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Access to Production and Use of Trees by Thai Farmers

Report No. 7

by

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1. Introduction

1.1. Background

Despite the important role of forests in the life of the rural poor in Thailand, the forests continue to disappear at an alarming rate, in part due to rapid increases in rural population. More than 60% of the Thai people live in rural areas. They use natural forest resources for fuelwood, charcoal, fences and poles, small timber, fodder and food. However, the forest is being exploited faster than it can renew itself (Chalamwong, 1989). The National Energy Administration (NEA) for example has predicted that the wood shortage will be serious by the year 2001. This could occur if there is no forestry program to sustain the supply of fuelwood.

There is a growing awareness among policy makers of the consequences of deforestation. As documented by Chantavorapap (1988) fuelwood shortages and serious environmental problems are already beginning to occur in Thailand although the fuelwood supply situation is not yet critical. More than 29% of forest areas remain relatively intact.

In terms of energy consumption, rural households depend largely on traditional fuels because they are readily available and relatively inexpensive. However, the signs of fuelwood shortage in rural areas are becoming more significant. According to the National Energy Administration, villagers have to travel farther to obtain their traditional fuel. To remedy these shortages and protect the environment, measures must be taken to protect the remaining forests and to regenerate new ones, both within and outside the reserved forest areas.

The most common approach has been to work outside of the forest reserves in community forest programs. Production and use of multipurpose tree species have been promoted in village and community forestry or agroforestry projects. These generally face complicated social, economic, cultural, technical, environmental, and managerial problems. If a project is to succeed and make sense to rural villagers, these obstacles must be overcome. The people in the village have to see clear advantages to be gained and must be able to absorb all the costs incurred in carrying out the project. As mentioned by Gautum (1986), "community forestry is not a technology, it is a process of social change that requires the continuous participation of whole communities in planning problem solving". On the other hand, the researchers so far have been unable to provide clear, workable recommendations to project implementors. This has been partly because researchers lacked knowledge of the needs and the social, economic and cultural conditions of villagers.

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1.2. Objectives

The major objectives of this study are:

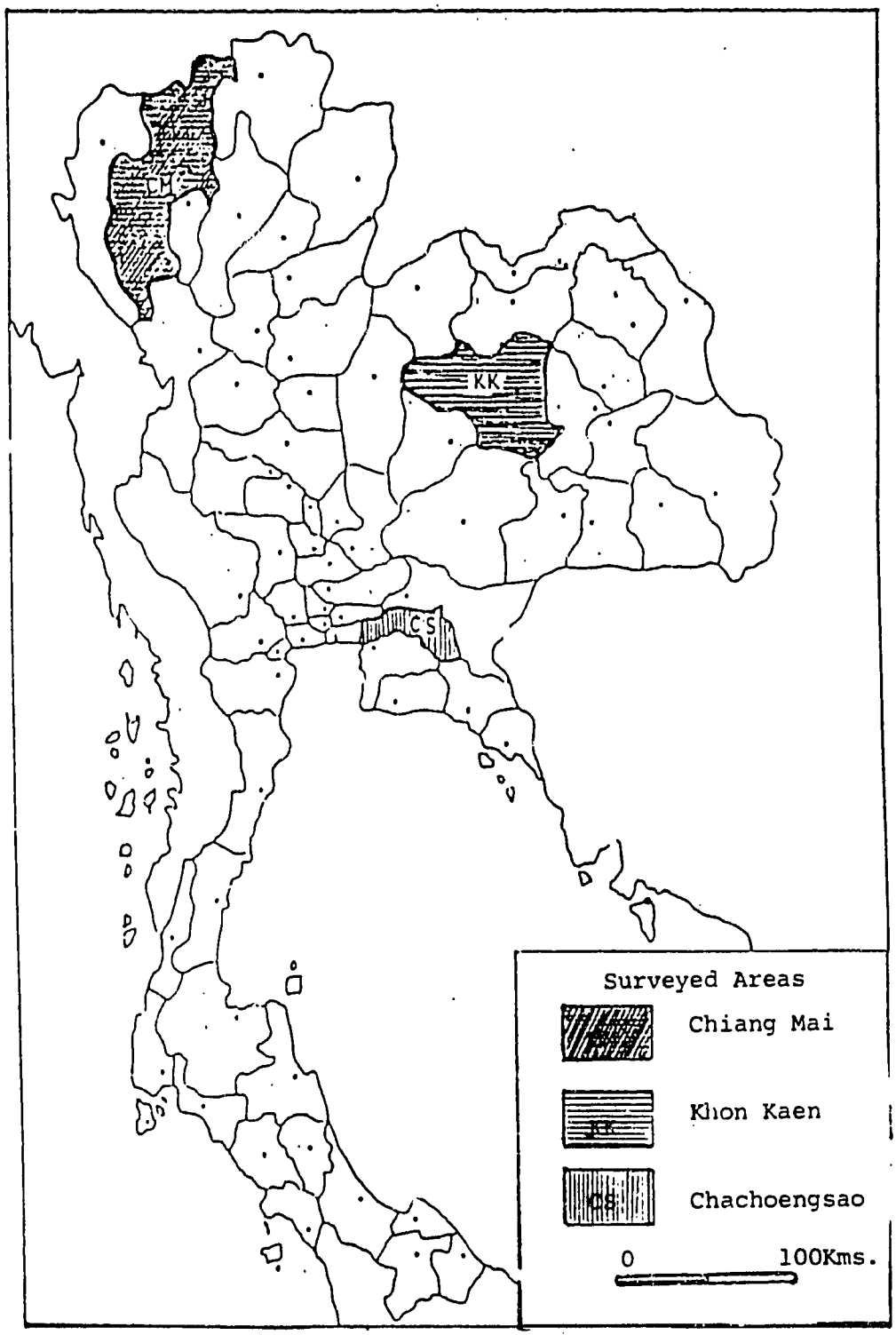
1) To describe farmers' use of trees at selected sites in Thailand. To determine how farmers gain access to trees;

2) To determine which trees farmers prefer, according to their different uses (fuelwood, charcoal, poles, fodder, etc.). To determine which tree characteristics contribute to the preferences;

3) To describe the current use of the three species (*Leucaena leucocephala, Acacia mangium,* and *Acacia auriculiformis*) tested in the F/FRED 1987 network field trials in Thailand. To determine the potential use of these species in places where farmers do not yet grow them. To determine the potential for additional use in places where these species are already being grown and used by farmers.

1.3. Methodology

A number of sites in Thailand were selected to grow MPTS as a part of the 1987 F/FRED network species trials. Trials were established in 6 provinces, namely, Chiang Mai, Khon Kaen, Chachoengsao, Ratchaburi, Udon Thani, and Chumporn. Data for this study were collected near the trial sites in Chiang Mai, Khon Kaen and Chachoengsao to represent the North. Northeast and Central Regions of Thailand, respectively (see Map 1). For the sample, villages near the trials in each of these three provinces were chosen, i.e. two villages were selected in the North, four in the Northeast, and six in the Center. Chosen at random from these villages were 100 sample households from the North, 105 in the Northeast, and 115 from villages in the Center. The results of this study are presented in the following sections.



Map 1. Map of Thailand

2. Characteristics of Sample Farms or Households

This section reviews the socio-economic characteristics of farm households proximite to the species trial sites in Chiang Mai, Khon Kaen and Chachoengsao provinces.

2.1. Age, Educations, and Experience

As can be seen in Table 1, out of 100 households in Chiang Mai 91% of the household heads were between 20 and 69 years of age. In the Khon Kaen sample, 99% of the household heads fell in this age category, and in Chachoengsao 97% were between 20 and 69. The majority in all three areas were between 40 and 59 years of age.

There was very little difference among household heads with respect to educational levels. In each of the study areas, approximately 66%-86% finished grade 4 in school. Almost all the rest had less than 4 years or no education.

2.2. Age Structure

Household labor consists of persons between 11 and 65 years of age. All other household members are considered as dependents. Members are also classified in Table 2 by sex and number in each household.

The majority of households in the three study provinces had one or two working-age males and one or two working-age females. In Chiang Mai, 82% of the households had one or two working-age males and 75% had one or two working-age females. In Khon Kaen 56% had one or two working-age males, and another 24% had three working-age males in the household. About 67% of the Knon Kaen households had one or two working-age females, with another 21% having three working-age females. In Chachoengsao, 71% of the households had one or two working-age males and 69% had one or two working-age females.

2.3. Part-Time vs. Full-Time Farmers

Some families are occupied only in farming while others work both on and off the farm. In the study areas the average number of full-time farmers per family was about 4 persons in Chiang Mai. 5.4 persons in Khon Kaen and 5 persons in Chachoengsao. The number of part-time farmers was highest in Chiang Mai (1.55 persons) mainly due to the short commuting distance to Chiang Mai city. The number of part-time farmers was slightly lower (1.2 persons) in Khon Kaen, and lowest in Chachoengsao (0.9 persons). The number of unemployed farmers was also highest in Chiang Mai with 1.82 persons, but only 1.2 and 1.4 persons per household in Khon Kaen and Chachoengsao (Table 3).

