocarpus	8.0
	Other	42.6
Kampangphet	Irvingia malayana	32.5
	Hydnocarpus	10.5
	Other	57.0
Lampang	Mallotus philippensis	13.3
	Xylia xylocarpa	11.8
	Dipterocarpus	10.6
	Hydnocarpus	7.8
	Other	56.5
Songkla	Vitex	24.4
	Grewia	24.1
	Rubber Tree	11.5
	Melaleuca	9.7
	Other	30.3
Chantaburi	Rubber Tree	23.3
	Melaleuca leucadendra	15.7
	Cratoxylon	10.6
	Peltophorum dasyrachis	9.3
	Other	41.1
Roi-et	Barringtonia	19.9
	Erythrophloeum succirubrum	19.3
	Xylia xylocarpa	7.8
	Other	53.0
Udorn Thani	Barringtonia	23.9
	Dipterocarpus	12.6
	Xylia xylocarpa	7.9
	Cratoxylon	7.7
	Other	47.9
Chiangmai	Xylia xylocarpa	19.2
	Mallotus philippensis	19.2
	Dipterocarpus	13.3
	Hydnocarpus	7.9
	Other	40.1

preferences by village is contained in the Appendix, Section A.4. From this data, it can be concluded that a large variety of trees are used for fuel. The preferences vary with supply so that differences can be observed not only between changwat, but among villages within the changwat. The villagers were asked only their first preference in selection of a fuelwood. It is possible that some of the species might have been ranked higher if a second preference were also recorded.

The diversity of preference is reflected in Table 10, where the four most preferred species are listed. The species are different for each changwat. In Petchaburi, there was no clear preference with the three most frequently mentioned species, Diosyros, Combretum, and Adinanthera, accounting for only 36 percent of the responses. In Korat, Shorea and Dipterocarpus were the preferred species mentioned by half the respondents. In Srisaket, Irvingia malayana was most frequently mentioned with Canarium subulatum, Dipterocarpus obtusifolius and Pterocarpus macrocarpus being of lesser importance. In Kampangphet, Irvingia malayana was the dominant species with one-third of the respondents naming it. In Lampang, the most frequently mentioned species were Mallotus philippensis, Xylia xylocarpa, Dipterocarpus and Hydnocarpus, but none of these were mentioned by more than one-eighth of the respondents.

In Songkhla the most frequently mentioned species were Vitex and Grewia, each mentioned by about one-quarter of the respondents. In Chantaburi rubber trees were mentioned by about one quarter of the respondents and Melaleuca Leucadendra by another sixth of the villagers interviewed. It is interesting that in Chantaburi the rubber trees are considered the most desirable fuelwood, whereas in Songkhla, with the much larger resource base and the considerable cuttings associated with the replanting activity, less than one-eighth of the vilagers mentioned rubber trees as a preferred source of fuelwood. In Roi-et about one-fifth of the villagers mentioned Barringtonia and another fifth mentioned Erythrophloeum succirubrum. Barringtonia was also the most frequently mentioned species in Udorn Thani with about one-quarter of the respondents selecting it. In Chiang Mai, the two dominant species were Xylia xylocarpa, and Mallolus phillippensis, both of which were mentioned by about one-fifth of the respondents.

The selection of species and the diversity of the selection is very much dependent on the available supply. In areas such as Lampang the wide variety of species and ready availability of fuelwood led to a great number of species being mentioned by the villagers as their first preference. In Songkhla, where there is also a large supply of wood but it is predominantly from the rubber planting areas, the number of species mentioned was limited to those associated with the rubber plantations. The changwat can be roughly divided into two groups. The first group, including Korat, Srisaket, Songkla, Chantaburi, and Chiang Mai, had two or three species account for one-half of the villagers' responses regarding preferred source of fuelwood. The second group, including Petchaburi, Kampangphet, Lampang, Roi-et, and Udorn Thani, had a greater diversity of species mentioned by the villagers.

3.2 Villagers' Observations

In Phase II of the survey the species preference was examined more closely. The observations of the forestry assistants based on their work in the village and their conversation with the villagers are summarized in Table 11. Separate preferences were determined for charcoal and firewood. Differences in charcoal species preference can be seen for the different changwat, however, certain species such as Irvingia, Xylia and Schleichera occur in more than one changwat. The reasons given for these preferences have to do largely with availability and ease of use. Specific qualities mentioned were the hardness of the wood, the density of the charcoal and the heat produced by the charcoal.

The species preferred for firewood tend to be different from those preferred for charcoal. Although there is some overlap within changwat, there is almost no similarity in species between the different changwat. The reasons for preferring different species for firewood are the availability of these species, the ease with which they can be cut for use in a fire, and their burning characteristics including ease of ignition and rate of combustion. The preferences observed by the forestry assistants are different from those mentioned by the villagers. It is thought that problems in translation of the local names of the species, differences in the way in which the questions were asked, and the separation of wood preferences for charcoal and firewood led to different responses. Species preferences were also affected by the type of stove. In all five changwat the villagers indicated that the choice of species for cooking fuels depended on the size of the stove and the ease of preparing the wood in small or large pieces.

The forestry assistants asked which species were the strongest in terms of ability to survive, which were easiest to remove branches from and which grew most rapidly. There was considerable overlap between the species mentioned in these questions and the species preferred for use as firewood and charcoal. Among those species most able to survive were Shorea obtusa, Irvingia malayana, and Dipterocarpus tuberculatus. Those species easiest to remove branches from were Cratoxylon, Dipterocarpus tuberculatus, Shorea Obtusa, and Shorea siamensis. The choice for most rapidly growing species was different for each changwat due to differences in the variety of species in each changwat and differences in local growing conditions. In Songkhla, Hevea was mentioned; in Chantaburi, Eugenia; in Roi-et, Shorea Obtusa; in Chiang Mai, Dimocarpus longan; and in Udorn Thani, Cassia siamea and Cratoxylon.

4. Need for Woodlots

The need for woodlots in the various survey villages was examined by all of the survey personnel. The enumerators recorded their observations in essays on the potential for woodlots in their villages. The forestry assistants also wrote essays on the requirements for woodlots in the villages. Finally, the survey supervisors' opinions on the shortages of wood in the survey villages were recorded.

Table 11

WOOD SPECIES SURVEY

	SONGKLA	CHANTABURI	ROI-ET	UDORN THANI	CHIANG MAI
1. What wood is preferred for charcoal ?	- Vitex pinnata - Grewia microcos - Atalantia monophylla	- Irvingia malayana - Rhizophora	- Irvingia malayana - Xylia xylocarpa - Pterocarpus macrocarpus	- Irvingia malayana - Shorea obtusa - Cratoxylon - Schleichera oleosa	- Colona - Dimocarpus - Castanopsis - Xylia xylocarpus - Schleichera oleosa
2. Why ?	- The wood is hard - It produces good heat - It is very easy to collect in the village	- The wood is hard - It's easy to start a fire - It produces good heat	- The wood is hard - It produces dense charcoal	- The wood is hard - Charcoal produces good heat - Charcoal is dense	- The wood is hard - The bark of the tree is very thin - The tree has small branches
3. What wood is preferred for firewood ?	- Hevea brasiliensis - Cratoxylon - Calophyllum floribundum	- Rhizophora - Nephelium	- Shorea obtusa, - Shorea roxburghii - Xylia xylocarpa - Dipterocarpus	- Dipterocarpus alatus, - Shorea obtusa, - Shorea siamensis - Irvirgia malayana	- Dimocarpus longan - Xylia xylocarpus - Shorea siamensis - Dipterocarpus tuberculatus - Lagerstroemia - Castanopsis - Pterocarpus macrocarpus
4. Why ?	- Easy to collect because there are many rubber plantations in the village - It produces good heat - It is very easy to ignite	- The wood is hard - It's a dense wood - The wood is easy to prepare and easy to cut - The wood dries quickly	- The wood is easy to collect - It is easy to start a fire	- The wood produces good heat - The wood is plentiful in forest - It's easy to collect in the village - It is easy to ignite - Not smokey - Less required than for other species	- The wood produces good heat - Low ash content

Table 11 (continued)

WOOD SPECIES SURVEY

	SONGKLA	CHANTABURI	ROI-ET	UDORN THANI	CHIANG MAI
5. Does the wood preference change for different stoves and utensils?	YES Different species of wood are used if the stove requires small or big pieces	YES The same as Songkla	YES The same as Songkla	YES The same as Songkla	YES The same as Songkla
6. What species is strongest, most able to survive ?	- Hevea brasiliensis - Vatica	- Irvingia malayana	- Shorea obtusa, - Dipterocarpus obtusifolius - Dipterocarpus tuberculatus	- Irvingia malayana - Pterocarpus macrocarpus - Shorea obtusa - Dipterocarpus tuberculatus - Erythrophloeum - Dipterocarpus alatus	- Shorea obtusa, - Shorea siamensis - Dipterocarpus tuberculatus, - Colona - Schleichera
7. From which species is it easy to remove branches ?	- Grewia microcos - Cratoxylon - Calophyllum floribundum	- Cratoxylon formosum	- Dipterocarpus tuberculatus - Shorea obtusa	- Randia - Cratoxylon - Xylia xylocarpa - Shorea obtusa - Shorea siamensis - Dipterocarpus tuberculatus	- Dimocarpus longans - Shorea obtusa - Shorea siamensis - Dipterocarpus tuberculatus - Colona - Schleichera

Table 11 (continued)

WOOD SPECIES SURVEY

	SONGKLA	CHANTABURI	ROI-ET	UDORN THANI	CHIANG MAI
8. What species grow rapidly ?	- Hevea brasiliensis	- Eugenia	- Shorea obtusa, - Dipterocarpus obtusifolius	- Cassia siamea - Cratoxylon - Albizzia	- Dimocarpus longan
9. What by-products are obtained from the wood ?	-Rubber latex -Furniture	- Food - House construction material	- Building construction material - Shade for liverstock - The leaf covers the roof	- Building construction material - Furniture	- Food - Selling

4.1 Existing Fuel Shortages

The shortage of fuelwood in the different villages was determined in two ways. First was by asking the supervisors to categorize wood scarcity as; 1) not enough now, 2) not enough for more than 10 years, and 3) enough for the foreseeable future. The results are shown in Table 12. Second was by evaluating the questionnaire data on fuel use and collection which was done in the report "Cooking, Lighting and Heating."

The data in Table 12 indicates that current shortages exist in all villages in Petchaburi, Roi-et and some villages in Korat, Srisaket, Lampang, and Udorn Thani. In only 10 percent of the survey villages did the supervisors observe a sufficient supply for the foreseeable future. Nearly all the villages in Songkhla, Chantaburi, Roi-et, Udorn Thani, and Chiang Mai, have woodland within the village, but most of the villages in the other changwat do not. Some public land is available in 83 percent of the survey villages but the suitability, size and availability of these lands vary. The availability of unused land is limited according to the enumerators' observations. Only 30 percent of the survey villages have unused land, and one-third of these are in Petchaburi.

4.2 Forestry Assistants' Observations

The forestry assistants prepared essays on the possibility of establishing woodlots in five of the survey changwat: Songkhla, Chantaburi, Roi-et, Udorn Thani, and Chiang Mai. Songkhla has sandy clay soils, salt marshes, and Samet forests. In four villages the existing village woodlands could be enriched, especially the Samet forests. Woodlots in new areas could be intercropped with cashew nut trees. In Chantaburi, the existing tree stock was thought to be sufficient for future fuelwood requirements. In Chiang Mai the forests are rapidly being depleted and replanting with faster growing species was considered appropriate. In Roi-et, a large area of public land was identified as being available for growing fuelwood for three of the survey villages that suffer from a scarcity of fuels. In Udorn Thani, the need for woodlots is not as great as in Roi-et and there is less public land. Only a small area of public land, cemeteries, unused fields, and deteriorated forests were identified as potential sites. For both Roi-et and Udorn Thani, the importance of introducing new species was emphasized because of the relatively slow growing species currently found in these areas. Both areas have sandy loam soils. Udorn Thani also has some sandy clay soils. For both areas a program of intercropping following the initial planting was recommended.

The potential sources of seed for the planting were identified as existing wood lands or institutional sources such as the Royal Forestry Department. The problems to be faced in maintaining the woodlot during the first few years range from poaching by villagers and grazing by animals to forest fires. The details of the forestry assistants' observations are included in the essays in the Appendix, Section A.5.

Table 12

SHORTAGES OF FUELWOOD
AND AVAILABILITY OF LAND FOR GROWING FUELWOOD

CHANGWAT-VILLAGE	SPECIFIC SHORTAGE*			DOES THE VILLAGE HAVE			
	1	2	3	WOODLAND [1]	PUBLIC LAND [2]	UNUSED LAND [3]	
1-1	x			-	x	x	
1-2	x			-	x	x	
1-3	x			-	x	x	
1-4	x			-	x	x	
1-5			x	-	x	x	
2-1	x			-	x	x	
2-2		x		-	x	-	
2-3		x		-	x	-	
2-4	x			-	x	-	
2-5	x			-	x	-	
3-1	x			-	-	-	
3-2		x		-	-	-	
3-3	x			-	-	-	
3-4			x	-	x	-	-
3-5	x			-	x	x	
4-1		x		-	-	x	
4-2			x	-	-	-	
4-3			x	-	x	-	
4-4		x		-	-	-	
4-5	x			-	x	x	
5-1		x		x	x	-	
5-2	x			x	x	-	
5-3	x			-	x	-	
5-4	x			-	x	-	
5-5			x	-	x	-	

* Code in text, page 27; [1] in village, supervisor's observation; [2] in or near village, enumerator's observation; [3] in village, enumerator's observation.

Table 12 (continued)

SHORTAGES OF FUELWOOD

AND AVAILABILITY OF LAND FOR GROWING FUELWOOD

CHANGWAT-VILLAGE	SPECIFIC SHORTAGE *			DOES THE VILLAGE HAVE		
	1	2	3	WOODLAND 1	PUBLIC LAND 2	UNUSED LAND 3
6-1		x		-	-	x
6-2		x		-	-	-
6-3		x		x	x	-
6-4		x		x	x	-
6-5		x		x	x	x
7-1		x		x	x	x
7-2		x		x	x	-
7-3		x		x	x	x
7-4		x		x	x	-
7-5		x		x	x	-
8-1	x			x	x	-
8-2	x			x	x	-
8-3	x			x	x	-
8-4	x			x	x	-
8-5	x			x	x	-
9-1		x		x	x	-
9-2		x		x	x	-
9-3	x			x	x	x
9-4		x		x	-	-
9-5	x			x	x	-
10-1			x	x	x	-
10-2			x	-	x	-
10-3			x	x	x	-
10-4			x	-	x	-
10-5			x	-	x	-

* Code in text, page 27; 1 in village, supervisor's observation; 2 in or near village, emumerator's observation; 3 in village, enumerator's observation.