In all three sample areas, farmers tend to have at least one person working off the farm to stabilize the family cash flow. (Table 4).

2.4. Temporary Migration

Temporary migration of household members is significant. At least 48% had some members temporarily away from home (Table 5) mostly in search of better opportunities or following their parents. Most of those who worked away sent remittances back to their homes. Farmers in Chiang Mai used these remittances mainly for productive purposes, but those in Chachoengsao, used them for non-productive household expenses. In Khon Kaen they were used mostly for repayment of debts (Table 6).

2.5. Land Resources

2.5.1. Land Holdings and Distance from Plots

Small land areas prevent farmers from managing and utilizing their resources efficiently. In Chiang Mai, landholding were relatively small as compared with Khon Kaen and Chachoengsao, where holdings averaged 26 and 32 rai, respectively. Farmers in Chachoengsao had to travel long distances, almost 5 kilometers from home, in order to reach in their plots. The distance was 2.5 kilometers in Khon Kaen and only 1.51 kilometers in Chiang Mai (Table 7).

2.5.2. Land Acquisition

Land can be obtained in many ways, most commonly through inheritance, purchase, marriage, or settlement. Most of the households in Chiang Mai and Khon Kaen obtained their land through purchase while farmers in Chachoengsao received theirs through inheritance (Table 7).

2.5.3. Land Rights

Secure land documents enable the owners to sell, transfer, and legally mortgage their land. In general, Full Title Deeds and Certificates of Utilization are considered to be secure documents. Table 7 indicates that most of the households in Chiang Mai and Khon Kaen had Certificates of Utilization. Approximately 46% of the farmers in Chachoengsao had other documents as evidence of their land claims. A significant proportion of land parcels (about 11%) in this province had no documents at all.

2.5.4. Land Fragmentation and Land Types

The degree of land fragmentation which may prevent farmers from managing their land efficiently is not very great. Approximately 72%, 8% and 69% of the households in Chiang Mai, Khon Kaen, and Chachoengsao, respectively, farmed only one or two parcels of land (Table 8).

Approximately 57% of the total parcels in Chiang Mai and 34% in Chachoengsao were low-land areas suitable for growing rice. In Khon Kaen about 62% of the total parcels were upland areas used mostly for growing upland field crops (Table 9).

2.5.5. Sources of Irrigation and Land Tenure

Approximately 63% of the land parcels in Chiang Mai were irrigated, while in Khon Kaen and Chachoengsao, only 17% and 19% were irrigated. Almost all the rest were completely dependent on rainfall. Natural sources of water such as rivers and streams were commonly found in the three study areas (Table 9).

2.5.6. Land Tenure

In all three areas, most of the land was cultivated by the owners or land holders themselves. Only about 3-9% leased out their land for rent in cash or in kind. A small proportion of land was left idle for other purposes (Table 9).

2.6. Major and Minor Crops

The major crops found in Chiang Mai and Khon Kaen were rice and beans, while potatoes and rice were most important for Chachoengsao farmers (Table 10).

Though less than half the households grew minor crops (and only 16% of them in Chachoengsao), the important minor or second crops in Chiang Mai, Khon Kaen, and Chachoengsao were tomatoes, beans, and rice, respectively (Table 11).

2.7. Sources of Income and Wealth

2.7.1. Net Family Income

Farm households generally earn their income from various sources such as crops, livestock, fishery, non-farm and off-farm work, and other small businesses. In the three study areas, the average yearly household income was about 30,762 baht in Chiang Mai and 22,640 and 28,770 baht in Khon kaen and Chachoengsao, respectively. The most important source of income in all three provinces was from crop production, i.e. 58% of total household income in Chiang Mai, 54% in Khon Kaen and 71% in Chachoengsao (Table 12). Off-farm work also provided substantial income to households in the three study areas.

2.7.2. Consumption Expenditure

Household expenses are grouped into eight categories: food, fuel and energy, housewares clothing, health, education, recreation and others. Reported household expenses in Chiang Mai, Khon Kaen, and Chachoengsao averaged 15,437, 7,601, and 23,698 baht, respectively. The highest proportion of expense was for food, followed by fuel and energy (excluding fuelwood) (Table 13).

When comparing the household income described in the previous section with these expenditures, it is interesting to note that in all three study areas, the household reported a surplus of income over expenditures. This is more likely due to under reporting of expenses than to actual substantial savings.

2.7.3. Selected Household Wealth

1) Housing Quality

Almost all the farm houses in the study were made of permanent materials, which contributes to the higher value of the house. The houses in Chiang Mai, Khon Kaen and Chachoengsao were valued, respectively, at 36,020, 44,071, and 60,945 baht. The value of the house plot are was highest in Chiang Mai, followed by Khon Kaen and Chachoengsao. When the value of the houses and the house plots were combined, however, total values did not differ much among the provinces. This suggests that the wealth of the farmers in the three sample areas was somewhat similar.

It was interesting to find that a large proportion of farmers already use toilet facilities, and most had electricity (Table 14).

2) Durable Assets

Since the government began to promote rural development and to supply electricity to the villages, farmers have obtained many types of electrical appliances. The most popular items are electric fans, radios and automatic rice cookers. Bicycles and motorcycles are important assets widely used in all areas, especially Chiang Mai where motorcycles have become a way of life in commuting to work in town and the city (Table 15).

3) Value of Farm and Animal Assets

Table 16 indicates that only farmers in Chachoengsao owned tractors. However, about 10%-28% of the farmers in the three sample provinces own power tillers. Storage houses, sprayers and water pumps were among major farm assets commonly found. In Chiang Mai the average value of this equipment per household, including the value of draft animals, was about 9,363 baht. This increased to 14,985 baht and 32,341 baht respectively in Khon Kaen and Chachoengsao.

3. Use of Trees

3.1. Use of Trees for Household Energy

The main use of trees for household energy is fuel for cooking. Other uses include building smoky fires to keep insects away from animals and fires for small business activities. Types of energy used in households range from fuelwood and charcoal to cooking gas and other materials. Cheap energy sources can substitute for expensive ones. Fuelwood is the most common sources of heating and cooking fuel in chiang Mai, used by 90% of the households. In contrast, households in Khon Kaen and Chachoengsao tend to use charcoal as their major source of cooking and heating fuel (about 68% in Khon Kaen and about 57% in Chachoengsao). Cooking gas has begun to replace other types of energy in Chachoengsao (Table 17).

3.2. Amount of Household Energy Used

The amount of fuelwood required per day varies among the three study areas. Farmers in Chiang Mai, Khon Kaen and Chachoengsao average about 3.47, 3.68, and 3.31 kilograms, daily. High demand makes fuelwood most expensive in Chiang Mai. The amount of fuelwood used varied considerably. In Chiang Mai the annual per capita consumption of fuelwood was double (300 kg.) the estimate of the Household Energy Administration (HEA) (154 kg.). However, the HEA estimate of per capita use of fuelwood in Khon Kaen was slightly higher than the actual figure and slightly low for Chachoengsao. Per capita use of charcoal in Chiang Mai was only 30 kg., but 105 kg. in Khon Kaen and 233 in Chachoengsao. The per capita use of LPG in Chiang Mai (24 kg.) and Chachoengsao (20 kg.) was lower than in the HEA estimate of 33 kg. Farmers in Chiang Mai were asked whether they would want a cheap substitute for fuelwood. They said that, in fact, they preferred fuelwood because food cooked over a wood fire was tastier. If forced to change, however, they saw cooking gas as the best alternative.

3.3. Source of Trees

Fuelwood and charcoal continue to be used in cooking because they are easily available and cheap. As shown in Table 18, farmers in Chiang Mai get fuelwood from forests and trees planted on their own land. Farmers in Khon Kaen can still get fuelwood from public forests, but their major source is trees growing wild on their own land. In Chachoengsao, there is reason to believe that fuelwood used for cooking and heating is becoming scarce. Most of the fuelwood in Chachoengsao comes from trees planted and growing wild on the farmers' own land. Farmers in Chiang Mai and Chachoengsao have now begun to purchase fuelwood from other areas (Table 18). The most important source of charcoal (41 to 65%) in the three study areas was from trees growing wild on the farmers own land. The next most important sources were public forests (12 to 40%) and newly planted trees on the farmers' own land (0 to 19%) (Table 19).

The current source of fences and poles was primarily the public forests, both in Chiang Mai (55%) and Khon Kaen (46%). Trees growing wild on the farmers' own land were the most important source in Chachoengsao (31%) and Khon Kaen (46%) as well (Table 20).

Farmers in Chiang Mai got most of their small timber from public forests (72%) with less getting it from trees growing wild on their own land (20%). Farmers in Khon Kaen got small timber from trees growing wild on their own land (69%) and less so from public forests (27%). Small timber in Chachoengsao comes from three equally important sources, namely, public forests, trees growing wild on the farmers' own land, and by purchase (Table 21).