4.3 Enumerators' Observations

After completing a month-long survey in a village, the enumerators were asked to evaluate the acceptability of a woodlot in their village. This evaluation was in the form of a structured essay. The questions which were asked in this essay are listed in the appendix, section A.6, together with the classification system developed to analyze the answers given. The enumerator's responses for each village are also included in the appendix. In the following paragraphs, a summary of the results will be given for each changwat. In reviewing this data, it should be remembered that the answers given are the opinions of the enumerators based on their discussions with villagers and their participation in village life. The essay format was presented to the enumerators at the completion of the Phase I survey. Although their interviews with village leaders included questions covering most of the essay questions, they were not entirely prepared. After the Phase II survey, the enumerators were better prepared.

In Petchaburi, the land identified as available for growing trees included public land and land owned by the villagers which was not currently used for agriculture. This land could be used for woodlots if the villagers understand the benefits to the community and are given proper resources and support. In 80 percent of the villages, additional land for planting can be found next to agricultural lands, roads and rivers. The same percentage of villages have areas where fuelwood could be intercropped with agricultural crops. In only two of the five villages is there sufficient space within the household compound for growing fuelwood.

The villagers are willing to help with the planting through volunteer labor if seeds are provided. The availability of labor for planting trees varies but there are no time constraints due to agriculture. The village headman is the best person to organize a woodlot program. Responsibility for protection of trees should be assigned to the villagers under direction of the village headman or a village committee.

The wood from the woodlot should be used for making charcoal. The distribution could be done according to labor input by villagers or according to the village headman's decision. Alternatively, the wood could be sold and the revenues turned over to the village development committee.

In Korat, the government public land that is not used for agriculture could be used for woodlots. The villagers would accept the development of woodlots if they understand the benefits and receive proper resources and instruction. Unused parcels of land along rivers, roads and fields are another location for tree planting but intercropping with agricultural crops would not be acceptable. Planting trees within household compounds should also be considered but space is limited.

The villagers would be willing to volunteer their labor for the planting if they understand the benefits and receive proper instructions. The period during which labor would be available was not clearly understood, although in two villages the rainy season was thought to be

preferable. A range of village leaders, including the headman, abbot and informal leaders, were suggested to organize the woodlot program. The responsibility for protection of the trees should be a shared responsibility of the villagers, possibly under the direction of a village committee. The wood should be used for charcoal making. Various non-commercial schemes were recommended for distributing the fuelwood to the villagers.

In Srisaket, three of the five villages have land available for woodlots on the unused land owned by government or villagers. Since the land is unused and fuel is scarce, the villagers are willing to develop this land for woodlots. Land along the roads, rivers and fields could also be planted but intercropping in the fields would not be successful. Plantings in household compounds might also be tried but space is limited.

The villagers would volunteer their labor for planting especially if directed to do so by the village headman. Labor is available in all months, but the dry season is best. The village headman would be the person to organize the woodlot program. The responsibility for maintenance of the woodlot should be shared by the villagers. The distribution of fuelwood should be based on the amount of labor donated by the villagers or the village headman's decision. Some of the wood would be used as fuelwood and the rest as charcoal.

In Kamphangphet, three out of five villages have public land or unused private land available for developing a woodlot. A variety of incentives were suggested to make the villagers willing to establish a woodlot. Other areas where trees might be planted include the unused land adjoining roads, rivers and fields and the household compounds where space is available. Intercropping on agricultural land would not be acceptable.

The villagers are willing to volunteer labor if seeds are provided. This labor is available all year but the rainy or dry season is preferable. The village headman should organize the woodlot program but the responsibility for protecting the woodlot should be shared by the villagers, possibly under the direction of a village committee. The wood would be distributed to the villagers according to the amount of labor contributed. The harvested wood would be used to make charcoal.

In Lampang, only one village has public land available for a woodlot. In another village intercropping with vegetables is possible. Planting in household compounds is also a possibility but only in the latter village is there enough space for fuelwood trees. Planting along roads, rivers and fields is also a possibility.

Labor would be available for planting on a volunteer basis if seed is available and the villagers have proper leadership and the option to plant on their own land. No information was available on periods of labor availability. The program should be organized by the village headman or village development committee. The protection of the woodlot should be a shared responsibility possibly under the direction of the village committee. The wood would be used directly as fuelwood.

In Songkla, three of the five villages have private land not used for agriculture which might be suitable for woodlots if the villagers understand the benefits. Areas along roads, rivers and fields and within household compounds could also be considered for planting, but space is limited.

Labor for planting could be obtained voluntarily from the villagers if seed is provided. Such labor is available all year, although the dry or winter seasons are preferable. The woodlot program should be organized by the village headman, agricultural extension agent or village development committee. A village committee should be set up to take responsibility for protection of the woodlot. A variety of methods were suggested for distribution of the wood.

In Chantaburi, four of the five villages have public or private land not used for agriculture which would be suitable for woodlots. Land along roads, rivers and fields which is unused could also be planted. Fuelwood trees could be planted among the rubber trees with vegetables also intercropped during the initial years. Space in the household compounds is limited but could be used for additional plantings.

Labor for planting is available in four out of five villages, but in one of these the labor would require wages. The period in which labor would be available is not well understood although the dry season might be preferable. The village headman or one of the other formal leaders, abbot, principal, or agricultural agent, should be selected to organize the woodlot. The protection of the fuel should be coordinated by the headman or a village committee. Various procedures for distribution of the fuelwood were suggested.

In Roi-et, public land is available for planting woodlots in all villages. The villagers would be willing to plant the land since it is currently unused. Areas along roads, rivers and fields might also be planted but intercropping in the fields would not be acceptable. The household compounds also have space for planting fuelwood trees.

The villagers are willing to volunteer their labor for planting if seed is provided, especially in the rainy or dry season. The woodlot program should be organized by the village headman or kamnan, but the protection of the trees should be a responsibility shared by the villagers. The wood would be distributed among the villagers according to various criteria.

In Udorn Thani, public land is available for planting woodlots in four out of five villages. This land is currently unused and the villagers would accept a woodlot since it is a public use. Unused land along rivers, roads and fields and in household compounds might also be planted, but intercropping in the fields is not acceptable.

The planting could be done by volunteer village labor provided they have proper leadership and understand the benefits. Marginal labor is available throughout the year but the dry season is preferable. Among the persons mentioned who should organize the woodlot program are the village headman (60%), the agricultural extension agent (20%), and an informal

leader (20%). The protection of the trees would be a shared responsiblility of the villagers possibly, under the directon of the village development committee or village headman. The fuelwood should be distributed among the villagers according to locally developed criteria.

In Chiang Mai, public land which is not used for agriculture could be used for woodlots. The villagers would accept this use since it is government land. Intercropping in the fields would not be possible but the unused land along the fields, rivers, and roads could be used. Also the villagers could plant trees in their household compounds where there is usually sufficient space. The trees could be planted by voluntary village labor if seeds are provided. Marginal labor is available throughout the year. The program could be organized by the village headman. The trees would be protected by the villagers as a shared responsibility and the basis for distribution of the harvested wood should be determined by the community.

4.4 Technology Preference

The enumerators were asked to summarize their knowledge of the survey villages by selecting the three most appropriate technologies (of those included in the project at that time) for their village. The results for woodlots are shown in Table 13. Woodlots are the first choice in 14 of the 50 villages, more than any other technology. In fact, 31 villages have woodlots among their top three priorities for technology needed. These recommendations were made without regard to the amount of land available.

In Korat, all five villages studied put woodlots among their greatest needs, three giving it top priority, and two placing it second among the technologies. There is public land available in all five of the communities. In Srisaket province, three villages are interested in having woodlots. It is the first choice in Pao, the second choice in Pong following solar energy to cure tobacco, and the third choice in Pran.

In two other provinces, Chiang Mai and Roi-et, four villages gave priority to woodlots. In Chiang Mai, even though there is no shortage of fuelwood in the five villages, all have public land and two have private land which could be used for woodlots. All five villages in Roi-et reported a scarcity of fuelwood. Three gave woodlots top priority and one placed it third among the new technologies. All five have public land available. In Petchaburi, two villages have woodlots as highest priority and two others have it as second priority. There were specific shortages of firewood in all Petchaburi villages, with immediate scarcity in all but one. All those wanting woodlots have some public land.

In Kampangphet there is no immediate shortage of fuelwood and little interest in woodlots. In Lampang, three of the five villages have a current scarcity of wood. Woodlots are the first priority in two of the villages and the third priority in another. Some public land is available for planting in these villages. In Chantaburi and Songkla there is no immediate wood shortage although the outlook for the next decade is not good. Only two villages in each province are considered prime candidates

Table 13

Technology Preference by Village : Woodlots

AREA CODE	CHOICE	AREA CODE	CHOICE
1 - 1	1	6 - 3	-
1 - 2	1	6 - 4	-
1 - 3	2	6 - 5	3
1 - 4	-	7 - 1	1
1 - 5	2	7 - 2	-
2 - 1	1	7 - 3	-
2 - 2	2	7 - 4	2
2 - 3	2	7 - 5	-
2 - 4	1	8 - 1	3
2 - 5	1	8 - 2	-
3 - 1	1	8 - 3	1
3 - 2	-	8 - 4	1
3 - 3	3	8 - 5	1
3 - 4	-	9 - 1	3
3 - 5	2	9 - 2	-
4 - 1	-	9 - 3	1
4 - 2	-	9 - 4	-
4 - 3	3	9 - 5	3
4 - 4	-	10 - 1	-
4 - 5	-	10 - 2	2
5 - 1	-	10 - 3	2
5 - 2	1	10 - 4	1
5 - 3	1	10 - 5	2
5 - 4	3		
5 - 5	-		
6 - 1	2		
6 - 2	-		

Note : choice indicates if woodlots was 1st, 2nd or 3rd choice of of enumerators for their survey village.

for woodlots. Many of these villages have both public land and wooded areas within the villages. In Udorn Thani, wood is more scarce than in Chantaburi and Songkla and three of the villages there have woodlots listed as a priority. In one village it is first priority. Most of the villages have both wooded areas and public land.

5. Conclusions

The use of trees is an important part of rural life. The villagers use a wide varity of species, but the choice is mostly limited to species common to the area. Trees are used for fuel, food, fodder, construction, and cash crops. They are grown around the houses, in and around these agricultural fields and in orchards. Fuelwood is collected from these sources and from forests and mountainous areas outside the boundary of the village. The villagers differentiate between species in their selection of wood for cooking, making charcoal, and construction. Species are also differentiated by survivability, growth rate and ability to coppice.

Most of the wooded areas within the villages have low tree density. With more dense planting these areas could provide a considerable share of the village demand. In low yield agriculture where the average land holding is relatively large, e.g., in the Northeast, the planting of trees in the field can provide a significant source of fuel. Orchards can provide a source of fuel but the long rotation period for fruit trees and the intermittent planting activities produce an irregular wood supply.

The principal constraint on the introduction of woodlots is the availability of suitable land for planting. While marginal areas along village and field boundaries, around the houses and along the roads are available for dispersed plantings, large unused tracts are rare.

Village labor is available at little or no cost for establishing woodlots provided that the villagers are aware of the need. Existing community organizations and leaders can be used for organizing and maintaining the woodlots.

The rapid depletion of the nation's forests is due to commercial exploitation of prime timber and commercial production of charcoal for industrial and urban domestic use. The villagers have contributed very little to the loss of Thailand's wood resources. However, in the future, rural domestic demand will become significant relative to the diminishing capital stock. Evidence from Thailand and elsewhere indicates that villagers will reduce their consumption of fuel as the supply diminishes. One result is more efficient use of cook stoves. As the shortage becomes acute, the villagers will take a more active interest in woodlots. Roi-et, Srisaket, and Petchaburi are examples of seriously decreasing sources. Since the pace of commercial exploitation, legal or otherwise, in Thailand does not appear to be diminishing, the importance of placing fuelwood sources under control of the villages will become more important.

With the average level of demand for cooking fuel, a little above one-quarter ton of air-dried wood per capita in the rural areas, and a rural population of about 35 million, the total demand for village cooking

is about 9 million tons of air-dried wood per year. To this must be added the requirements for heating, insect protection and construction, perhaps another 20 percent. For current village woodlands, with a sustainable yield of one ton per hectare, the total demand for land in equilibrium system would be 108,000 square kilometers or 20 percent of the available land. For normal forested areas with an annual sustainable yield of 2.5 tons per hectare, the demand for land would be 43,200 square kilometers. For woodlots with high yielding varieties producing an average sustainable yield of 10 tons per hectare, the total demand for land would be 10,800 square kilometers or about 2 percent of the available land area.

Table A.1

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 27% (53 HOUSEHOLDS)

CHANGWAT 1 PETCHBURI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
1	Diospyros rhodocalyx	ตะโก	9	4.3	-	100	-
2	Combretum quadrangulare	สะแก	7	13.0	-	100	-
3		กะโดไม้	5	14.0	-	80	20
4	Podocarpus neriifolius	ไม้จริง	2	50.5	-	100	-
5	Azadirachta var. siamensis	สะเดา	2	15.0	-	100	-
6	Arfeuillea arborescens	ไม้ตะไล	2	10.0	-	50	50
7	Lagerstroemia spp	ตะแบก	1	20.0	-	100	-
8	Ceiba pentandra	นุ่น	2	75.0	100	-	-
9	Dipterocarpus tuberculatus	พลวง	2	150.0	-	50	50
10	Mangifera indica	มะม่วง	7	15.0	88	13	-
11	Artocarpus heterophyllus	ขนุน	6	14.2	83	-	17
12	Afzelia xylocarpa	มะค่า	11	23.7	-	91	9
13	Morinda coreia	ยอ	2	10.0	-	100	-
14	Terminalia chelbula	สมอ	3	3.7	33	33	33
15	Moringa oleifera	มะรุม	1	10.0	100	-	-
16	Spodias pinnata	มะกอก	1	20.0	100	-	-
17	Dyospyros mollis	มะเกลือ	2	15.5	-	100	-
18	Xylia xylocarpa	แดง	3	9.0	-	100	-
19	Hymenodictyon excelsum	อุโลก	1	5.0	-	100	-
20	Litsea glutinosa	อีเหม็น	1	30.0	-	100	-
21	Shorea siamensis	รัง	3	43.3	-	66	33
22	Flacourtia indica	ตะขบ	1	50.0	-	100	100
23	Cocos nucifera	มะพร้าว	1	20.0	100	-	-
	Total of trees 1626.6						
	AVE trees per household 30.7						

Table A.2

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 21% (42 HOUSEHOLDS)

CHANGWAT 2 KORAT

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
1	Pterocarpus macrocarpus	ประดู่	8	3.5	-	38	100
2	Shorea siamensis	รัง	6	3.3	-	100	100
3	Dipterocarpus tuberculatus	พลวง	2	2.0	-	-	100
4	Bombax ceiba	งิ้ว	5	9.6	40	-	60
5	Shorea obtusa	เต็ง	12	4.8	-	1	-
6	Sindora siamensis	มะค่า	2	.5	-	100	50
7	Mangifera indica	มะม่วง	24	27.0	58	38	67
8	Cocos nucifera	มะพร้าว	18	19.7	67	44	56
9	Canarium subulatum	ไม้เสียม	2	3.0	-	50	100
10	Terminalia alata	ไม้เขียด	1	5.0	-	-	100
11		คะจิน	5	2.2	-	80	100
12	Xylia xylocarpa	ไม้แดง	4	2.5	-	75	100
13	Artocarpus heterophyllus	ขนุน	11	14.0	36	18	55
14	Bouea burmanica	มะปราง	14	12.7	64	36	57
15	Musa sapientum	กล้วย	4	82.5	50	-	75
16	Manilkara achras	ละมุด	12	12.8	50	25	8
17	Baccaurea ramiflora	มะไฟ	5	45.0	60	20	80
18	Bambusa	ไผ่	1	2.0	-	-	100
19	Citrus aurantifolia	มะนาว	3	16.3	67	-	67
20	Annona squamosa	น้อยหน่า	1	120.0	100	-	-
21	Diospyros decandra	จัน	1	5.0	100	-	-
	Total trees	2409.3					
	AVE trees per household		57.4				

Table A.3

ORCHARD - TREES OUTSIDE FAMILY COMPOUND PAGE 1

PERCENTAGE OF SAMPLE WITH TREES 84% (168 HOUSEHOLDS)

CHANGWAT 3 SRISAKET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
1	Irvingia malayana	บก	158	9.9	-	100	7
2	Eugenia cumini	หว้า	132	6.3	-	100	14
3	Sindora siamensis	แต้	98	6.4	-	96	6
4	Pterocarpus macrocarpus	ประดู่	116	7.3	-	97	18
5	Dipterocarpus obtusifolius	สะแบง	142	9.8	-	96	13
6	Azadirachta indica var siamensis	สะเดา	106	5.9	-	91	22
7	Tamarindus indicus	มะขาม	67	2.5	-	91	37
8	Peltophorum dasyrachis	อะลาง	37	3.6	-	97	-
9	Averrhoa bilimpi	ทะลิง	10	1.4	-	100	-
10	Hydnocarpus ilicifolius	หัวลิง	4	8.0	-	100	-
11	S. rea roxburghii	ขยอม	69	7.0	-	91	13
12	Streblus asper	ข่อย	46	7.4	-	100	15
13	Morinda coreia	ยอป่า	53	4.8	-	92	6
14	Xylia xylocarpa	แดง	22	6.0	-	95	19
15	Dialium cochinchinens	ลูกหยี	19	3.5	-	95	47
16	Combretum quadrangulare	สะแก	78	6.3	-	99	-
17	Diospyros rhodocalyx	ตะโก	46	5.8	-	100	15
18	Mangifera indica	มะม่วง	59	3.4	-	86	30
19	Cocos nucifera	มะพร้าว	5	3.4	-	40	60
20	Albizzia lebbek	จามจุรี	4	1.3	-	75	25
21	Schleichera oleosa	ไม้ค้อ	2	3.5	-	100	50
22	Parinari anamense	พอก	83	6.5	-	100	7
23	Dalbergia nigrescens	ขนวน	35	4.1	-	100	3
24	Psidium guajava	ฝรั่ง	2	3.0	-	100	100
25	Cassia bakeriana	กัลปพฤกษ์	9	4.7	-	100	22
26	Cassia fistula	ชัยพฤกษ์	10	1.2	-	100	-
27	Terminalia chebura	สัมมอ	6	3.3	-	100	17
28	Dipterocarpus alatus	ยาง	15	7.2	-	87	27

PERCENTAGE OF SAMPLE WITH TREES 84% (168 HOUSEHOLDS)

CHANGWAT 3 SRISAKET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
29	Lepisanthes rubiginosum	หวดข่า	5	1.6	-	100	100
30	Lagerstroemia	ตะแบก	32	4.1	-	100	-
31	Bauhinia	ชงโค	2	2.5	-	100	-
32	Cassia siamea	ขี้เหล็ก	6	1.6	-	100	17
33	Anisoptera costata	บาก	7	6.3	-	57	42
34	Terminalia bellirica	สมอ	18	11.2	-	83	28
35	Dipterocarpus intricartus	ตราด	24	7.2	-	88	13
36	Erythrophloeum succirubrum	พันซาด	28	11.1	-	100	14
37	Cratoxylon formosum	ติ้ว	10	10.2	-	100	-
38	Dalbergia cochinchinensis	กะยุง	28	5.6	-	100	-
39	Anthocophalus chinensis	เค็มกะตุ้ม	6	7.2	-	100	-
40	Careya sphaerica	กระโดน	26	3.6	-	96	19
41	Schoutenia hypoleuca	แดงกวง	1	10.0	-	100	-
42	Terminalia alata	กุลิก	2	3.5	-	100	-
43		เค็มกวง	8	9.8	-	100	-
44	Borassus flabellifer	ตาล	5	1.4	-	60	60
45	Barringtonia	จิก	2	6.5	-	100	-
46	Hopea odorata	แดน	1	5.0	-	100	-
47	Shorea obtusa	เต็ง	3	5.0	-	100	-
48	Peltophorum dasyrachis	ระเยก	6	6.2	-	100	-
49	Phyllanthus emblica	กันตรี	5	16.0	-	100	-
50	Lagerstroemia speciosa	เค็มกันเจิง	17	5.5	-	100	-
51	Diospyros	ตะโกนึง	24	6.5	-	100	8
52	Dalbergia	พะยุง	16	3.3	-	100	25
53		คำย่อ	1	5.0	-	100	-
54	Dalbergia nigrescens	สะนวน	2	6.0	-	100	-
55		โคมไคร	1	10.0	-	100	-
56		ตะเมียว	1	2.3	-	100	-

ORCHARD TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 84% (168 HOUSEHOLDS)

CHANGWAT 3 SRISAKET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
57		เคิมสโนน	8	1.2	-	100	-
58	Eugenia	เคิมปลึง	19	1.7	-	100	-
59		กะเสด	12	1.8	-	100	-
60		กะธั่น	17	1.3	-	100	-
61	Feroniella lucida	กะชัง	9	1.9	-	100	-
62		ทุบ	6	1.0	-	100	-
63	Ceiba pentandra	นุ่น	3	2.0	-	75	25
64		ขาน	2	3.0	-	100	-
65	Shorea siamensis	รัง	1	100.0	-	100	-
66		เคิมตะลด	1	10.0	-	100	-
67		กะลัน	4	4.0	-	100	-
68	Xylia xylocarpa	เคิมสะกรม	2	2.5	-	100	-
69		ไผ่	2	30.5	-	100	-
70		สะบัก	1	7.0	-	100	-
71	Lepisanthes fruticosa	ชะเรียง	4	4.3	-	100	-
72		กะพัง	2	2.5	-	100	-
73	Feroniella lucida	กะสัง	5	1.6	-	100	-
74	Archidendron jiringa	กะเนียง	1	20.0	-	100	-
75	Shorea obtusa	เต็ง, รัง	5	7.6	-	100	-
76	Archidendron jiringa	กะเนียง	1	50.0	-	100	-
77		ถ่าง	1	30.0	-	100	-
78	Borassus flabellifer	เคิมตะโนด	1	32.0	-	100	-
79	Gardenia obtusifolia	เคิมตะนูน	1	5.0	-	100	-
	Total trees 11758.5						
	AVE per household 70						

Table A.4

ORCHARD - OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 49% (97 HOUSEHOLDS)

CHANGWAT 4 KAMPANGPET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH/ LATIN	THAI			% SELL	% FUEL	% OTHER
1	Mangifera indica	มะม่วง	39	21.2	41	13	84
2	Cocos nucifera	มะพร้าว	16	35.4	50	-	56
3	Artocarpus heteroph	ขนุน	7	15.9	57	-	57
4	Musa sapientum	กล้วย	7	125.7	57	-	71
5	Irvingia malayana	มะหมก	41	12.4	-	98	2
6	Vatica cinerea	สะเดาปัด	2	3.5	-	100	100
7	Lagerstroemia	ตะแบก	11	6.1	-	36	64
8	Dimocarpus longan	ลำไยดง	3	11.7	-	100	-
9	Azadirachta indica	สะเดา	4	7.5	-	50	50
10	Bouea burmanica	มะปราง	5	2.6	-	-	100
11	Afzelia xylocarpa	มะค่า	9	2.9	-	-	100
12	Dipterocapus alatus	ไม้ยาง	11	2.2	-	27	73
13	Hydnocarpus ilicifolius	กะเบาสิง	2	51.0	-	100	-
14	Ceiba pentandra	นุ่น	3	6.7	33	-	67
15	Anthocephalus chinensis	กระทุ่ม	3	4.3	-	-	100
16	Pterocarpus macrocarpus	ประดู่	4	2.3	-	-	100
17	Tetrameles nudiflora	กะพง	1	5.0	-	-	100
18	Eugenia jambolana	ชมพู่	2	4.5	-	-	100
	Total trees 3254.7						
	AVE trees per household 33.6						

Table A.5

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 20% (40 HOUSEHOLDS)

CHANGWAT 5 LAMPANG

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR		
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER
1	Mangifera indica	มะม่วง	8	12.5	75	25	62
2	Artocarpus heterophyllus	ขนุน	7	4.9	43	14	100
3	Citrus aurantifolia	มะนาว	3	11.3	100	-	67
4	Samanea saman	ฉำฉา	17	12.4	-	12	88
5	Annona squamosa	น้อยหน่า	2	15.0	100	-	50
6	Dimocarpus longan	ลำไย	10	22.1	100	10	20
7	Manilkara achras	ละมุด	3	7.7	67	67	67
8	Punica granatum	ทับทิม	1	20.0	100	-	100
9	Zizyphus auritiana	พุทรา	1	10.0	-	-	100
10	Acacia pennata subsp insuavis	ชะอม	1	200.0	100	-	100
11	Bombax ceiba	งิ้ว	1	60.0	100	-	-
12	Cocos nucifera	มะพร้าว	3	36.0	75	-	25
13	Tamarindus indica	มะขาม	1	25.0	-	100	100
14	Musa sapientum	กล้วย	9	119.4	89	-	67
15	Carica papaya	มะละกอ	2	11.5	100	-	50
16	Bambusa	ไผ่	4	5.8	75	25	100
17	Cratoxylon fomosum	ติ้ว	1	15.0	-	100	-
18	Psidium guajava	ฝรั่ง	1	5.0	100	-	100
19	Xylia xylocarpa	ไม้แดง	2	7.5	50	-	50
20	Pterocarpus macrocarpus	ไม้ตู่	1	5.0	-	-	100
21	Dipterocarpus tuberculatus	พลวง	1	20.0	-	-	100
22	Dipterocarpus obtusifolius	เคียง	1	20.0	-	-	100
23	Shorea obtusa	แงะ	4	33.5	-	-	100
24	Shorea siamensis	เบา	5	11.4	-	60	60
25	Holoptelea integrifolia	กะเจ๊า	1	20.0	-	-	100
26	Lepisanthes fruticosa	สะเรียง	1	10.0	-	-	100
27	Harissonia perforata	ไม้จี้	1	10.0	-	-	100
28	Parinari anamense	หมื่น	2	41.0	-	50	50

Table A.6

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 88% (159 HOUSEHOLDS)

CHANGWAT 6 SONGKLA

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
1	Anacardium occidentale	มะม่วงหิมพานต์	41		90	-	5	48
2	Durio zibethinus	ทุเรียน	39		74	1	-	67
3	Nephelium lappaceum	เงาะ	25		64	4	-	76
4	Musa sapientum	กล้วย	11		73	-	-	72
5	Parkia speciosa	สะตอ	27		89	15	-	59
6	Artocarpus integer	จำปาดะ	12		67	1	-	100
7	Cocos nucifera	มะพร้าว	42		64	2	-	88
8	Artocarpus heterophyllus	ขนุน	22		59	14	-	77
9	Citrus aurantifolia	มะนาว	3		67	-	-	67
10	Manilkara achras	ละมุดฝรั่ง	3		-	-	23	67
11	Borassus flabellifer	ตาล	22		5	10	32	100
12	Vitex pinnata	ไม้นน	7		-	71	29	-
13	Melaleuca leucadendra	เสม็ด	13		-	92	18	-
14	Hevea brasiliensis	ยางพื้นเมือง	156		98	32	-	2
15	Tamarindus indica	มะขาม	5		-	-	-	100
16	Litsea monopetala	หัง	2		-	-	100	-
17	Aglaia domestica	ลางสาด	5		80	-	-	100
	Total trees							
	AVE trees	per household						

Table A.7

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLES OF THE TREES 78% (141 HOUSEHOLDS)