Finally, although tree fodder is not very popular in Thailand, a few farmers use it from public forests and from trees growing wild on their own land, both in Chiang Mai and Khon Kaen (Table 22).

Trees are important sources of food in Khon Kaen and Chachoengsao. Farmers in Chiang Mai and Khon Kaen get food from trees mostly in public forests, while those in Chachoengsao generally use trees planted on their own land (Table 23).

3.4. Parts of Tree Used

In the study areas, farmers got fuelwood largely from fallen branches and leaves. The next most important sources were lopped off branches and felled trees (Table 24). In Chiang Mai wood used to make charcoal usually came from lopped off branches (50%) and felled trees (40%). Farmers in Khon Kaen and Chachoengsao largely gathered felled trees (73%) and fallen branches and leaves (45%), almost all for their own use (Table 25).

Farmers in Khon Kaen used fodder gathered from lopped off branches (90%) while farmers in Chachoengsao mostly used fallen branches and leaves (66%) (Table 26).

3.5. Easy Access to Trees

Many villagers have ready access to trees on their own land on paddy dikes or land boundaries, and they commonly get tree products from public forests. The degree of scarcity determines the interest of villagers in tree production. As researchers at Khon Kaen University found the situation of fuelwood use in the surveyed area is reaching the stages of "early scarcity and severe shortage"[1] (Grandstaff, et al., 1986). Farmers are then more likely to grow trees intentionally for fuel, fruit and other needs.

Farmers in Chiang Mai still have little difficultly finding fuelwood. Farmers in Khon Kaen and Chiang Mai had some difficulty getting fuelwood (Table 27). The situation appeared worse when asked about access to charcoal. Most farmers (over 70%) in all three areas had difficulty getting wood for charcoal (Table 28). Due to the close proximity of forests in Chiang Mai a majority of farmers there had easy access to trees for fences and poles. But it Khon Kaen and Chachoengsao wood for fences and poles was as difficult to find as fuelwood. More than 80% of the households in these two areas began to experience difficulty in finding wood for these purposes (Table 29).

3.6. Time Allocated to Wood Collection

Most households in the survey communities spent less than 10 days during the previous month collecting fuelwood (Table 30)[2]. In Khon Kaen and Chachoengsao, most households made charcoal (Table 31). Less than 150 kg. charcoal was produced at each session. Some is used at home and the rest sold (Table 32).

[1] Early-scarcity means more restricted access to nearby forest but still have plenty of trees in agricultural land. The use of trees is more conservative.

Severe-shortage means villagers have no nearby forest and few trees left in agricultural land. The use of trees is even more conservative.

[2] A "day" in this case is any part of the day. If someone collects fuelwood for 2 hours a day for ten days, they are reported as spending 10 days collecting fuelwood. A "day" does not refer to a full working day.

Time spent collecting trees for fences and poles was from 1 to 5 days per month in all three of the surveyed areas (Table 33). Even with the shortage of cut-and-carry fodder in Khon Kaen and Chachoengsao, farm households there spent less than 5 days per month collecting (Table 34). A similar amount of time was spent for collection of tree products for food (Table 35).

3.7. Future Access to Natural Forests

As most tree products come from natural forests or naturally growing tree, farmers were asked about the availability of trees for fuelwood, charcoal, fences and poles in the future. Between 70% and 84% of the households in Chiang Mai believed that the present natural forests will last for at least another 20 years and more. In contrast, most farmers in Khon Kaen and Chachoengsao predict that in 10 years trees will no longer be available from natural stands for these purposes (Table 36 to 38).

3.8. Solving the problem of Tree Shortages

Tables 39 to 41 present the suggestions of the farmers themselves as to how to solve the problem of tree shortages. Most of the farmers -- about 50% in Chiang Mai, 71% in Khon Kaen, and 41% in Chachoengsao -- expect to buy fuelwood from other areas. A large number of farmers in Chiang Mai and Chachoengsao also suggest that they can switch to cooking gas (Table 39).

More than 60% of the farmers in Chiang Mai would solve their own charcoal shortage by purchasing charcoal. Only a few respondents in this province suggested they would grow their own trees. All the farmers in Khon Kaen who use charcoal would purchase it from other areas. In contrast, most farmers in Chachoengsao would turn to cooking gas to remedy their charcoal shortage (Table 40).

If trees were unavailable for fences and poles, most farmers plan to substitute other materials for wood (Table 41). It is interesting to note that farmers seldom considered growing their own trees as a means of reducing tree shortages, even when it was presented to them as a possible option. Only about 16 to 18% of the farmers who use trees to make fences and poles would get these products from intentionally planted trees. Nearly all farmers would rather purchase fuelwood, charcoal or fuel substitutes than grow trees for fuelwood or charcoal.

4. Tree Species Used and their Characteristics

In this section, the following questions are addressed:

i) What trees are still available and are potentially multipurpose?
ii) What are the uses of each kind of trees?
iii) What are the desired characteristics of these trees?

4.1. What Trees are still Available?

4.1.1. Trees for Fuelwood Use

The study communities near the species trial sites in Chiang Mai, Khon Kaen and Chachoengsao also happen to be near public forests, especially in the first two provinces. Most of their fuelwood comes from large standing trees in the state-owned forests or from scattered big trees left from a forest recently cleared for private farmland. In the sample area in Chiang Mai 65% of thee households indicated *Dipterocarpus tuberculatus Roxb,* (Yang) is the most important tree for charcoal in the area. The next most important species were *Mangifera indica Linn* (Ma muang), and *Shorea obtusa* Wall (Table 42).

In Khon Kaen, Teng (*Shorea obtusa*) Wall and Jim (*Barringtonia acutangula Green*) are the two most important trees. Many grew along their paddy fields. Eucalyptus (*Eucalyptus camaldulensis*) has gained some popularity as a source of fuelwood in this province (Table 42).

In Chachoengsao, no particular type of tree dominates as a source of fuelwood. Four species, *Irvingia malayana Oliver* (Kabok), *Mangifera indica Linn* (Ma muang), *Pterocarpus macrocarpus Kurz* (Pra du), and *Lagerstroemia cuspidata* Wall (Tabac), together accounted for 40% of the preferred available trees (Table 42).

However, not all the available trees are used. Table 43 presents the species actually used by farmers for fuelwood. In Chiang Mai less than half used *Dipterocarpus tuberculatus Roxb* (43%). The mango tree, *Mangifera indica Linn*, ranked second (21%), and another fruit tree, *Euphoria longan* , ranked third (6%). In Khon Kaen, more than half the farmers used *Shorea siamensis Miq* (9%) ranking much lower. In Chachoengsao, mango (*Mangifera indica Linn*) is a popular species growing along boundaries and in homestead areas. Many farm households (26%) used it for fuelwood. Trees next in popularity for fuelwood were Tabac (*Lagerstroemia cuspidata*) (10%) and Kabok (*Irvingia malayana Oliver*) (10%).

The indiscriminate search for fuelwood leads farmers to their uneconomical practices. Some of the trees used for fuelwood such as Teng, Yang, Jik, are valuable timber species and could provide higher income if processed for timber. Many of the fruit trees used for fuelwood such as Ma muang, Ma khaam, Lumyai, Khee lek, and Sa dao are not as important economically but are still important sources of food and cash income.

4.1.2. Trees for Use as Charcoal

In Chiang Mai, trees still available to make charcoal were Ma khaam reported by (50% of the respondents), Yang (30%), Kabok (10%) and Teng (10%) (Table 44). Farmers have actually used all these species to make charcoal, with Ma khaam the most frequently used, followed by Teng, Kabok and Ma muang (Table 45). Many of the farmers mentioned that Ta khraw (*Schleichera obosa Merr*) was the best species for making charcoal, but it is no longer available in nearby forests.

Many more tree species are available in Khon Kaen to make charcoal. Teng (mentioned by 40% of the respondents), Jik (20%), Dengue (*Xylia kerrii Craib* and *Hutch*) (8%) and Rung (5%) are popular species, with Teng (40%), Rung (19%), and Jik (15%) most frequently used by the farmers for charcoal (Table 44 and 45).

In Chachoengsao, three species are recognized as being generally available for making charcoal in the province, namely Kabok (26%), Kratin (*Leucaena leucacephala De Witt*) (13%) and Nonsee (*Peltophorum pterocarpum Back Ex. Heyne*) (9%). These last two are fast growing species (Table 44. To make charcoal, farmers use four or five major locally available species, i.e. Kabok (32%), Ma muang (8%), Nonsee (6%), Dengue (6%), and Khoi (*Streblus asper Lour*) (5%) (Table 45).

4.1.3. Trees for Fences and Poles

In Chiang Mai, about 60% of the respondents said that bamboo (Phai) was the most important species for fencing and poles. Others mentioned were Teng (18%) and Yang (8%) (Table 46). Farmers have used them all, with Phai most popular (41%), and Teng (21%) and Yang (18%) making up most of the rest (Table 47).