CHANGWAT 7 CHANTABURI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
1	Cocus nucifera	มะพร้าว	45		44	13	43	96
2	Mangifera indica	มะม่วง	35		20	14	66	91
3	Artocarpus heterophyllus	ขนุน	19		26	10	64	95
4	Psidium guajava	ฝรั่ง	9		-	-	-	89
5	Musa sapientum	กล้วย	13		38	-	-	85
6	Phyllanthus acidus	มะยม	9		-	-	-	89
7	Aglaia domestica	ลางสาด	7		42	14	-	86
8	Nephelium lappaceum	เงาะ	30		76	13	-	90
9	Durio zibethinus	ทุเรียน	42		83	11	6	83
10	Annona squamosá	น้อยหน่า	8		37	25	38	100
11	Melaleuca leucadendra	เสม็ด	10		20	70	20	-
12	Hevea brasiliensis	ยางพารา	78		89	30	3	8
13	Ananas comosus	สัปปะรด	7		14	-	-	86
14	Cratoxylum maingayi	แต้ว	7		-	71	28	-
15	Lagerstroemia	ทะแบก	10		-	80	30	-
16	Peltophorum dasyrachis	อินทรีย์	7		-	85	14	-
17	Areca catechu	หมาก	9		55	-	-	100
18	Carica papaya	มะละกอ	6		16	-	-	100
19	Tamarindus indica	มะขาม	8		-	-	12	75
20	Sandoricum koetjape	กระท้อน	5		60	40	-	100
21	Zizyphus mauritiana	พุทรา	6		33	33	-	100
22	Citrus maxima	ส้มโอ	7		57	14	39	86
23	Manilkara achras	ละมุด	6		-	-	-	100
24	Manihot esculenta	มัน	9		100	-	-	-
	Salacca [illegible]	ระกำ	5		-	-	20	80
	Total trees							
	AVE trees per household							

Table A.8

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 85% (153 HOUSEHOLDS)

CHANGWAT 8 ROI-ET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
1	Tamarindus indica	มะขาม	65		3	77	20	69
2	Irvingia malayana	ไม้บก	42		-	100	2	14
3	Streblus asper	ไม้ข่อย	31		-	90	10	10
4	Erythrophleum succirubrum	ไม้ขาด	72		-	94	6	-
5	Shorea obtusa	ไม้จิก	80		-	99	18	-
6	Xylia xylocarpa	ไม้แดง	50		-	100	6	2
7	Pterocarpus macrocarpus	ประดู่	64		-	98	2	-
8	Mangifera indica	มะม่วง	28		-	75	25	75
9	Eugenia cumini	ไม้หว้า	12		-	92	8	50
10	Ceiba pentandra	ไม้นุ่น	20		-	55	55	25
11	Dipterocarpus tuberculatus	ไม้ทุง	41		5	98	20	-
12	Sindora siamensis	ไม้แต้	24		-	100	4	-
13	Diospyros ethretioides	ตีนกวง	5		-	100	40	-
14	Combretum quadrangulare	สะแก	5		-	100	-	-
15	Bambusa	ไผ่	27		-	37	30	56
16	Albizzia lebbek	จามจุรี	8		-	100	-	-
17	Terminalia alata	ไม้เขือก	7		-	100	-	-
18	Schleichera oleosa	ต้นค้อ	23		-	87	13	35
19	Spondias pinnata	มะกอก	18		-	67	23	44
20	Peltophorum dasyrachis	อะลาง	10		-	100	10	-
21	Leucaena leucocephala	กระถิน	6		-	100	-	83
22	Cassia siamea	ขี้เหล็ก	6		-	67	23	100
23	Zizyphus mauritiana	ทุทรา	18		-	56	44	61
24	Adina cordifolia	เขวา	5		-	100	20	-
25	Dipterocarpus obtusifolius	ตะแบง	44		-	100	-	-
26	Psidium guajava	ฝรั่ง	6		-	67	23	67
27	Lepisanthes rubiginosa	หวด	6		-	100	-	-
28	Dalbergia cochinchinensis	พยุง	24		-	92	8	4

ORCHARD - TREES OUTSIDE FAMILY COMPPOUND

PERCENTAGE OF SAMPLE WITH TREES 85% (153 HOUSEHOLDS)

CHANGWAT 8 ROI-ET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
29	Shorea roxburghii	พยอม	40		-	100	3	5
30	Parinari anamense	พอก	6		-	100	-	-
31	Careya sphaerica	กระโดน	5		-	80	20	40
32	Cocos nucifera	มะพร้าว	10		-	50	50	80
33	Shorea obtusa	เต็ง	9		-	100	-	-
34	Dipterocarpus alatus	ยาง	20		-	95	5	5
35	Anisoptera costata	บาก	5		-	100	-	20
36	Psidium guajava	ฝรั่ง	5		-	80	20	60
	Total trees							
	AVE trees per household							

Table A.9

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PAGE 1

PERCENTAGE OF SAMPLE WITH TREES 84% (152 HOUSEHOLDS)

CHANGWAT 9 UDORNTHANI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
1	Artocarpus heterophyllus	ขนุน	12		-	-	-	100
2	Shorea obtusa	ไม้จิก	77		1	88	31	-
3	Shorea siamensis	รัง	66		2	95	30	-
4	Dipterocarpus tuberculatus	ไม้ฤง	39		-	64	59	-
5	Terminalia alata	ไม้เขือก	30		-	83	37	-
6	Schleichera cleoso	ไม้คร้อ	21		-	81	29	14
7	Shorea obtusa	ไม้เต็ง	22		5	95	36	-
8	Pterocarpus macrocarpus	ประดู่	43		2	60	58	-
9	Dipterocarpus tuberculatus	ไม้พลวง	8		13	63	63	13
10	Tamarindus indica	มะขาม	28		4	43	19	68
11	Xylia xylocarpa	ไม้แดง	31		-	71	55	-
12	Mangifera indica	มะม่วง	47		17	34	11	89
13	Musa sapientum	กล้วย	17		41	-	-	100
14	Cassia fistula	แก่นคูณ	5		20	20	40	40
15	Dipterocarpus obtusifolius	ตะแบง	20		5	95	45	-
16	Irvingia malayana	มะหมก	6		-	100	50	17
17	Cratoxylon formosum	ติ้ว	20		-	100	5	-
18	Lagerstroemia	ไปสือก	7		-	71	43	-
19	Cocos nucifera	มะพร้าว	5		20	-	-	80
20		สะทาม	6		-	100	17	-
21	Eugenia cumini	หว้า	9		11	56	11	33
22	Borassus flabellifer	ตาล	14		-	50	14	93
23	Melanorrhoea pilosa	น้ำเกลี้ยงหมู	9		-	56	22	-
24	Samanea saman	ก้ามปู	8		-	50	75	13
25	Lagerstroemia	ตะแบก	5		-	60	80	-
26	Carica papaya	มะละกอ	10		50	-	-	100
27	Sindora siamensis	ไม้แค้	6		-	83	17	-
28	Azadirachta indica	สะเดา	7		14	43	14	57

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 84%(152 HOUSEHOLDS)

CHANGWAT 9 UDORNTHANI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
29	Annona squamosa	น้อยหน่า	6		-	-	-	100
30	Ceiba pentandra	นุ่น	6		33	-	33	67
	Total trees							
	AVE trees per household							

Table A.10

ORCHARD - TREES OUTSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREE 37% (67 HOUSEHOLDS)

CHANGWAT 10 CHIANGMAI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	ENGLISH LATIN/	THAI			% SELL	% FUEL	% OTHER	% CONSUME
1	Cocos nucifera	มะพร้าว	23		65	30	-	100
2	Dimocarpus longan	ลำไย	22		68	68	-	95
3	Musa sapientum	กล้วย	24		83	-	-	96
4	Bambusa	ไผ่	9		33	-	-	100
5	Artocarpus heterophyllus	ขนุน	5		20	40	-	80
	Total trees							
	AVE trees per household							

Table A.11

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 90% (179 HOUSEHOLDS)

CHANGWAT 1 PETCHBURI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
1	Mangifera indica	มะม่วง	72	4.2	100	1	3	-
2	Cocos nucifera	มะพร้าว	143	6.6	100	-	6	-
3	Artocarpus heterophyllus	ขนุน	85	4.8	100	-	4	-
4	Tamarindus indica	มะขาม	53	2.2	100	-	4	-
5	Pithecellobium dulce	มะขามเทศ	12	2.3	75	-	25	-
6	Musa sapientum	กล้วย	13	47.8	100	-	-	-
7	Phyllanthus acidus	มะยม	50	2.7	100	-	-	-
8		ไผ่	5	2.4	100	-	80	100
9	Manilkara achras	ละมุด	21	2.2	100	-	-	-
10	Ceiba pentandra	นุ่น	51	6.1	-	-	2	100
11	Sandoricum koetjape	กระท้อน	16	1.6	100	-	-	-
12	Eugenia	ชมพู่	27	.6	100	-	-	-
13	Feronia limonia	มะขวิด	9	2.3	100	-	22	-
14	Psidium guajava	ฝรั่ง	27	1.7	100	-	-	-
15	Zizyphus mauritiana	ทุทราา	8	.9	100	-	-	-
16	Citrus hystrix	มะกรูด	9	1.4	100	-	-	-
17	Borassus flabellifer	ตาล	18	1.6	100	-	1	-
18	Moringa oleifera	มะรุม	18	2.4	100	-	-	-
19	Artocarpus altilis	สาเก	7	1.3	100	-	29	14
20	Sesbania grandiflora	แค	5	2.0	100	-	-	-
21	Dimocarpus longan	ลำไย	4	1.5	100	-	-	-
22	Citrus aurantifolia	มะนาว	4	9.3	100	-	-	-
23	Annona squamosa	น้อยหน่า	10	3.5	100	-	-	-
24	Averrhoa carambola	มะเฟือง	5	1.0	100	-	-	-
25	Leucaena leucocephala	กระถิน	5	2.6	100	-	-	-
26	Carica papaya	มะละกอ	15	2.2	100	-	-	-
27	Punica granatum	ทับทิม	6	2.5	100	-	-	-
Total trees 3290								

Ave trees par household 16.7

Table A.12

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 90% (179 HOUSEHOLD)

CHANGWAT 2 KORAT

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
1	Tamarindus indica	มะขาม	40	2.6	100	-	50	-
2	Mangifera indica	มะม่วง	84	5.2	100	-	21	-
3	Artocarpus heterophyllus	ขนุน	26	3.1	100	-	-	-
4	Cocos nucifera	มะพร้าว	107	6.4	100	-	35	-
5	Sandoricum koetjape	กระท้อน	4	1.3	100	-	25	-
6	Ceiba pentandra	งิ้ว (นุ่น)	69	14.1	-	-	9	100
7	Musa sapientum	กล้วย	74	19.3	100	3	-	-
8	Pithecellobium dulce	มะขามเทศ	4	1.5	100	-	-	-
9	Bouea burmanica	มะปราง	16	4.1	100	-	38	-
10	Manilkara achras	ละมุด	46	8.0	100	-	17	-
11	Bambusa	ไผ่	29	1.4	100	-	48	52
12	Cassia siamea	ขี้เหล็ก	6	2.3	100	-	50	-
13	Aegle marmelos	มะตูม	4	1.8	100	-	-	-
14	Psidium guajava	ฝรั่ง	26	2.7	100	-	4	-
15	Carica papaya	มะละกอ	50	4.2	100	6	2	14
16	Streblus asper	ข่อย	6	1.3	-	-	67	33
17	Leucaena leucocephala	กระถิน	11	2.6	100	-	9	-
18	Diospyros decandra	จัน	9	1.6	67	-	33	-
19	Sesbania grandiflora	แค	4	3.5	100	-	-	-
20	Annona squamosa	น้อยหน่า	14	6.1	100	-	-	-
21	Zizyphus mauritiana	ทุทราา	3	1.7	100	-	-	-
22	Citrus aurantifolia	มะนาว	7	3.9	100	-	14	-
23	Areca catechu	หมาก	4	10.0	100	-	-	-
24	Citrus maxima	ส้มโอ	4	1.8	100	-	-	-
25	Baccaurea ramiflora	มะไฟ	4	4.3	100	-	50	-
	Total trees 4740							
	Ave trees per household 26.5							

Table A.13

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 89% (178 HOUSEHOLDS)

CHANGWAT 3 SRISAKET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Sesbania grandiflora	แค	11	1.4	100	-	64	-	-
2	Areca catechu	หมาก	28	7.2	46	-	7	-	18
3		ไผ่	35	8.0	51	-	-	6	20
4	Cocos nucifera	มะพร้าว	131	5.1	100	-	43	4	11
5	Mangifera indica	มะม่วง	81	4.2	79	-	26	-	-
6	Ceiba . pentandra	นุ่น	87	6.0	11	-	29	32	48
7	Zizyphus mauritiana	ทุทราา	17	1.6	65	-	64	-	-
8	Psidicum guajava	ฝรั่ง	47	2.4	74	-	38	-	-
9	Cassia siamea	ขี้เหล็ก	17	2.0	82	-	53	-	-
10	Artocarpus heterophyllus	ขนุน	39	3.2	92	-	51	3	-
11	Albizzia lebbek	จามจุรี	3	1.7	-	-	100	-	33
12	Morus alba	หม่อน	4	2.0	-	-	-	-	100
13	Annona squamosa	น้อยหน่า	20	3.4	90	-	45	5	-
14	Saccharum officinarum	อ้อย	3	80.0	67	-	-	-	-
15	Phyllanthus acidus	มะยม	9	1.3	100	-	44	-	-
16	Dimocarpus longan	ลำไย	5	1.8	100	-	80	-	-
17	Leucaena leucocephala	กระถิน	16	1.8	100	-	56	6	-
18	Citrus aurantifolia	มะนาว	6	2.3	100	-	50	33	-
19	Tamarindus indica	มะขาม	10	1.5	90	-	60	10	-
20	Aegle marmelos	มะตูม	4	1.3	100	-	50	-	-
21	Borassus flabellifer	ตาล	5	1.8	60	-	-	-	20
22	Tectona grandis	สัก	3	2.7	-	-	33	-	66
23	Averrhoa carambola	มะเฟือง	8	1.6	100	-	38	13	-
24	Erythrophleum succirubrum	ศรีมหาพต	1	11.0	-	-	100	-	100
25	Morinda coreia	ยอป่า	5	1.4	80	-	60	-	-
26	Punica granatum	ทับทิม	3	3.5	100	-	67	33	-
27	Lagerstroemia	ตะแบก	4	1.3	-	-	50	-	50
28	Pithecellobium dulce	มะขามเทศ	1	7.0	100	-	-	-	-