In Khon Kaen Teng (28%), Jik (22%), Dengue (20%) and Rung (10%) were considered the most appropriate species available to make fences and poles (Table 46). Phai (Bamboo) is also widely used. In terms of actual use, Teng was most widely used (24%). followed closely by Phai (22%), Jik (20%), and Dengue (18%) (Table 47).

In Chachoengsao, Phai tended to dominate, as most popular available species with Pra du, Kabok, Dengue and Klang (*Dialium cochinchinese*) far behind (Table 46). Phai is also the most often used because of its easy accessibility, followed by Krathin and Phunjump (*Vatica spp*) (Table 47).

4.1.4. Trees for Small Timber

According to respondents in Chiang Mai, trees still available for use as small timer were Yang (76%), Rung (8%), Dengue (4%) and Tueng (*Dipterocarpus tuberculatus Roxb Var*) (4%) (Table 48). The farmers felt all these trees were most appropriate for this use in roughly the same order (Table 49).

In Khon Kaen, Jik (27%), Teng (21%), Dengue (15%), Tabac (9%) and Pra du (6%) were reported available to make small timber. Farmers preferred Dengue (45%) and Teng (24%), as the most appropriate species for small timber (Table 48 and 49).

In Chachoengsao, the major species found locally to make timber were Tabac (reported by 36% of the respondents). Tabac seemed the best timber species to farmers in Chachoengsao, followed by Yang and Pra du. (Table 48 and 49).

4.1.5. Trees for Food

Many tree species, both cultivated and wild, provide man with food and medicine (Grandstaff, et al., 1988).

In Chiang Mai, bamboo shoots (Phai) are one of the most important local vegetables. Bamboo (Phai) also ranked first in popularity and suitability in Khon Kaen, followed by Kratin, Khee Lek and Sadao.

In Chachoengsao, farmers prefer Kratin, Khee lek and Sadao as well as Bamboo. Farmers leaves and flowers of Khae (*Sesbania grandiflora Desv.*), Cha-om (*Acacia pennata L. Wild*), Tae (*Cratoseylon prunifolium Kurz*) and Ma rum (*Maringa oleifera Lank*) are used for a variety of dishes (cooked with curry, boiled, or fried) (Table 50).

4.1.6. Trees for Fodder

Only two among the sample population in Chiang Mai used trees for fodder. These species were Kratin and Ma muang. In Khon Kaen, where ten of the sample farmers use tree fodder, Kratin is the most popular fodder species. Only used Kathon (*Sandoricum koetjape Merr.*). In Chachoengsao, Khoi (*Streblus asper Lour*) is most commonly used by 6 of the 9 farmers using tree fodder. Kratin, Ma muang, and Phai were used by one farmer each in Chachoengsao (Table 51).

4.2. Trees which are still available on Homestead Land

Most trees are planted on homesteads for fruit or food. Ma muang and Ma khaam are most important in both Chiang Mai and Khon Kaen. Other trees popular in Khon Kaen were Kratin (11%), Noy Na (*Anrona squamosa Linn*) (4%), Noon (*Bombox beiba Linn.*) (4%) and Maprao (*Cocos nucifera Linn*) (2%). The pattern for homesteads in Chachoengsao was the same: Ma muang (54%), Kratin (8%), and Ma khaam (8%) (Table 52).

4.3. Species of Trees Planted

4.3.1. Non-fruit Trees Planted on Cultivated Land

A few farmers in Chiang Mai grow fast growing species, such as Kratin (6% of the respondents), Noon (6%) and Phai (3%) in their crop fields. A larger proportion of farmers planted Teng (29%), Sak (*Tectona grandis Linn.*) (13%), Dengue (9%), and Waa (*Syzygium spp*) (9%) (Table 53).

In Khon Kaen, farmers planted Teng (25%), Dengue (10%), Jik (9%) and Pradu (7%) in their fields. In Chachoengsao, trees intentionally planted on cultivated land include Ma muang (23%), Nonsee (12%), and to a lesser extent Yangpara (*Hevea brasiliensis Wild*) (9%), Kabok (9%), Yang (9%), Eucalyptus (7%), and Kratin (3%) (Table 53).

4.3.2. Fruit Trees on Cultivated Land

In Chiang Mai, most of the farmers (81%) planted Ma muang in their fields, 6% planted Maprao (*Cocos nucifera Linn.*) 5% Lumyai, and about 4% Ma khaam (Table 54).

The two major fruit tree species planted in farmers' fields in Khon Kaen were Ma muang (45% of the respondents) and Ma khaam (43%). Very few planted any other fruit-tree species in their fields.

More than half of the households in Chachoengsao planted Ma muang in their fields. Khanoon (*Artocarpus heterophyllus Lamk*) was also quite popular, planted in the fields more than a quarter of the households. Ma khaam and Linchee (*Litchi chinensis Linn*) were much less widespread (Table 54).

5. Farmers' Experience in Tree Growing

In this section, the experience of farmers growing fast growing species are described, especially the priority species in the F/FRED 1987 network field trials. The potential production of species not now grown by farmers is considered. Lastly, tree rights in the study areas are examined.

5.1. Experience of Growing Multipurpose Tree Species (MPTS) and Reasons to Grow MPTS

In two out of the three surveyed areas, a large proportion of farmers had intentionally grown trees. In Khon Kaen and Chachoengsao, 57% and 50% of the farmers surveyed grew MPTS. In Chiang Mai, however, only 16% had ever planted these species. Farmers grow trees for consumption (fruit and other food) and for others purposes. In Khon Kaen, the main reason farmers gave for not growing MPTS was that they had no available land. This factor is a very important constraint not only for tree production but for other cash crops as well (Table 55).

Most of the farmers who grow MPTS had received no advice from either the government or private agencies. In Chachoengsao however, where farmers have grown Eucalyptus for some time, about 40% had received advise, some from extension workers (24%) and the rest from other government officers (14%) (Table 56).

Farmers who have grown MPTS received their seedlings largely from unidentified sources. Among the identified sources were public nurseries, from which 11 of the 16 farmers growing MPTS in Chiang Mai obtained their seedlings. The most significant identified source in Khon Kaen was the forestry officer, and in Chachoengsao they were the public nurseries and neighbours (Table 56).

Species preferences of farmers who already grow MPTS in the three study areas is shown in Table 57. Eucalyptus was very popular in Chiang Mai, while both Ma muang and Eucalyptus were popular in Khon Kaen and Chachoengsao.

From 38 to 50% of the farmers in the study areas said the seedlings they received were adequate. A great many other farmers still did not receive enough seedlings. Based on the number received, Chachoengsao was the only area growing many trees from seedlings (more than 550). These trees were generally grown on the homestead, followed by planting on bunds and for fencing. Most farmers transport their seedlings by hand and truck. Distances travelled to obtain seedlings were relatively near, ranging from 2.8 to 6.2 kilometers (Table 58).

Types of seedlings received in Chiang Mai were Eucalyptus (received by 43% of the respondents), Kratin (18%), Sa dao (12%) and Care (6%). In Khon Kaen the most common seedlings were Ma nuang, followed by Ma khaam, Eucalyptus, Kratin, and hai. Eucalyptus was a popular seedling with Chachoengsao farmers, followed by Ma muang, Yangpara, and Kratin (Table 59).

Farmers were asked if they want to continue growing MPTS. The results, as shown in Table 60, indicated that farmers in Chiang Mai did not want to go on planting trees because they wanted to switch to other cash crops. Interestingly, 15 of these 16 farmers have never cut the trees they planted. By contrast, most farmers in Khon Kaen and Chachoengsao wanted to continue planting trees. Most who did not want to continue said they did not have any more land. Others said they had enough trees or were switching to other crops. Most of these farmers as well have not harvested the trees they planted (Table 60).

Farmers in the three sampled areas were asked if they had heard about social forestry programs. Most said they had heard about it. When asked to comment on the program a small number referred to negative aspects such as the reduction of cultivation and grazing areas, while the major perceived benefits were more fuelwood and a better supply of fodder (Table 61).

The farmers were also asked to rank their knowledge of and the performance of the priority MPTS under the F/FRED project. Eucalyptus, the most widely known of the species, received the highest rank in all three areas. The second rank was either Leucaena leucocephala or Acacia Auriculiformis depending on the province. Acacia mangium was the least known of the 4 species (Table 62).

Farmers' perceptions of the benefits of these four trial species are tabulated in Table 63. In Chiang Mai, farmers believed the most important benefit of growing these species was to obtain fuelwood. In Khon Kaen, farmers said they would use Eucalyptus for charcoal (30%), fuelwood (20%), for sale (23%) and to make timber (19%). The major benefits of *Acacia auriculiformis* were given as charcoal, fodder, and for sale. Similar benefits were reported for Leucaena.

In Chachoengsao, most farmers said the benefits of growing Eucalyptus were in its value as a cash crop, followed by use as fuelwood, timber and charcoal. For Acacia and Leucaena, fuelwood, charcoal and sale were ranked as the major benefits (Table 63).

5.2. Tree Rights

The efforts to establish fuelwood plantations using fast-growing species seem to have a high chance of success. Trees can be grown anywhere on homestead land, along boundaries, or intercropped with cash crops, and the land area can be either state-owned or private. However, if this program is to emphasize broad participation by rural people, the project has to develop a better understanding of property rights in tree production and uses of trees.

This study attempts to gain a better understanding of tree rights on private, rented-in and state-owned land. Table 64 presents the distribution of households who respond to the question concerning the right to use and produce trees on public land. Almost all farmers agreed that villagers could gather fallen branches and leaves of trees growing wild on public land. However, only a few said they had a right to lop branches off standing trees on public land, except in Chachoengsao where nearly half felt free to lop branches from standing trees. Most farmers felt they did not have the right to fell trees on public land.

It was considered almost impossible to use trees growing in the area of another village. Respondents in all three study areas also doubted that individuals had the right to grow trees on public land. This may be because they have doubts about their rights to use what they plant.

Thai farmers are also unlikely to own a tree growing on someone else's land. But many farmers considered they had the right to collect leaves and branches that have fallen from a tree on someone else's property.

Only very few farmers in the three areas considered they could lop branches off trees on their neighbour's property, and virtually none felt they had the right to fell their neighbours' trees (Table 65).

Farmers felt similar restrictions to the use of trees on rented-in land. The renter may be granted rights to use fallen branches and leaves and to lop some branches from trees on land they rent in. But felling trees, either for own use or for sale, was considered impossible by all but on few respondents in Khon Kaen and Chachoengsao, who felt justified in felling trees either planted or growing wild on land they rent in (Tables 66 and 67).

If a farmer rented in a home plot and wanted to grow trees on it, only 19% to 29% said this would be acceptable. As for the selection of crops to grow on rented-in land, the owner is clearly the decision maker. A few farmers thought it might be possible for owner and renter to make a joint decision on the matter.

6. Conclusion

1) Fuelwood is the most important cooking fuel in rural households in the three study areas. According to the study, only rich rural families have a choice to switch to a better alternative. The rural poor virtually have no choice. There is a growing concern among the general public to save the remaining forest. This forces farmers to plant their own trees, both for household use and for income.

2) The results of the study showed that fuelwood is the least expensive of the farmers' fuel alternatives. Chantavarapap (1988) suggests that the cost of fuelwood also depends on its proximity to the village.

3) It is possible to increase the supply of fuelwood on a small scale with fast-growing tree plantations. The community requirement, as mentioned by Thaiutsa (1988), is the last but most important.

4) The most important sources of charcoal are from trees growing wild on private land or in public forests.

5) The most important sources of fences and poles, small timber, fodder, and food are from trees growing wild.

6) Farmers suggested that the way to solve the problem of the tree shortage was first to buy from other areas, and only then to grow their own trees or switch to other fuel alternatives such as LPG.

7) Most of the trees used for fuelwood and charcoal are very valuable and could be put to better use than fuelwood.

8) Trees found on homestead land were mostly fruit trees.

9) Trees on cultivated land were mostly timber trees and a few fruit trees.

10) The most popular trees from the three studies areas were Mango, Tamarind and Jackfruit.

11) Only 16% of the farmers in Chiang Mai had planted trees, compared to more than 57% and 49% in Khon Kaen and Chachoengsao. They planted mainly for food and fodder. These farmers have planted on their own initiative. They have not received much encouragement from government agencies.

12) Farmers received seedlings mainly from unofficial sources, not official sources.

13) Most of the farmers in Chiang Mai did not want to grow more trees because their land is limited and they prefer to grow cash crops. Farmers in Khon Kaen and Chachoengsao want to continue growing trees. However, land seems to be a major

constraint for future tree planting in these provinces as well.

14) With regard to tree rights, most farmers agreed that villagers could gather fallen branches and leaves, and lop-off branches, but could not fell trees on public land.

15) Farmers cannot grow trees on someone else's land without permission even if they rent in the land. However, they do collect fallen branches and leaves from their neighbours' property.

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Table 1. Age Education and Experience of Household Heads.

Unit: Percentage (Household)

Characteristics	Chiang Mai		Khon Kaen		Chachoengsao	
N	100		105		115	
Age						
20 - 29	7.0	(7)	2.9	(3)	4.3	(5)
30 - 39	21.0	(21)	24.8	(26)	16.5	(19)
40 - 49	16.0	(16)	36.2	(38)	31.3	(36)
50 - 59	32.0	(32)	22.8	(24)	29.6	(34)
60 - 69	15.0	(15)	12.4	(13)	15.6	(18)
>70	9.0	(9)	0.9	(1)	2.6	(3)
Education						
Illiterate	12.0	(12)	2.9	(3)	8.7	(10)
Cannot Write but can read	9.0	(9)	-		8.7	(10)
< Grade 4	9.0	(9)	6.7	(7)	7.8	(9)
Grade 4	66.0	(66)	85.7	(90)	73.9	(85)
> Grade 4	4.0	(4)	4.8	(5)	0.9	(1)
Experience Levels (Year)						
< 10	16.0	(16)	10.5	(11)	22.6	(26)
11 - 20	10.0	(10)	30.5	(32)	20.9	(24)
21 - 30	18.0	(18)	28.5	(30)	29.6	(34)
> 30	56.0	(56)	30.5	(32)	26.9	(31)

Table 2. Age and Sex Structure of Households.

Unit: Percentage (Household)

No. of household members in each age/sex group	Chiang Mai		Khon Kaen		Chachoengsao	
Age 11 - 65 year						
Male						
0	4.0	(4)	5.7	(6)	5.2	(6)
1	48.0	(48)	25.5	(27)	35.7	(41)
2	34.0	(34)	30.2	(32)	35.7	(41)
3	13.0	(13)	23.6	(25)	17.4	(20)
4	1.0	(1)	11.3	(12)	4.3	(5)
5	-		3.8	(4)	1.7	(2)
Female						
0	11.0	(11)	-		0.9	(1)
1	43.0	(43)	20.8	(22)	35.7	(41)
2	32.0	(32)	46.2	(49)	33.0	(38)
3	10.0	(10)	20.8	(22)	20.9	(24)
4	4.0	(4)	10.4	(11)	7.8	(9)
> 4	-		1.8	(2)	1.8	(2)
Less than 11 year						
Male						
0	69.0	(69)	67.0	(71)	66.1	(76)
1	24.0	(24)	30.2	(32)	27.0	(31)
2	7.0	(7)	1.9	(2)	5.2	(6)
> 2	-		0.9	(1)	1.7	(2)
Female						
0	76.0	(76)	52.8	(56)	70.4	(81)
1	22.0	(22)	38.7	(41)	20.9	(24)
2	2.0	(2)	8.5	(9)	6.1	(7)
> 2	-		-		2.6	(3)

Table 3. Number of Full-time, Part-time, and Unemployed Farmers.

Unit: Percentage (Household)

No. of household members in each work category	Chiang Mai		Khon Kaen		Chachoengsao	
No. of Full-time Farmers (person)						
1	2.0	(2)	-		0.9	(1)
2	3.5	(3)	0.9	(1)	3.5	(4)
3	32.0	(32)	16.2	(17)	14.8	(17)
4	21.5	(21)	15.2	(16)	25.2	(29)
5	14.0	(14)	16.2	(17)	21.7	(25)
6	6.5	(6)	22.9	(24)	16.5	(19)
7	5.5	(5)	19.1	(20)	8.7	(10)
8	-		4.8	(5)	6.1	(7)
> 8	-		4.7	(5)	2.6	(3)
Average	4.03		5.45		4.96	
No. of Part-time Farmers (person)						
	1.55		1.02		0.88	
Unemployed Farmers (person)						
	1.82		1.20		1.44	

Table 4. Distribution of Households having Members Working Part-time.

Unit; Percentage (Household)

Household Members (Person)	Chiang Mai		Khon Kaen		Chachoengsao	
0	30.0	(30)	37.1	(39)	32.2	(37)
1	40.0	(40)	38.1	(40)	40.9	(47)
2	24.0	(24)	16.2	(17)	20.0	(23)
3	5.0	(5)	6.7	(7)	7.0	(8)
4	-		1.0	(1)	-	
5	1.0	(1)	1.0	(1)	-	
Total	100.0	(100)	100.0	(105)	100.0	(115)

Table 5. Distribution of Households which had Household Members who have ever Migrated and Reasons for Migration.

Unit: Percentage (Household)

	Chiang mai		Khon Kaen		Chachoengsao	
Temporary Migration						
Never Migrated	43.1	(25)	36.9	(24)	18.3	(13)
Migrated	56.9	(33)	63.1	(41)	81.7	(58)
Reasons for Migration						
Lack of Land for Cultivation	13.8	(8)	12.3	(8)	18.3	(13)
Poor Soil	-		15.4	(10)	14.1	(10)
Lack of Water	2.4	(2)	-		-	
Follow Parent	37.9	(22)	38.5	(25)	26.8	(19)
Better Opportunity for Work	39.6	(23)	10.8	(7)	40.8	(29)
Other	56.9	(33)	23.1	(15)	7.0	(5)
Total	58*		65*		71*	

* Only Households with members who have migrated

Table 6. Number of Households having Member Temporarily Living Away from Home and Sending Remittances and the Reasons for Sending Remittances.