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 89% (178 HOUSEHOLDS)

CHANGWAT 3 SRISAKET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
29	Carica papaya	มะละกอ	5	2.8	100	-	20	20	-
30	Musa sapientum	กล้วย	13	32.0	100	-	-	23	8
31		ยาสูบ	2	195.0	50	-	-	-	50
32	Dipterocarpus intricatus	ชาด	1	5.0	-	-	100	-	100
33	Anacardium occidentale	มะม่วงหิมพานต์	15	5.5	53	-	53	-	-
34		แขว	1	10.0	100	-	-	-	-
35	Eugenia cumini	หว้า	6	2.0	-	-	83	-	17
	Total trees 3730								
	AVE trees per household 20.4								

Table A.14

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 87% (.74 HOUSEHOLLS)

CHANGWAT 4 KAMPAENGPETCH

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
1	Phyllanthus acidus	มะยม	18	2.1	100	-	-	-
2	Mangifera indica	มะม่วง	95	8.0	100	-	2.1	-
3	Cocos nucifera	มะพร้าว	95	8.4	99	-	3.2	-
4	Musa sapientum	กล้วย	56	35.3	100	-	-	-
5	Cocos nucifera	ขนุน	76	4.6	100	-	3	-
6	Cassia siamea	ขี้เหล็ก	2	2.5	100	-	50	50
7	Psidium guajava	ฝรั่ง	40	4.2	100	-	-	-
8	Zizyphus mauritiana	พุทรา	15	1.3	100	-	7	-
9	Citrus aurantium	ส้ม	9	2.4	100	-	-	-
10	Ceiba pentandra	นุ่น	31	7.6	-	-	-	100
11	Carica papaya	มะละกอ	13	2.7	100	8	-	-
12	Borassus flabellifer	ตาล	4	1.5	100	-	-	-
13	Tamarindus indica	มะขาม	27	2.0	100	-	7	-
14	Averrhoa carambola	มะเฟือง	6	1.2	100	-	-	-
15	Bambusa	ไผ่	15	1.6	47	-	100	100
16	Eugenia	ชมพู่	16	2.3	100	-	-	-
17	Citrus aurantifolia	มะนาว	12	2.3	100	-	-	-
18	Dimocarpus longan	ลำไย	5	1.2	100	-	-	-
19	Manilkara achras	ละมุด	4	5.6	100	-	-	-
20	Sesbania grandiflora	แค	5	2.0	100	-	-	-
21	Baccaura ramiflora	มะไฟ	4	1.3	100	-	-	-
22	Punica granatum	ทับทิม	2	3.5	100	-	-	-
23	citrus hystrix	มะกรูด	3	1.7	100	-	-	-
24	Leucaena leucocephala	กระถิน	1	7.0	100	-	-	-
25	Artocarpus lakoocha	มะหาด	1	9.0	100	-	-	-
26	Pithecellobium dulce	มะขามเทศ	5	2.2	100	-	-	-
27	Acacia concinna	ชะอม	1	5.0	100	-	-	-
28	Lepisanthes rubiginosa	มะหวด	1	5.0	100	-	-	-
29	Bouea burmanica	มะปราง	4	5.3	100	-	-	-

TREES IN FAMILY COMPOUND (2)

PERCENTAGE OF SAMPLE WITH TREES 87% (174 HOUSEHOLDS)

CHANGWAT 4 KAMPANGPHET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
	Total trees 4650							
	AVE trees per household 26.8							
30	Annona squamosa	น้อยหน่า	33	3.5	100	-	-	-
31	Sandoricum koetjape	กระท้อน	7	1.4	100	-	14	14

Table A.15

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 92% (184 HOUSEHOLDS)

CHANGWAT 5 LAMPANG

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
1	Tamarindus indica	มะขาม	30	2.7	97	-	83	-
2	Mangifera indica	มะม่วง	94	3.1	100	-	14	-
3	Dimocarpus longan	ลำไย	71	2.8	100	-	28	-
4	Musa Sapientum	กล้วย	24	13.0	100	46	-	-
5	Ceiba pentandra	งิ้ว	16	3.0	-	-	19	100
6	Artocarpus heterophyllus	ขนุน	60	2.3	100	-	18	3
7	Averrhoa carambola	มะเฟือง	6	1.0	100	-	-	-
8	Cocos nucifera	มะพร้าว	72	3.1	100	-	11	1
9	Bauhinia malabarica	ผักเสี้ยว	8	1.6	100	-	-	-
10	Boueá burmanica	มะปราง	27	2.4	100	-	15	-
11	Citrus maxima	ส้มโอ	2	2.5	100	-	-	-
12	Manilkara achras	ละมุด	32	3.2	100	-	28	-
13	Leucaena leucocephala	กระถิน	4	1.8	100	-	25	-
14	Psidium guajava	ฝรั่ง	15	1.4	100	-	33	-
15	Annona squamosa	น้อยหน่า	27	2.0	100	-	7	-
16	Samanea saman	ฉำฉา	22	3.0	-	-	77	95
17	Carica papaya	มะละกอ	34	2.6	100	18	-	-
18	Pyrus malus	แอปเปิ้ล	6	1.0	100	-	33	-
19	Citrus mazima	ส้มโอ	31	2.4	100	-	3	-
20	Moringa oleifera	มะรุม	3	2.3	100	-	-	-
21		ไผ่	11	3.2	27	-	91	91
22	Citrus aurantium	ส้ม	4	2.0	100	-	-	-
23	Borassus flabellifer	ตาล	4	2.0	100	-	25	-
24	Spondias pinnata	มะกอก	5	1.2	100	-	-	-
25	Citrus aurantifolia	มะนาว	8	2.1	100	-	-	-
26	Areca catechu	หมาก	6	2.3	100	-	-	-
27	Sandoricum koetjape	กระท้อน	10	2.0	100	-	40	-
28	Acacia concinna	ชะอม	25	4.8	100	-	-	-

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 92% (184 HOUSEHOLDS)

CHANGWAT 5 LAMPANG

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR			
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% OTHER
29	Citrus hystrix	มะกรูด	13	2.0	100	-	8	-
30	Eugenia	ชมพู่	5	1.2	100	-	20	-
	Total trees 2580							
	AVE trees per household 14.1							

Table A.16

TREE IN FAMILY COMPOUND

PAGE 1

PERCENTAGE OF SAMPLE WITH TREES 87% (157 HOUSEHOLDS)

CHANGWAT 6 SONGKLA

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Manilkara achras	สะมุด	8	5.4	100	-	13	-	-
2	Cocos nucifera	มะพร้าว	105	6.5	77	2	5	-	-
3	Durio zibethinus	ทุเรียน	25	3.7	88	-	4	-	8
4	Bambusa	ไผ่	8	2.6	50	-	-	-	50
5	Bouea oppositifolia	มะปริง	6	1.7	83	-	-	-	17
6	Mangifera indica	มะม่วง	29	2.8	90	-	7	-	3
7	Musa sapientum	กล้วย	53	15.2	94	8	-	-	-
8	Phyllanthus acidus	มะยม	26	1.3	96	-	-	-	4
9	Carica papaya	มะละกอ	24	5.9	100	13	-	-	-
10	Areca catechu	หมาก	16	9.1	81	-	-	-	19
11	Tamarindus indica	มะขาม	56	1.7	71	-	7	-	22
12	Parkia speciosa	ไม้สะตอ	6	1.2	67	-	1	-	32
13	Borassus flabellifer	ตาล	16	2.4	75	-	13	-	12
14	Averrhoa carambola	มะเฟือง	6	1.3	100	-	17	-	-
15	Eugenia	ชมพู่	16	2.1	100	-	6	-	-
16	Psidium guajava	ฝรั่ง	22	2.4	95	-	5	-	-
17	Citrus aurantifolia	มะนาว	20	2.0	90	-	-	-	10
18	Pyrus malus	แอปปิ้ล	6	1.2	83	-	-	-	17
19	Nephelium lappaceum	เงาะ	7	6.0	43	-	-	-	57
20	Livistona saribus	เหรง	3	13.7	-	-	-	-	100
21	Citrus aurantium	ส้ม	24	7.4	100	-	-	-	-
22	Sandoricum koetjape	กระท้อน	22	1.9	100	-	5	-	-
23	Aglaia domestica	ลางสาด	6	5.2	67	-	17	-	16
24	Baccaurea ramiflora	มะไฟ	3	1.7	100	-	33	-	-
25	Bouea burmanica	มะปราง	5	1.8	100	-	20	-	-
26	Dipterocapus alatus	ยางพารา	8	14.4	-	-	13	38	49
27	Leucaena leucocephala	กระถิน	5	2.0	100	-	-	-	-
28	Artocarpus heterophyllus	ขนุน	49	3.2	92	2	4	-	-

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 87% (157 HOUSEHOLDS)

CHANGWAT 6 SONGKLA

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
29	Hopea ferrea	เหฉา	1	7.0	-	-	-	-	100
30	Ceiba pentandra	นุ่น	6	2.8	17	-	-	-	83
31	Anacardium occidentale	มะม่วงหิมพานต์	22	5.0	82	-	5	-	13
32	Citrus maxima	ส้มโอ	15	3.9	87	-	-	-	13
33	Punica granatum	ทับทิม	4	2.8	75	-	-	-	25
34	Annona squamosa	น้อยหน่า	7	6.3	100	-	-	-	-
35	Archidendro jiringa	เนียง	5	2.0	100	-	-	-	-
36	Sesbaria grandiflora	แค	1	5.0	100	-	-	-	-
	Total trees 3230								
	AVE tree per household 20.6								

Table A.17

TREES INSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLES OF TREES 78% (141 HOUSEHOLDS)

CHANGWAT 7 CHANTABURI (1)

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Nephelium lappaceum	มะละกอ	48	3.1	83	-	2	-	2
2	Salacca rumphii	ระกำ	4	10	100	-	-	-	-
3	Annona squamosa	น้อยหน่า	25	5.2	84	-	12	-	-
4	Manilkara achras	ละมุด	7	3.5	85	-	-	-	-
5	Ananas comosus	สัปปะรด	11	43	100	-	-	-	-
6	Moringa oleifera	มะรุม	7	2.6	85	-	-	-	14
7	Piper betel	พลู	17	6.8	76	-	-	-	-
8	Ipomoea aquatica	ผักบุ้ง	1	50	100	-	-	-	-
9	Sandoricum koetjape	กระท้อน	13	1.5	84	-	15	-	-
10	Bouea burmanica	มะปราง	3	2.7	66	-	33	-	-
11	Erythrina fusca	ทองหลาง	2	5.5	50	-	-	-	-
12	Areca catachu	หมาก	19	6.6	100	-	-	-	-
13		ไผ่	12	12.8	50	-	-	-	50
14	Ceiba pentandra	นุ่น	7	1.1	28	-	14	-	71
15	Annona squamosa	มะพร้าว	83	19.3	89	-	14	-	3
16	Zizyphus mauritiana	ทุทราา	22	3	90	-	13	-	9
17	Saccharum officinalum	อ้อย	7	30.4	85	-	-	-	-
18	Capsicum frutescens	พริก	2	6	100	-	-	-	-
19	Cymbopogon citratus	ตะไคร้	2	16.5	100	-	-	-	-
20	Musa sapientum	กล้วย	58	29.3	81	15	-	-	-
21	Tamarindus indica	มะขาม	31	1.6	80	-	3	-	9
22	Psidium guajava	ฝรั่ง	27	2.1	96	-	11	-	-
23	Bouea oppositifolia	มะปริง	6	1.5	66	-	50	-	-
24	Mangifera indica	มะม่วง	85	5	80	-	17	-	4
25	Eugenia	ชมพู่	5	2	80	-	20	-	-
26	Artocarpus heterophyllus	ขนุน	33	4.4	78	-	15	-	3
27	Phyllanthus acidus	มะยม	32	2.3	81	-	15	-	-
28	Aglaia domestica	ลางสาด	4	9.8	100	-	-	-	-

TREES INSIDE FAMILY COMPOUND

PERCENTAGE OF SAMPLES AT TREES 78% (141 HOUSEHOLDS)

CHANTABURI

(2)

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
29	Citrus maxima	ส้มโอ	20	5.2	75	-	10	10	-
30	Durio zibethinus	ทุเรียน	20	12.6	75	-	-	15	-
31	Garcinia mangostana	มังคุด	3	1.7	66	-	33	-	-
32	Sesbania grandiflora	แค	4	1.5	75	-	25	25	-
33	Cassia siamea	ขี้เหล็ก	2	2.5	50	-	100	-	-
34	Morinda citrifolia	ยอ	7	1	85	-	14	14	-
35	Anacardium occidentale	มะม่วงหิมพานต์	9	5.8	88	-	33	11	-
36	Nephelium lappaceum	เงาะ	10	11.6	100	-	10	40	-
37	Pyrus malus	แอบเปิ้ล	3	1.7	66	-	-	33	-
38	para rubber tree	ยางพารา	5	34.4	40	-	-	60	-
39	Leucaena leucocephala	กระถิน	2	11	100	-	50	-	-
40	Acacia [illegible]	ชะอม	2	13	100	-	-	-	-
41	Spondias pinnata	มะกอก	2	3.5	50	-	50	-	-
42	Delonix regia	หางนกยูง	1	5	-	-	-	-	100
43	Manihot esculenta	มัน	1	100	100	-	-	-	-
	Total trees 6640								
	AVE trees per household 49.1								

Table A.18

TREES IN FAMILY COMPOUND

PAGE 1

PERCENTAGE OF SAMPLE WITH TREES 83% (151 HOUSEHOLDS)

CHANGWAT 8 ROI-ET

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Phyllanthus acidus	มะยม	44	1.6	70	-	19	-	11
2	Flacourtia indica	ตะขบ	3	1.3	100	-	-	-	-
3	Mangifera indica	มะม่วง	83	3.7	77	-	34	4	2
4	Punica granatum	ทับทิม	13	1.8	100	-	5	-	-
5	Cocos nucifera	มะพร้าว	41	2.6	87	-	20	6	-
6	Annona squamosa	น้อยหน่า	40	3.1	98	-	15	-	-
7	Carica papaya	มะละกอ	20	3.4	95	-	-	5	-
8	Musa sapientum	กล้วย	27	32.9	100	-	-	7	-
9	Leucaena leucocephala	กระถิน	40	2.1	100	5	30	-	3
10	Ceiba pentandra	นุ่น	37	3.7	-	-	21	-	65
11	Psidium guajava	ฝรั่ง	43	2.0	97	-	33	-	-
12	Cassia siamea	ขี้เหล็ก	23	2.0	100	-	26	-	-
13	Pithecellobium dulce	มะขามเทศ	29	1.4	93	-	48	-	-
14	Averrhoa carambola	มะเฟือง	13	1.4	85	-	23	-	-
15	Tamarindus indica	มะขาม	30	1.5	93	-	33	-	3
16	Areca catechu	หมาก	11	2.5	91	-	9	-	-
17	Diospyros mollis	มะเกลือ	4	1.3	-	-	50	-	50
18	Artocarpus heterophyllus	ขนุน	11	1.3	91	-	18	-	-
19	Diospyros decandra	จัน	6	1.2	83	-	-	-	17
20	Sesbania grandiflora	แค	21	1.3	86	-	24	-	5
21	Citrus aurantifolia	มะนาว	19	1.5	89	-	16	-	-
22	Bambusa	ไผ่	21	34.3	38	-	19	10	48
23	Dalbergia cochinchinensis	พยุง	2	2.0	-	-	100	-	-
24	Flacourtia indica	ตะขบ	5	1.0	100	-	100	-	-
25	Annona squamosa	น้อยหน่า	23	7.1	100	-	21	-	-
26	Gossypium barbadense	ฝ้าย	2	6.5	50	-	-	-	50
27	Orocylum indicum	ต้นพ้อ	4	1.8	75	-	25	-	-
	Total trees 3810								

AVE trees per household 25.2

Table A.19

TREES IN FAMILY COMPOUND

PAGE 1

PERCENTAGE OF SAMPLE WITH TREES 91% (164 HOUSEHOLDS)

CHANGWAT 9 UDORNTHANI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Cocos nucifera	มะพร้าว	93	3.7	94	-	16	3	3
2	Artocarpus heterophyllus	ขนุน	22	1.9	77	-	9	5	-
3		ไผ่	28	15.8	68	-	11	7	43
4	Mangifera indica	มะม่วง	40	3.4	87	-	15	3	13
5	Averrho carambola	มะเฟือง	11	1.3	64	-	18	-	-
6	Azadirachta indica var siamensis	สะเดา	5	1.4	100	-	20	-	-
7	Dimocarpus longan	ลำไย	8	1.3	75	-	13	-	13
8	Ceiba pentandra	นุ่น	36	2.6	6	-	25	-	97
9	Annona squamosa	น้อยหน่า	33	4.3	85	-	-	2	13
10	Psidium guajava	ฝรั่ง	18	2.8	61	-	-	-	-
11	Citrus aurantifolia	มะนาว	12	4.0	83	-	-	17	17
12	Carica papaya	มะละกอ	32	4.2	91	-	-	3	3
13	Musa sapientum	กล้วย	29	20.8	93	4	6	6	10
14	Sesbania grandiflora	แค	8	2.3	100	-	-	-	-
15	Cassia siamea	ขี้เหล็ก	4	1.8	100	-	25	-	-
16	Tamarindus indica	มะขาม	36	1.9	88	-	19	6	3
17	Neptunia oleracea	กะเฉด	2	2.5	100	-	-	-	-
18	Cassia fistula	คูณ	1	5.0	-	-	-	-	100
19	Leucaena leucocephala	กระถิน	17	2.8	88	-	6	-	-
20	Cajanus cajans	ถั่วแย	1	5.0	100	-	-	-	-
21	Phyllanthus acidus	มะยม	9	1.1	89	-	-	-	11
22	Borassus flabellifer	ตาล	8	4.2	88	-	25	13	25
23	Zizyphus mauritiana	พุทรา	10	1.3	100	-	-	-	10
24	Punica granatum	ทับทิม	3	1.7	100	-	-	-	-
25	Baccaurea ramiflora	มะไฟ	2	3.0	100	-	100	-	50
	Total trees	3290							
	AVE trees per household		20.1						

Table A.20

TREES IN FAMILY COMPOUND

PERCENTAGE OF SAMPLE WITH TREES 91% (163 HOUSEHOLDS)

CHANGWAT 10 CHIANGMAI

NO.	SPECIES		NO. OF HOUSEHOLD	AVE TREES PER HOUSEHOLD	USES FOR				
	LATIN/ ENGLISH	THAI			% FOOD	% FODDER	% FUEL	% SELL	% OTHER
1	Mangifera indica	มะม่วง	57	3.7	99	-	42	9	-
2	Dimocarpus longan	ลำไย	47	3.4	99	-	62	23	-
3	Manilkara achras	ละมุด	9	1.8	100	-	22	-	-
4	Musa sapientum	กล้วย	25	17.7	92	16	-	28	-
5	Carica papaya	มะละกอ	15	3.6	100	-	-	-	-
6		ไม้ไผ่	9	2.6	44	-	-	22	-
7	Eugenia	ชมพู่	9	1.2	100	-	-	-	-
8	Litchi chinensis	ลิ้นจี่	11	2.2	82	-	36	9	-
9	Citrus maxima	ส้มโอ	11	1.5	100	-	36	-	-
10	Pyrus malus	แอบเปิ้ล	4	1.3	100	-	-	-	-
11	Areca catechu	หมาก	8	5.4	88	-	-	13	-
12	Citrus aurantifolia	มะนาว	4	2.8	100	-	-	-	-
13	Ficus lacor	บักเดื่อค	5	1.8	100	-	60	20	-
14	Tamarindus indica	มะขาม	19	1.7	95	-	53	16	-
15	Bouea burmanica	มะปราง	16	1.6	94	-	25	6	-
16	Castanopsis	ก่อ	1	5.0	-	-	-	-	100
17	Annona squamosa	น้อยหน่า	2	2.5	100	-	50	-	-
18	Cocos nucifera	มะพร้าว	30	2.9	97	-	3	10	-
	Total trees 1510								
	AVE trees per household 9.2								

Table A.21

SPECIES OF TREES IN PADI FIELDS OF SRISAKET

NO.	SPECIES	VILLAGE1 KOA	VILLAGE2 KOK	VILLAGE3 PRAN	VILLAGE4 MAIKAND SANGKAN	VILLAGE5 PONG	TOTAL	% SPECIES
1	กลาง	60	13	-	13	8	94	1.0
2	กะบก	180	427	344	80	157	1188	13.1
3	แค	37	241	65		163	506	5.[illegible]
4	หว้า	98	301	123	31	116	669	7.4
5	ชนวน	42	22	9			73	.8
6	ตะโก	7	139	22		3	171	1.9
7	ประดู่	28	346	147	18	84	623	6.9
8	แดง	1	67			49	117	1.3
9	สะแบง	59	626	164	320	90	1259	13.9
10	สะเดา	39	265	216	22	59	601	6.6
11	สะแก	33	140	87	50	94	404	4.5
12	มะม่วง	26	52	35		24	137	1.5
13	มะขาม	33	42	82		20	177	2
14	พันชาด		269			3	272	3
15	พยอม	57	148	75		54	334	3.7
16	ยอ	50	68	153			271	3.0
17	คราด		133		3		136	1.5
18	ช้อย	65	98	64	10		237	2.6
19	คิ้ว		50	6			56	.6
20	เค็ง	9	16	51			76	.8
21	หัวลิง	42					42	.5
22	ตะแบก	3		14	21	28	66	.7
23	กระโดน				5	53	58	.6
24	ปลิง				47		47	.5
25	เคิมกวง					56	56	.6

NO.	SPECIES	VILLAGE1 KOA	VILLAGE2 KOK	VILLAGE3 PRAN	VILLAGE4 MAIKAND SANGKAN	VILLAGE5 PONG	TOTAL	% SPECIES
26	หอก	11		118	115	199	443	1.9
27	[illegible]					69	69	.8
28	สรีอีง			161			161	1.8
29	เคิมกับเจิง			78			78	.8
30	กันตรี			82			82	.9
31	OTHER	96	104	131	101	103	544	6.0
	TOTAL	976	3,567	2,227	836	1,432	9,038	100

List of Species Table A-21.

1. Peltophorum dasyrachis
2. Irvingia malayana
3. Sindora siamensis
4. Eugenia cumini
5. Dalbergia nigrescens
6. Diospyros rhodocalyx
7. Pterocarpus macrocarpus
8. Xylia xylocarpa
9. Dipterocarpus obtusifolius
10. Azadirachta siamensis
11. Combretum quadrangulare
12. Mangifera indica
13. Tamarindus indica
14. Erythophloem succirubrum
15. Shorea roxbuxburghii
16. Morinda citrifolia
17. Dipterocarpus intricatus
18. Streblus asper
19. Cratoxylon formosum
20. Dialium cochinchinense
21. Hydnocarpus ilicifolius
22. Lagerstroemia
23. Careya sphaerica
24. Macaranga lowii
26. Parinari anamense
27. Dalbergia cochinchinensis
29. Lagerstroemia speciosa
30. Phyllanthus emblica
31. Other

25.,28. Unknown

A.4 Forest Recommendations for Woodlots

IV.1 A Woodlot in Songkla

Pachiang Village

1. What are the local species?

   Grewia paniculata.
   Vitex pinnata.
   Atalantia monophylla.

2. What land could be used for woodlots.

   Salt water marsh and Samed forest.

3. What are the types of soil and topology?

   This area is flat with sandy clay and salty soil.

4. What is the seed source?

   Do not have sources of seed in the village because the forest was already destroyed, villagers have to go to Chaajna Village for seeds.

5. How would the young trees be protected?

   Should build fences, post a guard to take cover and clear weeds; dig pools for moisture.

6. What additional uses should be made of the woodlot?

   Grow cash crops such as cashew nut trees, which endure in bad conditions, and some agricultural plants (ground bean, cucumber groups).

7. Would this fuel be converted to charcoal and if so should this be done in the woodlot or at the villages?

   Should be converted in the woodlot area.

Tung Pra Village

1. Grewia paniculata.
   Vitex pinnata.
   Atalantia monophylla.

2. Should cultivate at the head of the field.

3. This area is flat with clay soils.

4. At Chaajna Village.

Tung Pra Village, continued

5. The same as Pachiang village's protection.

6. No.

7. The same as Pachiang village.

Paa Pluu Village

1. Grewia paniculata.
   Vitex pinnata.
   Atalantia monophylla.

2. Samed forest.

3. Flat area, sandy soil.

4. Chaajna Village has seeds.

5. The same protection.

6. Should cultivate cashew nut trees?

7. The same as Pachiang Village.

TairKhyng Village

1. Grewia paniculata.
   Vitex pinnata.
   Atalantia monophylla.

2. Samed and burned forest.

3. Sandy clay soil, flat plain.

4. Chaajna village as a seed source.

5. The same protection as other villages.

6. Cultivated cashew nut trees.

7. The same as Pachiang village.

Chaajna Village

1. Grewia paniculata.
   Vitex pinnata.
   Atalantia monophylla.

Chaajna Village, continued

2. No response.

3. Crumbly soil, flat plain.

4. In the deep forest around the mountain.

5. The same protection as other villages.

6. Bean groups and cucumber groups.

7. In the woodlot area.

Notes: Samed forest should include other trees that can be converted to good charcoal.

The soil characteristics are not clear because we did not take a sample, but most of the soil is sandy, (near the sea).

IV.2 A Woodlot in Chantaburi

Area 7

The Proposed Woodlot in Amphoe Tamai, Changwat Chantaburi

The survey data indicates that in Tambon Graja, Sanamchai, they do not need woodlots because:

1) They do not have problems with wood supply, because the main occupation of the villagers is growing Hevea brasiliensis and they use old trees and other trees for fuelwood in cooking. There are many Hevea brasiliensis trees in this area and they have relatively short rotation periods, so the firewood supply should not run out.

2) Almost all of the area is used for cultivation, and there is little public land or other space for woodlots. Since the people have an adequate firewood supply, they would probably not cooperate with the woodlot program.

Suggestion

There are many Melaleuca leucadendra, Rhizophora mucronata, Avicennia alba forests in Tambon Graja and Tambon Sanamchai. Most of them are public forests where people cut their firewood. Wood consumption in these forests will eventually reduce them to degenerated forests because of the over-cutting. There is a need to grow trees for replacement, otherwise the forests will soon be destroyed. The wood from these forests provides good fuel. They need a short rotation. It is important to do something to replace and maintain firewood in these forests as a viable source of firewood.

In areas other than the Para Rubber forest, we should use methods as follows:

1. grow Melaleuca leucadendra, Rhizophora mucronata in the same forest;
2. use local seeds from the same place and maintain small trees;
3. protect small trees from animals, especially the crabs which like to eat young seedings; and
4. the benefits from these forests are that the wood is good for fuelwood and for charcoal, but it is necessary to improve the charcoal kilns and the charcoal-making technology.

IV.3 A Woodlot in Roi-et

Area 8

A Proposed woodlot in the Roi-et Survey Areas

1) Local seed should not be grown because the old forests of Shorea obtusa and Shorea siamensis were completely destroyed.

The species of trees that grow in dry dipterocarp are Shorea obtusa, Dipterocarpus tuberculatus, Dipterocarpus obtusifolius, Xylia xylocarpa, Irvingia malayana and Taklaw (Schleichera oleosa). They grow so slowly that even if the proposed woodlot starts from small trees, it will take a long time to grow trees to the size needed. The program would fail because it is difficult to find the seeds, and there is a low percentage of survival.

The plants which are appropriate to grow in this area are plants which are easy to maintain and take three to four years to grow to firewood or charcoal size. Gratinnarong (Genus Leucaena) should be grown in the survey area, because it is easy to care for and grows fast; also it can endure dry weather and bad soil conditions.

2) From the survey it was learned that the area for woodlots should be in the public land, 496 Rai of which is located near the boundary of three villages, (Pahan, Paver, Kluaj) in Tambon Suancig, Changwat, Roi-et. A woodlot in this area would benefit all these villages.

3) The soil type in this public land is sandy loam and fine sand. The soil depth is good; the water depth is three meters. This area is upland and clear. It has a slope of three to eight percent.