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Household members Living Away from Home			
Sending Home Remittance	85.7 (12)	64.0 (16)	64.3 (18)
Not Sending Home Remittance	14.3 (2)	36.0 (9)	35.7 (10)
Total	100.0 (14)	100.0 (25)	100.0 (28)
Purpose of Sending Remittances			
Household Expenditure	16.7 (2)	12.5 (2)	66.7 (12)
Farm Expenses	83.3 (10)	6.3 (1)	27.7 (5)
Repayment of Debt	-	81.2 (13)	5.6 (1)
Total	100.0 (12)	100.0 (16)	100.0 (18)

* Only households with members sending have remittance.

Table 7. Land Size, land Acquisition and Land Document.

Unit: Percentage (Household)

	Chiang Mai		Khon Kaen		Chachoengsao	
Land Size/Plot (rai)	3.5		12.4		17.5	
Distance of Plot from Home (km.) Acquisition of Land	1.51		2.51		4.88	
Purchase	21.2	(29)	32.3	(61)	43.5	(84)
In heritage	43.8	(60)	47.1	(89)	24.4	(47)
Marriage	..		3.7	(7)	1.6	(3)
Settlement	10.2	(14)	4.8	(9)	17.1	(33)
Given by Government	0.7	(1)	2.1	(4)	0.5	(1)
Others	24.1	(33)	10.0	(19)	13.0	(25)
Total	100.0	(137)	100.0	(189)	100.0	(193)
Land Document						
Undocumented	0.7	(1)	0.5	(1)	11.3	(21)
Full Tite Deeds	23.4	(32)	1.6	(3)	23.8	(46)
Certificate of utilization	61.3	(84)	81.0	(153)	19.2	(37)
Other Documents	14.6	(20)	16.9	(32)	46.1	(89)
Total	100.0	(137)	100.0	(189)	100.0	(193)

Table 8. Distribution of Land Holdings by Number of Parcels.

Unit: percentage (Household)

Number of Parcels	Chiang Mai	Khon Kaen	Chachoengsao
No Land	16.0 (16)	-	9.6 (11)
1	48.0 (48)	43.8 (46)	43.5 (50)
2	24.0 (24)	37.1 (39)	26.1 (30)
3	9.0 (9)	14.3 (15)	13.9 (16)
4	1.0 (1)	4.8 (5)	4.3 (5)
5	2.0 (2)	-	2.6 (3)
Total	100.0 (100)	100.0 (105)	100.0 (115)

Table 9. Characteristics of Land, Sources of Irrigation and Land Tenure.

Unit: Percentage (Household)

	Chiang Mai		Khon Kaen		Chachoengsao	
Land Type						
Low-land	57.7	(79)	15.9	(30)	34.2	(66)
Up-land	30.7	(42)	62.4	(118)	34.2	(66)
Both	11.7	(16)	21.7	(41)	31.6	(61)
Source of Irrigation Water						
Natural	14.5	(11)	12.2	(23)	23.3	(45)
Tube-well	-		11.1	(21)	6.2	(12)
Rainfed	11.7	(16)	69.8	(132)	53.4	(103)
Irrigation Canal	62.8	(86)	5.8	(11)	13.0	(25)
Others	1.5	(2)	1.1	(2)	4.1	(8)
Land Tenure						
Owner-Cultivated	85.4	(117)	86.8	(164)	76.3	(154)
Leased for Cash	1.5	(2)	0.5	(1)	2.1	(4)
Leased for Crops	5.8	(8)	1.6	(3)	7.3	(14)
Idle	0.7	(1)	6.3	(12)	1.0	(2)
Others	6.6	(9)	4.8	(9)	9.8	(19)

Table 10. Main Crops in the Study Areas.

Unit: Percentage (Household)

Main Crops	Chiang Mai		Khon Kaen		Chachoengsao	
Rice	47.2	(35)	90.3	(92)	35.7	(35)
Beans	44.5	(33)	1.9	(2)	-	
Tobacco	2.7	(92)	-		-	
Garlic	1.4	(1)	-		-	
Corn	1.4	(1)	2.9	(3)	-	
Tomatoes	2.7	(2)	1.0	(1)	-	
Melon	-		1.0	(1)	1.0	(1)
Jute	-		1.9	(2)	-	
Sugarcane	-		1.0	(1)	-	
Potatoes	-		-		45.9	(45)
Shallot	-		-		10.2	(10)
Others	-		-		17.4	(7)
Total	100.0	(74)	100.0	(102)	100.0	(98)

Table 11. Minor Crops Grown in Study Areas.

Unit: Percentage (Household)

Minor Crops	Chiang Mai	Khon Kaen	Chachoengsao
Tomatoes	30.6 (15)	-	-
Tobacco	16.3 (8)	-	-
Beans	22.4 (11)	25.5 (12)	10.5 (2)
Garlic	12.2 (6)	-	-
Shallot	6.1 (3)	-	-
Lettuce Plant	6.1 (3)	4.3 (2)	-
Melons	4.1 (2)	2.1 (1)	-
Chili	2.2 (1)	2.1 (1)	-
Jute		12.8 (6)	-
Corn	-	19.1 (9)	15.8 (3)
Potatoes	-	4.3 (2)	10.5 (2)
Rice	-		31.6 (6)
Others	-	29.8 (14)	31.6 (6)
Total	100.0 (49)	100.0 (47)	100.0 (19)
Total	100.0 (74)	100.0 (102)	100.0 (98)

Table 12. Sources of Farm Income and Off-Farm Work.

Unit: Baht/Household (Percentage)

Items		Chiang Mai	Khon Kaen	Chachoengsao
I)	Income from:			
	Crops	11,438 (58.1)	8.842 (54.1)	16,306 (71.4)
	Livestock	763 (3.9)	1.838 (11.2)	1,658 (7.3)
	Fishery	-	393 (2.4)	121 (0.5)
	Non-Farm Work	52 (0.3)	3,175 (19.4)	352 (1.5)
	Small Business	1,398 (7.1)	882 (5.4)	643 (2.8)
	Others	6,020 (30.6)	1,220 (7.5)	3,744 (16.5)
	Total	19,671 (100)	16,350 (100)	22,824 (100)
II)	Income from Off-farm Work			
	Agriculture	3,026 (27.3)	1,928 (30.7)	3,544 (59.6)
	Wage	7,908 (71.3)	4,096 (65.1)	2,351 (39.5)
	Salaries	157 (1.4)	266 (4.2)	51 (0.9)
	Total	11,091 (100)	6,290 (100)	5,946 (100)
	Total (I + II)	30,762	22,640	28,770

Table 13. Household Expenditures

Unit: Baht/Household

Source of Expenditure	Chiang Mai	Khon Kaen	Chachoengsao
Food	9,690	3,492	3,176
Fuel and Energy	1,718	408	3,144
Housewares	786	864	1,488
Clothing	906	816	1,464
Health	658	1,020	1,968
Education	858	694	1,604
Recreation	292	221	621
Others	527	86	233
Total	15,437	7,601	23,698

Table 14. Housing Quality, Use of Toilet and Electricity, and Value of Home Plots.

Unit: Baht/Household

	Chiang Mai		Khon Kaen		Chachoengsao	
Housing Quality (as percentage of high quality materiais)						
Roof	82.0	(82)	99.0	(104)	94.8	(109)
Floor	89.0	(89)	96.2	(101)	96.5	(111)
Wall	76.0	(76)	90.5	(96)	92.2	(106)
House Using Toilet and Electricity						
Use Toilet	90.0	(90)	98.1	(103)	67.0	(77)
Use Electricity	92.0	(92)	90.5	(95)	68.7	(79)
Value of Home and Home Plot						
Size of Home Plot (rai)	1.27		0.34		1.16	
Value of Home Plot (Baht)	53,648		26,043		22,543	
Value of House Plus Home Plot (Baht)	89,668		70,114		83,488	

Table 15. Durable Household Assets.

Unit: Percentage (Household)

Items	Chiang Mai		Khon Kaen		Chachoengsao	
T.V. Black & White	48.0	(48)	26.7	(28)	46.1	(53)
T.V. Color	15.0	(15)	12.4	(13)	12.2	(14)
Electric Fan	63.0	(63)	64.8	(68)	50.4	(58)
Refrigerator	20.0	(20)	8.6	(9)	13.0	(15)
Iron	42.0	(42)	49.5	(52)	42.6	(49)
Video	1.0	(1)	1.9	(2)	1.7	(2)
Transistor Radio	35.0	(35)	52.4	(55)	60.0	(69)
Radio with Cassette Tape	37.0	(37)	42.9	(45)	36.5	(42)
Electric Cooking Pot	21.0	(21)	21.0	(22)	47.8	(55)
Electric Stove	5.0	(5)	3.8	(4)	1.7	(2)
Liquid Fuel Stove	8.0	(8)	1.9	(2)	39.1	(45)
Bicycle	76.0	(76)	83.8	(88)	84.3	(97)
Motorcycle	61.0	(61)	29.5	(31)	36.5	(42)
Car	4.0	(4)	-		16.5	(19)
Other	-		13.3	(14)	14.8	(17)
Average Value of Durable Assets (Baht)	1,569		802		3,039	

Table 16. Farm Assets.