4) Acacia auriculiformis seeds are usually available from the Department of Forestry's agencies, such as Khon Kaen Provincial Forest Office and Seedling Center.

5) After growing, it is necessary to protect the young trees from the following:

   a) Some of the villagers will attempt to destroy the small plants because they are used to cultivating the public land and would not like the woodlot in public land. It is important they they understand and cooperate with the woodlot program;

   b) Protection from animals: There are many cattle and buffalos in the area; fences will be required around the woodlot;

   c) Observation of the area indicates that there would be few problem with weeds. Most of the area is clear. There is some grass and weeds, but these should not be an obstacle; and

   d) There is a problem with dry weather. The woodlot program should start to grow small plants in the rainy season on the available water. This may not be a major problem, since Acacia auriculiformis can endure dry weather.

IV.3 A Woodlot in Roi-et (continued)

A Proposed woodlot in the Roi-et Survey Areas

6) It might be advisable to grow other plants in the woodlot between the trees in the first two-year period. The intercropped plants might include ground bean, corn and sesame.

7) The villagers could make charcoal in the village or woodlot area, but they should be consulted about the place to make charcoal and the way to maximize the benefit that they will receive.

IV.4 A Woodlots in Udorn Thani

Area 9

Where Will We Grow Firewood Lots in Each Village's Area in Changwat Udorn Thani?

Ban Men, Ban Khaw, Amphoe Myang

1) Kind of woods; there are few local species of woods that can be used for firewood. Most of the woods in Ban Men are Shorea obtusa, Shorea siamensis and Dipterocarpus alatus. The trees that can be used for firewood are Cratoxylon formosum and Cratoxylon cochinchinensis. They grow quickly and can endure dry weather.

2) The growing area should be in deteriorated areas or in the space around the villages (30 Rais).

3) The type of soils is this area are sandy loam and sandy clay. The topography is a plain about 600-800 meters above sea level.

4) Seeds for planting can be found in the forest in seeding season.

5) Protection of small trees can be accomplished by:

   - Hiring local people or officers to protect the trees;
   - Providing fences around the woodlot;
   - Clearing the weeds from around the trees; and
   - Providing summer water from wells or other sources.

6) Other plants that could be grown in the woodlot areas are agriculture plants grown between the trees. The agricultural produce should be bean groups, sugarcane or pineapple. Charcoal can be made in the woodlot area but it is necessary to be careful about forest fires. We suggest making charcoal in the woodlot area because the distance between the woodlot and the village is not far.

Ban Nong, Bua Dang, Tambon Nong Han, Changwat Udorn Thani

1) Some of the trees in the existing stock can be grown in the woodlot such as Cratoxylon formosum, Strychnos nux-vomica. Because their growing period is less than other trees, they can be cut for firewood in four years. Acacia auriculiformis and Eucalyptus could be grown to replace Cratoxylon formosum and Cratoxylon cochinichinensis which do not grow well in this weather and environment.

2) Most of the areas for woodlots are cemeteries and the perimeters of fields. This village does not have public lands.

Where Will We Grow Firewood Lots in Each Village's Area in Changwat Udorn Thani?

Ban Nong Bua Dang, Tambon Nong Han, Changwat Udorn Thani continued

3) The types of soil in the village are sandy soil and sandy clay. This type of soil is not good for some economic plants. The topography is level, and the area includes a big lake, Nong Bua Dang, which has water throughout the year. This area is about 400-700 meters above sea level.

4) Seeds for growing trees should be gathered from the forest, from Udorn Thani Provincial Forest Office and Seedlings Center or from the Nong Bua Dang forest nursery.

5) Protection of the young trees could be accomplished by:

   - Hiring some more people or officers to prevent early cutting;
   - Placing fences around the woodlot;
   - Clearing weeds from around the woodlot (spacing two-by-two meters); and
   - Using a well or irrigation to provide water to the field.

6) Intercropping can be done with agricultural plants such as sugarcane, banana or coconut palm.

7) Charcoal should be made outside the village near the woodlot in order to protect the supply and reduce transport costs.

Ban Kha Wua, Tambon Pung Ngu, Amphoe Nong Han

1) There are a few local species that can be used for firewood. Other plants need to be grown in this area such as Acacia auriculiformis and Eucalyptus.

2) Trees can be grown in the cemetery, on the perimeters of the fields and in unused fields (7 Rai).

3) The type of soil is sandy clay and loamy sand. Most of the villagers grow rice and cassava. The area is about 400-600 meters above sea level.

4) The seeds or young plants, such as Gratinnarong and Eucalyptus, can be obtained from government agencies or the Seedlings Center in Udorn Thani.

Where Will We Grow Firewood Lots in Each Village's Area in Changwat Udorn Thani?

Ban Kha Wua, Tambon Pung Ngu, Amphoe Nong Han, continued

5) Protection of small trees can be accomplished by:

   - o Hiring some villagers to protect the young trees;
   - o Providing fences;
   - o Clearing weeds from around the trees (Radius one-two meters); and
   - o Supplying water to the field by well or irrigation.

6) Vegetables should be grown in the woodlot so the villager will receive additional income.

7) Charcoal should be made in the woodlot, but adequate fire protection must be provided.

Ban Sam Kha Suntisuk, Tambon Mag Ja, Amphoe Nong Wua Soe

1) The fuelwoods near the villages such as Cratoxylon formosum, Strychnos nux-vomica, Mellanorrhoea glaba, and Tamarindus indica do not produce enough cooking heat.

2) Growing areas should be old, deteriorated forest and open areas (two Rai).

3) The soil in the area is sandy loam. This area is a gently undulating plain. Some sections are able to store water, although the area is generally not suitable for holding water.

IV.5 A Woodlot in Chiang Mai

Area 10

The environment of five villages (Tongguy, Hong Noc, Hong Nai, Khe leg huang, Ban Maa, Hopra and Sunpayang) includes Teng-Rang forest (dry dipterocarp); some of the areas were destroyed, but some are still intact. The type of soil is sandy clay with few minerals or nutrients. The soil cannot hold water. This area can be described as follows:

1) The local trees grow slowly, but are appropriate to the area. For firewood, species should be grown that are fast-growing, such as Acacia auriculiformis and Leucaena leucocephala, and which will endure the dry weather.

2) The growing area should be Teng-Rang forest, which was destroyed and public land (20 Rai) in Ban Hong Noc, Hong Nai.

3) The type of soil is sandy clay, which is easily destroyed but has few mineral and runoff problems.

4) It is easy to find Acacia auriculiformis seeds in this area from government agencies. There are already many Leucaena leucocephala in this area.

5) Protection from forest fires: Forest fires occur in this area every year, so a protection line should be established in this area for the first one to two years. There are few dangers from villagers and

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1. The villagers ought to grow Dimocarpus longan for fuelwood because they grow in a few years. Dimocarpus longa woodlots can provide a fuel source if properly maintained.

2. If the forests are cut down, other trees should be grown immediately in order to replace the plants and protect the soil from erosion.

3. If we want to establish a woodlot in the dry dipterocarp which was destroyed, then the plants will grow slowly and have a high cost for maintenance.

4. Seeds for woodlots can be obtained from the forest or at government agencies.

5. Small plant protection can be accomplished by:

- Hiring some more people to protect wood cuttings;
- Providing fences;
- Clearing weeds at least one a month; and
- Providing wells in the woodlot areas to supply water in summer.

6. Cash crops, including sugarcane and coconut palm, should be grown in the woodlots.

7. Charcoal should be made in the woodlots because the field are far from the village.

animals. The Ban Sunpayang area has many cattle, so fences will be needed around the woodlot. In summer the weather is hot and dry, so the roots will need adequate soil in order to store water.

6) Agricultural plants can be intercropped the first one to two years to replace weeds, but as the trees grow, they will cover the area. The agricultural plants to be intercropped should be of the bean group because these provide minerals and nutrients for the trees.

7) Charcoal can be made in the woodlot or the village. The village will be better and more convenient for transportation.

Ban Sri Chiang Mai, Tumbon Na Dee, Amphoe Muang, Changwat Udorn Thani

1) There are few species in this area suitable for firewood because they are too slow growing, such as Shorea obtusa, Melanorrhoea glaba, Xylia xylocarpa, and Strychnos nux-vomica.

2) There is no area to grow woodlots, except cemeteries and the perimeters of fields, because most of the land belongs to the villagers.

3) The soil is sand and sandy clay; the topography is flat.

4) Seeds for woodlots can be obtained from the forest, the Department of Forestry or other government agencies.

5) Small tree protection can be accomplished by:

   - Recruiting villagers to protect the woods from cutting;
   - Clearing weeds from around the trees (spacing two by two meters); and
   - Providing water from wells during the summer.

6) The villager should obtain some more income by growing cash crops in the woodlot.

7) Charcoal can be made in the village because the field is close to the village. If the woodlot is in the cemetery, they can make charcoal in the village.

Table A.22

TYPE OF FUELWOOD PREFERRED FOR COOKING

CHANGWAT CODE \ VILLAGE CODE	1		2		3		4		5	
	TYPE	%	TYPE	%	TYPE	%	TYPE	%	TYPE	%
1 (PHETCHABURI)	Combretum quadrangulare	31.6	Diospyros rhodocalyx	17.3		14.9		14.9		13.3
	Diospyros rhodocalyx	29.8	Azadirachta siamensis	13.6		14.9		14.9	Combretum quadrangulare	11.1
		10.5		12.3	Afzelia xylocarpa	11.9	Afzelia xylocarpa	12.8	Citrus aurantifolia*	8.9
	Afzelia xylocarpa	8.8	Afzelia xylocarpa	11.1			Azadirachta siamensis	6.4	Shorea obtusa	6.7
	Azadirachta siamensis	5.3	Cassia siamea	6.2	Combretum quadrangulare	10.7	Diospyros rhodocalyx	6.4	Afzelia xylocarpa	4.4
	others	14.0		4.9	Azadirachta siamensis	10.7		6.4	Mangiferea indica	4.4
				4.9		6.0	Citrus aurantifolia*	4.3	Artocarpus heterophyllus	4.4
			Hydnocarpus ilicifolius	3.7		6.0	Hydnocarpus ilicifolius	4.3	Diospyros rhodocalyx	4.4
			Diospyros mollis	3.7		6.0		4.3		4.4
			others	22.3	other	24.8		4.3		4.4
							others	21.0	Schleichera oleosa	4.4
									Diospyros mollis	4.4
									others	24.8
2 (KORAT)	Shorea obtusa	32.0	Shorea obtusa	30.2	Shorea obtusa	33.6	Shorea obtusa	32.6	Shorea obtusa	20.8
	Shorea siamensis	29.5	Shorea siamensis	19.8	Shorea siamensis	28.2	Shorea siamensis	19.8	Cratoxylon cochinchinensis	15.3
	Tamarindus indica	7.7	Barringtonia coccinea	14.6	Dipterocarpus tuberculatus	10.9	Afzelia xylocarpa	9.3	Shorea siamensis	15.3
	Azadirachta siamensis	3.9	Xylia xylocarpa	9.4	Barringtonia coccinea	6.4	Cratoxylon cochinchinensis	7.0		12.5
	Lagerstromia spp	3.9	Sindora siamensis	6.3	Xylia xylocarpa	6.4	Diospyros rhodocalyx	4.7	Mangiferea indica	9.7
	others	23.0	Dipterocarpus tuberculatus	5.2	others	14.5		4.7	Afzelia xylocarpa	8.3
			others	14.5			others	21.9	others	18.1
3 (SRISAKET)	Irvingia malayana	23.3	Irvingia malayana	35.0	Irvingia malayana	32.0	Irvingia malayana	25.0	Irvingia malayana	30.9
	Eugenia cumini	18.4	Dipterocarpus obtusifolius	11.7	Eugenia cumini	12.3	Dipterocarpus obtusifolius	17.5	Sindora siamensis	19.5
	Parinare anamense	8.7	Pterocarpus macrocarpus	9.7	Pterocarpus macrocarpus	10.7	Shorea roxburghii	11.7	Combretum quadrangulare	10.6
	Dipterocarpus obtusifolius	7.8	Sindora siamensis	9.7	Peltophorum dasyrachis	7.4	Pterocarpus macrocarpus	10.0	Pterocarpus macrocarpus	9.8
	Peltophorum dasyrachis	7.8	Eugenia cumini	8.7	Morinda citrifolia	5.7	Eugenia cumini	9.2	Eugenia cumini	8.1
	Hydnocarpus ilicifolius	5.8	Terminalia bellirica	6.8	Parinari anamense	5.7	Parinari anamense	9.2	Parinare anamense	6.5
	Shorea roxburghii	3.9	others	18.4	Combretum quadrangulare	5.7	Sindora siamensis	5.0	others	14.6
	others	24.2			Azadirachta siamensis	4.9	otehrs	12.4		
					others	15.6				

*possible mistranslation

VILLAGE CODE / CHANGWAT CODE	1		2		3		4		5	
	TYPE	%	TYPE	%	TYPE	%	TYPE	%	TYPE	%
4 (KAMPHANGPHET)	Irvingia malayana	31.6	Irvingia malayana	46.5	Irvingia malayana	34.3	Irvingia malayana	18.4	Irvingia malayana	31.7
	Schleichera oleosa	22.8	Hydnocarpus ilicifolius	22.1	Azadirachta siamensis	21.0		11.5	Hydnocarpus ilicifolius	17.0
	Rubber tree	7.0	Dimocarpus longan	21.1	Afzelia xylocarpa	7.6	Azadirachta siamensis	10.3	Lagerstroemia spp	7.3
	Hydnocarpus ilicifolius	5.3	others	10.3	Hydnocarpus ilicifolius	7.6	Afzelia xylocarpa	8.0		4.8
	others	33.3			Azadirachta siamensis	6.7	Hydnocarpus ilicifolius	5.7	Rubber tree	4.8
					Rubber tree	6.7		4.6	Baccaurea ramiflora	2.4
					others	16.1		4.6	Diospyros malabarica	2.4
								4.6	Mangifera indica	2.4
							Streblus asper	2.3	Artocarpus heterophyllus	2.4
							Fauhinia malabarica	2.3	Pterocarpus macrocarpus	2.4
							Anisoptera costata	2.3	Schleichera oleosa	2.4
							others	25.4	others	30.0
5 (LAMPANG)	Xylia xylocarpa	23.0		27.0	Xylia xylocarpa	17.7	Albizzia lebbek	19.6	Dipteracarpus obtusifolius	25.9
		17.7		16.0		15.7	Dipterocarpus	15.6		19.0
		15.0		11.0	Pterocarpus macrocarpus	11.5	Tamarindus indica	14.4		8.6
	Dipterocarpus obtusifolius	11.5		11.0		9.7	Xylia xylocarpa	9.3	Colona floribunda	7.8
		13.3	Xylia xylocarpa	9.0		8.8		7.2	Albizzia lebbek	4.3
	Cratoxylon formosum	7.1		5.0	Albizzia lebbek	6.2	Shorea obtusa	4.1	Cratoxylon formosum	4.3
	others	12.4	others	21.0		5.3		4.1	Mangifera indica	3.4
						5.3	others	25.8		3.4
					others	25.8			others	23.3
6 (SONGKHLA)	Grewia paniculata	24.7	Grewia paniculata	22.5	Melaleuca leucadendra	23.6	Grewia paniculata	24.8	Vitex pinnata	32.6
	Vitex pinnata	23.5	Vitex pinnata	22.5	Vitex pinnata	22.2	Vitex pinnata	21.0	Grewia panculata	30.4