Unit: Percentage (Household)

Items	Chiang Mai		Khon Kaen		Chachoengsao	
Tractor		-		-	3.5	(4)
Power Tiller	10.0	(10)	28.6	(30)	20.9	(24)
Water Pump	9.0	(9)	25.7	(27)	36.5	(38)
Sprayer	57.0	(57)	12.4	(13)	32.2	(33)
Cart	3.0	(3)	5.7	(6)	16.5	(19)
Others	3.0	(3)	90.5	(95)	82.6	(95)
Storage Barn	74.0	(74)	91.4	(96)	43.5	(50)
Values of Selected Equipment and Draft Animals						
Farm Equipment	1,539		5,950		16,482	
Storage Barn	4,095		3,008		4,718	
Cattle	1,369		1,705		4,189	
Buffalo	2,360		4,322		5,952	
Total	9,363		14,985		31,341	

Table 17. Use of Trees Near Species Trial Sites, 1987

Unit: Percentage (Household)

Item	Chiang Mai		Khon Kaen		Chachoengsao	
Type of Domestic Energy Use						
Fuelwood only	69.0	(69)	10.5	(11)	7.0	(10)
Charcoal only	-		40.0	(42)	34.8	(40)
Fuelwood > Charcoal	21.0	(21)	21.9	(23)	13.0	(15)
Charcoal > Fuelwood	1.0	(1)	24.8	(26)	14.8	(17)
Cooking Gas (LPG)	1.0	(1)	-		15.7	(18)
Other	8.0	(8)	2.9	(3)	14.8	(17)
Amount of Fuelwood Used						
Per day (kg.)	3.47		3.68		3.31	
Per capita (kg./year)	300		127		183	
Price (baht/kg.)	2.90		0.42		1.59	
Cost/day (baht)	10.06		1.55		5.76	
Amount of Charcoal Used						
Per day (kg.)	1.48		2.05		3.52	
Per capita (kg/year)	36		105		233	
Price (baht/kg.)	2.20		1.70		2.13	
Cost/day (baht)	3.26		3.48		7.48	
Amount of Gas Used						
Per day (kg.)	2.20		-		0.24	
Per capita (kg./year)	24		-		20	
Price (baht/kg.)	10.00		-		10.58	
Cost/day (baht)	22.00		-		2.54	

Table 18. Source of Trees Used for Fuelwood

Unit: Percentage (Household)

Source	Chiang Mai	Khon Kaen	Chachoengsao
Trees Used			
Public Forests	52.0 (51)	28.8 (19)	11.3 (7)
Natural grown trees, on own land	2.0 (2)	62.1 (41)	35.5 (22)
Intentionally planted trees, on own land	32.8 (32)	4.6 (3)	30.6 (19)
Purchased	10.2 (10)	3.0 (2)	11.3 (7)
Other	3.0 (2)	1.5 (1)	11.3 (7)
Total	100 (98)	100 (66)	100 (62)

Table 19. Source of Trees Used for Charcoal.

Unit: Percentage (Household)

Use & Source of	Chiang Mai	Khon Kaen	Chachoengsao
Use Charcoal			
Use	10.0 (10)	71.4 (75)	57.7 (66)
Do not use	90.0 (90)	28.6 (30)	42.6 (49)
Total	100 (100)	100 (105)	100 (115)
Source			
Public Forests	40.0 (4)	26.7 (20)	12.7 (8)
Naturally grown, on own land	50.0 (5)	65.3 (49)	40.9 (27)
Planted on own land	-	5.4 (4)	19.7 (13)
Purchased	10.0 (1)	1.3 (1)	16.7 (11)
Public land area	-	-	6.1 (4)
Other	-	1.3 (1)	4.5 (3)
Total	100 (10)	100 (75)	100 (66)

Table 20. Source of Trees Used for Fences and Poles

Unit: Percentage (Household)

Sources	Chiang Mai	Khon Kaen	Chachoengsao
Public Forests	55.2 (32)	46.0 (23)	15.8 (12)
Naturally grown trees, on own land	5.2 (3)	46.0 (23)	31.6 (24)
Intentionally, planted trees, on own land	24.2 (14)	2.0 (1)	30.3 (23)
Purchased	3.3 (2)	6.0 (3)	9.2 (7)
Other	12.1 (7)		13.1 (10)
Total	100 (58)	100 (50)	100 (76)

Table 21. Source of Trees Used for Small Timber

Unit: Percentage (Household)

Sources	Chiang Mai	Khon Kaen	Chachoengsao
Private Forests	72.0 (18)	27.3 (9)	30.0 (9)
Naturally grown trees, on own land	20.0 (5)	69.7 (23)	20.0 (6)
Intentionally, planted trees, on own land	8.0 (2)	-	6.7 (2)
Purchased			30.0 (9)
Public land area		3.0 (1)	3.3 (1)
Other			10.0 (3)
Total	100 (25)	100 (33)	100 (30)

Table 22. Source of Trees Used for Fodder

Unit: Percentage (Household)

Sources	Chiang Mai	Khon Kaen	Chachoengsao
Public Forests	50.0 (1)	40.0 (4)	11.2 (1)
Naturally grown trees, on own land	50.0 (1)	30.0 (3)	33.3 (3)
Intentionally planted trees, on own land	-	10.0 (1)	22.2 (2)
Purchased	-	20.0 (2)	33.3 (3)
Total	100 (2)	100 (10)	100 (9)

Table 23. Uses, Sources of Trees and Parts of Tree Used for Food

Unit: Percentage (Household)

Sources	Chiang Mai	Khon Kaen	Chachoengsao
Used	16.0 (16)	79.0 (83)	94.8 (109)
Sources			
Public forests	81.3 (13)	60.2 (50)	7.3 (8)
Naturally group trees, on own land	-	19.3 (16)	17.4 (19)
Intentionally planted trees, on own land	18.7 (3)	12.0 (10)	59.6 (65)
Purchased	-	8.5 (7)	8.3 (9)
Other	-	-	7.4 (8)
Total	100 (16)	100 (83)	100 (109)

Table 23. (Continued)

Sources	Chiang Mai	Khon Kaen	Chachoengsao
Parts of Trees Used			
Root/Shoots/Tubers	68.7 (11)	60.2 (50)	13.8 (15)
Stem/Branches	-	3.6 (3)	0.9 (1)
Flowers/Leaves	31.3 (5)	28.9 (24)	80.7 (88)
Other	-	7.3 (6)	4.6 (5)
Total	100 (16)	100 (83)	100 (109)

Table 24. Parts of Trees Used for Fuelwood

Unit: Percentage (Household)

Part of Trees	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves	45.9 (45)	32.3 (22)	51.6 (32)
Lopped Branches	35.7 (35)	21.2 (14)	32.3 (20)
Felled Trees	13.3 (13)	31.8 (21)	16.1 (10)
Other	5.1 (5)	13.7 (9)	-
Total	100 (98)	100 (66)	100 (62)

Table 25. Parts of Trees Used for Charcoal

Unit: Percentage (Household)

Part of Trees	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves	-	10.7	45.5
Lopped Branches	50.0 (5)	9.3 (7)	25.8 (17)
Felled Trees	40.0 (4)	73.3 (55)	22.7 (15)
Other	10.0 (1)	6.7 (5)	6.0 (2)
Total	100 (10)	100 (75)	100 (66)
Purpose			
For own use	100.0 (10)	85.3 (64)	94.0 (62)
For sale	-	4.0 (3)	3.0 (2)
For both reason	-	10.7 (8)	3.0 (2)
Total	100.0 (10)	100 (75)	100 (66)

Table 26. Parts of Trees Used for Fodder

Unit: Percentage (Household)

Part of Trees	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves	-	-	66.7 (6)
Lopped Branched	-	90.0 (9)	33.3 (3)
Other	100 (2)	10.0 (1)	
Total	100 (2)	100 (10)	100 (9)

Table 27. Ease of Finding Trees for Fuelwood

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Easy to find	71.7 (71)	32.0 (32)	17.5 (20)
Somewhat difficult	17.2 (17)	33.0 (33)	22.8 (26)
Difficult to find	9.1 (9)	28.0 (28)	40.4 (46)
Could not find	2.0 (2)	7.0 (7)	19.3 (22)
Total	100 (99)	100 (100)	100 (114)