VILLAGE CODE / CHANGWAT CODE	1		2		3		4		5	
	TYPE	%	TYPE	%	TYPE	%	TYPE	%	TYPE	%
	Rubber tree	20.0	Melaleuca leucadendra	16.9	Grewia paniculata	18.1		9.5	Cratoxylon cochinchinensis	16.3
	Melaleuca leucadendra	8.2	Rubber tree	15.3	Rubber tree	15.3	Cratoxylon cochinchinensis	7.6	others	20.7
	others	23.6	others	23.5	others	23.5	Rubber tree	7.6		
								5.7		
							others	23.8		
7 (CHANTABURI)	Rubber tree	38.7	Rubber tree	23.9	Rubber tree	30.6	Rubber tree	18.8		19.8
		21.3		17.9	Melaleuca leucadendra	26.4	Peltophorum dasyrachis	17.5	Cratoxylon cochinchinensis	16.3
	Melaleuca leucadendra	9.3	Cratoxylon cochinchinensis	14.9		9.7	Cratoxylon cochinchinensis	15.0	Peltophorum dasyrachis	11.6
	Lagerstroemia spp	8.0		11.9	Cratoxylon cochinchinensis	6.9		10.0		8.1
	others	22.7	Peltophorum dasyrachis	10.4	Peltophorum dasyrachis	6.9	Litchi chinensis	7.5	Irvingia malayana	7.0
			others	21.0	others	19.5		5.0	Rubber tree	4.7
							Irvingia malayana	5.0		4.7
							others	21.2	others	27.8
8 (ROI-ET)	Erythophleum succirubrum	27.1	Barringtonia coccinea	33.3	Shorea roxburghii	15.5	Pterocarpus macrocarpus	23.8	Erythrophleum succirubrum	35.9
	Barringtonia coccinea	21.9	Erythophleum succirubrum	33.3	Barringtonia coccinea	11.8	Shorea roxburghii	13.3	Barringtonia coccinea	32.6
		15.6	Xylia	18.8	Dipterocarpus	9.5	Dipterocarpus	11.4		16.3
	Tamarindus indica	5.2	others	6.2	Pterocarpus macrocarpus	9.1	Rubber tree	9.5	Xylia xylocarpa	12.0
	Streblus asper	5.2			Xylia xylocarpa	8.2	Sindora siamensis	5.7	others	3.2
	others	25.0			Cratoxylon formosum	8.2	Anisoptera costata	4.8		
					Irvingia malayana	8.2	Peltophorum dasyrachis	4.8		
						5.5	others	21.0		
					others	24.0				
9 (UDORNTHANI)	Barringtonia coccinea	29.5	Barringtonia coccinea	28.0	Cratoxylon formosum	24.5	Barringtonia coccinea	19.3	Barringtonia coccinea	20.2
	Shorea siamensis	20.0	Shorea siamensis	25.0	Barringtonia coccinea	22.4	Xylia xylocarpa	19.3	Xylia xylocarpa	20.2
		12.6	Cratosylon formosum	14.0	Irvingia malayana	21.4	Shorea siamensis	12.5	Lagerstroemia	12.0

VILLAGE CODE / CHANGWAT CODE	1		2		3		4		5	
	TYPE	%	TYPE	%	TYPE	%	TYPE	%	TYPE	%
10 (CHIANGMAI)	Schleichera oleosa	7.4	Irvingia malayana	9.0	Shorea obtusa	6.1	Shorea obtusa	11.4	Pterocarpus macrocarpus	12.0
	Irvingia malayana	6.3	others	24.0		5.1		9.1	Irvingia malayana	7.1
	others	24.2			Shorea siamensis	5.6	Lagerstroemia spp	6.8	Schleichera oleosa	4.8
					others	14.9	Erythrophleum succirubrum	5.7	others	23.7
							others	15.9		
	Dipterocarpus obtusifolius	28.3		28.4	Xylia xylocarpa	32.6	Xylia xylocarpa	32.9		21.9
	Xylia xylocarpa	23.3		18.2	Castanopsis spp	14.0		22.0	Dimocarpus longan	18.8
		20.0	Dipterocarpus obtusifolius	15.9		10.5	Pterocarpus macrocarpus	8.5	Dipterocarpus obtusifolius	16.7
		13.3	Dimocarpus longans	11.4		10.5		6.1		13.5
	others	15.1	others	26.1		7.0		4.9		8.3
					Dipterocarpus obtusifolius	5.8	others	25.6	Xylia xylocarpa	7.3
						4.7			Shorea obtusa	5.2
					others	14.9			others	8.3

Table A. 23

Glossary of Species

Firewood--Botanic Name

	English	Thai
1.	Anisoptera costata	กระบาก
2.	Afzelia xylocarpa	มะค่า
3.	Azadirachta indica	สะเดา
4.	Acacia auriculiformis	กระถินณรงค์
5.	Atalantia monophylla	มะกรูดผี
6.	Albizzia lebbek	จามจุรี
7.	Adina cordifolia	เขวา
8.	Acacia concinna	ชะอม
9.	Bouea burmanica	มะปราง
10.	Baccaurea ramiflora	มะไฟ
11.	Buchanaia siamensis	ศรีธนนชัย
12.	Barringtonia coccinea	จิก
13.	Bambusa	ไผ่
14.	Bauhinia pottsii	ชงโค
15.	Cassia siamea	ขี้เหล็ก
16.	Calophyllum pulcherrimum	ตังหน
17.	Cratoxylon cochinchinensis	แต้ว
18.	Canarium subulatum	มะเลื่อม
19.	Combretum quadrangulare	สะแก
20.	Casuarina junghuhniana	สนประดิพัทธิ์
21.	Cratoxylon formosum	ติ้ว
22.	Colona floribunda	ปอ
23.	Castanapsis spp	ก่อหนาม
24.	Careya sphaerica	กระโดน
25.	Ceiba pentandra	นุ่น
26.	Cassia fistula	คูณ
27.	Dipterocarpus obtusifolius	เหียง, สะแบง
28.	Dalbergia cochinchinensis	พยุง
29.	Dipterocarpus tuberculatus	พลวง, กุง, พลอง
30.	Diospyros mollis	มะเกลือ

Table A.23, continued

Glossary of Species

Firewood--Botanic Name

	English	Thai
31.	Dipterocarpus alatus	ยาง
32.	Dipterocarpus grandiflorus	ยูง
33.	Delonix regia	หางนกยูง
34.	Dialium cochinchinensis	หยี
35.	Dimocarpus longan	ลำใย
36.	Dalbergia nigrescens	ขนวน
37.	Diospyros rhodocalyx	ตะโก
38.	Dipterocarpus intricatus	ตราด, ตาด, กราด
39.	Eugenia cumini	พว้า, หว้า
40.	Eugenia grandis	เมา
41.	Eugenia scortechinii	หว้าหิน
42.	Erythrophloem succirubrum	ฟันชาด, ชาด
43.	Erythrina fusca	ทองหลาง
44.	Ficus religiosa	โพธิ์
45.	Ficus lacor	บักเฮือด
46.	Grewia paniculata	พลา
47.	Hopea odorata	ตะเคียน
48.	Hymenodictyon excelsum	อุโลก
49.	Hevea brasiliensis	ยางพารา
50.	Hydnocarpus ilicifolius	กระเบาลิง, หัวลิง
51.	Hopea ferrea	เหลาเตา
52.	Irvingia malayana	กระบก, มะหมก, ตะบก
53.	Leucaena leucocephala	กระถิน
54.	Lagerstroemia	ตะแบก
55.	Litchi chinensis	ลิ้นจี่
56.	Lepisanthes rubiginosum	หวดข่า
57.	Musa sapientum	กล้วย
58.	Mangifera caloneura	มะม่วงป่า
59.	Morinda coreia	ยอป่า

Table A.23, continued

Glossary of Species

Firewood--Botanic Name

	English	Thai
60.	Melaleuca leucadendra	เสม็ด, เสม็ดขาว
61.	Mimosa pigra	ไมยราพยักษ์
62.	Melanorrhoea glaba	รัก
63.	Mangifera indica	มะม่วง
64.	Macaranga lowii King and Gamble	ปลึง
65.	Melanorrhoea pilosa	น้ำเกลี้ยงหมู
66.	Morus alba	หม่อน
67.	Nephelium hypoleucum	คอแลน
68.	Pterocarpus macrocarpus	ประดู่
69.	Psidium guajaua	ฝรั่ง
70.	Peltophorum dasyrachis	อาลาง
71.	Perinari anamense	พอก
72.	Phyllanthus emblica	กันตริ
73.	Peltophorum dasyrachis	อินทรีย์
74.	Rhizophora mucronata	โกงกาง
75.	Sandoricum koetjape	กระท้อน
76.	Shorea obtusa	เต็ง
77.	Shorea roxburghii	พยอม
78.	Shorea siamensis	รัง
79.	Schleichera oleosa	ตะคร้อ, สะกรอ
80.	Strychnos nux-blanda	ตูมกาขาว
81.	Sindora siamensis	แต้
82.	Streblus asper	ข่อย
83.	Strychnos nux-vomica	ตูมกาแดง
84.	Sesbania grandiflora	แคบ้าน
85.	Samanea saman	ฉำฉา
86.	Terminalia bellirica	สมอพิเภก
87.	Tectona grandis	สัก
88.	Tamarindus indica	มะขาม

Table A.23, continued

Glossary of Species

Firewood--Botanic Name

English	Thai
89. Terminalia alata	เขือก
90. Vitex pinnata	นน, ตีนนก
91. Xylia xylocarpa	แดง
92. Zizyphus mauritiana	พุทรา

Table A.23, continued

Glossary of Species

Fruit Tree--Botanic Name

	English	Thai
1.	Annona squamosa	น้อยหน่า
2.	Annona reticulata	น้อยโหน่ง
3.	Averrho carambola	มะเฟือง
4.	Aegle marmelos	มะตูม
5.	Anacardium occidentale	มะม่วงหิมพรานต์
6.	Artocarpus lakoocha	มะหาด
7.	Artocarpus altilis	สาเก
8.	Acacia rugata	ส้มป่อย
9.	Areca catechu	หมาก
10.	Artocarpus heterophyllus	ขนุน
11.	Aglaia domestica	ลางสาด
12.	Archidendron Jiringa	เนียง
13.	Borassus flabellifer	ตาล
14.	Bouea burmanica	มะปราง
15.	Baccaurea ramiflora	มะไฟ
16.	Bouea oppositifolia	มะปริง
17.	Cocos nucifera	มะพร้าว
18.	Citrus hystrix	มะกรูด
19.	Citrus aurantifolia	มะนาว
20.	Carica papaya	มะละกอ
21.	Citrus aurantium	ส้ม
22.	Citrus maxima	ส้มโอ
23.	Diospyros rhodocalyx	ตะโก
24.	Durio zibethinus	ทุเรียน
25.	Diospyros malabarica	มะพลับ
26.	Diospyros mollis	มะเกลือ
27.	Dimocarpus longa	ลำใย
28.	Dialium cochinchinensis	หยี
29.	Diospyros decandra	จัน
30.	Eugenia paniala	มะเกี๋ยง

Table A.23, continued

Glossary of Species

Fruit Tree--Botanic Name

	English	Thai
30.	Elaeocarpus hygrophilus	มะกอกน้ำ
31.	Flacourtia indica	ตะขบ
32.	Feronia limonia	มะขวิด
33.	Garcinia mangostana	มังคุด
34.	Irvingia malayana	มะหมก
35.	Lepisanthes rubiginosa	มะหวด
36.	Litchi chinensis	ลิ้นจี่ป่า, สีรามัน
37.	Mangifera indica	มะม่วง
38.	Moringa oleifera	มะรุม
39.	Mangifera spp.	มะม่วงป่า
40.	Morinda citrifolia	ยอ
41.	Marinda coreia	ยอป่า
42.	Manilkara achras	ละมุด
43.	Musa sapientum	กล้วย
44.	Manihot esculenta	มันสำปะหลัง
45.	Nephelium lappaceum	เงาะ
46.	Nipa fruitcans	จาก
47.	Punica granatum	ทับทิม
48.	Prunus persica	ท้อ
49.	Psidium guajava	ฝรั่ง
50.	Pithecellobium dulce	มะขามเทศ
51.	Phyllanthus acidus	มะยม
52.	Phyllanthus emblica	มะขามป้อม
53.	Pakia speciosa	สะตอ
54.	Pyrus malus	แอบเปิ้ล
55.	Chukras velutina	ยมหิน
56.	Salacca rumphii	ระกำ
57.	Salacca edulis	สะละ
58.	Sandoricum koetjape	กระท้อน
59.	Spondias pinnata	มะกอก

Table A. 23, continued

Glossary of Species

Fruit Tree--Botanic Name

English	Thai
60. Schleichera oleosa	ตะคร้อ
61. Saccharum officinarum	อ้อย
62. Tamarindus indica	มะขาม
63. Terminalia chebula	ส้มมอ
64. Eugina	ชมพู่
65. Zizyphus mauritiana	พุทรา