Table 28. Ease of Finding Trees for Charcoal Making

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Easy to find	21 (8)	29.0 (29)	10.0 (11)
Somewhat difficult	-	22.0 (22)	16.4 (18)
Difficult to find	13.1 (5)	40.0 (40)	40.0 (44)
Could not find	65.9 (25)	9.0 (9)	33.6 (37)
Total	100 (38)	100 (100)	100 (110)

Table 29. Ease of Finding Trees for Fences and Poles

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Easy to find	52.8 (38)	17.1 (17)	18.8 (21)
Somewhat difficult	11.1 (8)	22.2 (22)	13.4 (15)
Difficult to find	6.9 (5)	38.4 (38)	17.9 (20)
Could not find	29.2 (21)	22.2 (22)	49.9 (56)
Total	100 (72)	100 (99)	100 (112)

Table 30. Time Spent to Collect Fuelwood

Unit: Percentage (Household)

Time Spent (day/month)	Chiang Mai	Khon Kaen	Chachoengsao
< 1	8.2 (8)	86.0 (80)	10.9 (10)
1 - 10	89.8 (88)	11.8 (11)	81.5 (75)
11 - 20	1.0 (1)	-	3.3 (3)
> 20	1.0 (1)	2.2 (2)	4.3 (4)
Total	100 (98)	100 (93)	100 (92)

Table 31. Time Spent Making Charcoal

Unit: Percentage (Household)

Time spent (day/month)	Chiang Mai	Khon Kaen	Chachoengsao
1 - 5	100 (10)	56.0 (42)	74.2 (49)
6 - 10	-	14.7 (11)	12.1 (8)
11 - 15	-	18.6 (14)	10.6 (7)
> 15	-	10.7 (8)	3.1 (2)
Total	100 (10)	100 (75)	100 (66)

Table 32. Amount of Charcoal made per Session.

Unit: Percentage (Household)

Amount (kg./session)	Chiang Mai	Khon Kaen	Chachoengsao
1 - 50	80.0 (8)	50.7 (38)	30.3 (20)
51 - 100	20.0 (2)	10.7 (8)	21.2 (14)
101 - 150	-	14.7 (11)	10.6 (7)
151 - 200	-	8.0 (6)	13.6 (9)
200 - 250	-	6.7 (5)	1.5 (1)
> 250	-	9.2 (7)	22.8 (15)
Total	100 (10)	100 (75)	100 (66)

Table 33. Time Spent to Collect Trees for Fences and Poles

Unit: Percentage (Household)

Time Spent (day/month)	Chiang Mai	Khon Kaen	Chachoengsao
< 1	10.3 (6)	2.0 (1)	3.9 (3)
1 - 5	74.1 (43)	92.0 (46)	85.5 (65)
6 - 10	6.8 (4)	6.0 (3)	3.9 (3)
11 - 15	3.4 (2)	-	3.9 (3)
> 15	5.4 (3)	-	2.8 (2)
Total	100 (58)	100 (50)	100 (76)

Table 34. Time Spent to Collect Fodder.

Unit: Percentage (Household)

Time Spent (day/month)	Chiang Mai	Khon Kaen	Chachoengsao
< 1	50.0 (1)	-	-
1 - 5	50.0 (1)	90.0 (9)	55.6 (5)
6 - 10	-	10.0 (1)	22.2 (2)
> 10	-	-	22.2 (2)
Total	100 (*2)	100 (10)	100 (9)

Table 35. Time to Collect Parts of Trees for Food.

Unit: Percentage (Household)

Time Spent (day/month)	Chiang Mai	Khon Kaen	Chachoengsao
< 1	-	3.6 (3)	7.3 (8)
1 - 5	93.7 (15)	72.3 (60)	84.4 (92)
6 - 10	6.3 (1)	14.5 (12)	5.5 (6)
> 10	-	9.6 (8)	2.8 (3)
Total	100 (16)	100 (83)	100 (109)

Table 36. Number of Years Farmers Expect Existing Natural Sources of Trees Used for Fuelwood will last.

Unit: Percentage (Household)

Years	Chiang Mai	Khon Kaen	Chachoengsao
< 1	-	-	10.9
1 - 10	15.6 (15)	88.2 (82)	81.5 (75)
11 - 20	3.1 (3)	11.8 (11)	3.3 (3)
> 20	81.3 (78)	-	2.5 (4)
Total	100 (96)	100 (93)	100 (92)

Table 37. Number of Years Farmers Expect Existing Natural Sources of Trees Used for Charcoal will last.

Unit: Percentage (Household)

Years	Chiang Mai	Khon Kaen	Chachoengsao
< 1	-	2.2 (2)	10.3 (8)
1 - 10	10.0 (1)	79.1 (72)	79.5 (58)
11 - 20	20.0 (2)	15.4 (9)	5.5 (4)
21 - 30	-	1.1 (1)	1.4 (1)
> 31	70.0 (7)	2.2 (2)	2.7 (2)
Total	100 (10)	100 (91)	100 (73)

Table 38. Number of Years Farmers Expect Existing Natural Sources of Trees Used for Fences and Poles will last.

Unit: Percentage (Household)

Years	Chiang Mai	Khon Kaen	Chachoengsao
< 1	-	3.9 (3)	5.3 (3)
1 - 10	12.1 (6)	75.3 (58)	83.9 (47)
11 - 20	1.9 (1)	10.4 (8)	3.6 (2)
21 - 30	1.9 (1)	5.2 (4)	3.6 (2)
31 - 40	-	2.6 (2)	-
> 40	84.1 (43)	2.6 (2)	3.6 (2)
Total	100 (5)	100 (77)	100 (56)

Table 39. Ways of Solving Shortages of Trees Used for Fuelwood

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Buy fuelwood from other areas	50.0 (1)	71.4 (5)	40.9 (9)
Buy Charcoal from other areas	-	14.3 (1)	22.7 (5)
Use cooking gas	50.0 (1)	14.3 (1)	31.8 (7)
Other	-	-	4.5 (1)
Total	100 (2)	100 (7)	100 (22)

Table 40. Ways of Solving Shortages of Trees Used to Make Charcoal.

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Use fuelwood purchased from another areas	8.7 (2)	-	16.2 (6)
Purchase charcoal from another areas	60.9 (14)	100 (9)	27.0 (10)
Use gas	8.7 (2)	-	56.8 (21)
Grow trees	21.7 (5)	-	
Total	100 (23)	100 (9)	100 (37)

Table 41. Ways of Solving Shortages of Trees Used to Make Fences and Poles

Unit: Percentages (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Purchase from another areas	12.5 (2)	27.3 (6)	26.8 (15)
Substitute by other materials	68.8 (11)	45.4 (10)	51.8 (29)
Grow trees	18.5 (3)	27.3 (6)	16.1 (9)
Other	-	-	5.3 (3)
Total	100 (16)	100 (22)	100 (56)

Table 42. Species Available for Fuelwood

Botanical Name	Local Name	Percentage (household)	
Chiang Mai:			
Dipterocarpus tuberculatus Roxb.	Yang	65.3	(62)
Mangifera indica Linn	Ma muang	13.7	(13)
Shorea obtusa Wall	Teng	8.4	(8)
Xylia Kerrii Craib & Hutch	Daeng	3.2	(3)
Tamarindus indica Linn	Ma Khaam	2.1	(2)
Schleichera leosa merr,	Takhraw	1.1	(1)
Other		6.2	(6)
Total		100	(95)
Khon Kaen:			
Shorea obtusa Wall	Teng	41.9	(39)
Barringtonia acutangula Green	Jik	23.7	(22)
Eucalyptus camaldulensis	Eucalyptus	7.5	(7)
Cratoseylon nerrifolium Kurz	Tiew	7.5	(7)
Lagerstroemia cuspidata Wall	Tabac	2.2	(2)
Shorea siamensis Miq	Rung	2.2	(2)
Xylia kerrii Craib & Hutch	Daeng	2.2	(2)
Other		12.8	(12)
Total		100	(93)
Chachoengsao:			
Irvingia malayana Oliver	Kabok	11.9	(11)
Mangifera indica Linn.	Ma muang	8.7	(8)
Pterocarpus macrocarpus Kurz	Pra du	9.8	(9)
Lagerstroemia cuspidata Wall	Tabac	9.8	(9)
Eucalyptus camaldulensis	Eucalyptus	7.6	(7)
Azadirachta indica Juss.	Sadao	5.4	(5)
Other		46.8	(43)
Total		100	(92)

Table 43. Species Actually Used for Fuelwood.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Dipterocarpus tuberculatus Roxb	Yang	43.3 (42)
Mangifera indica Linn	Ma muang (Mango)	21.6 (21)
Euphoria longan	Lumyai	6.2 (6)
Tamarind indica Linn	Makhaam	4.1 (4)
Shorea obtusa Wall	Teng	4.1 (4)
Shorea siamensis Miq	Rung	3.1 (3)
Xylia kerrii Craib & Hutch	Daeng	3.1 (3)
Other		14.5 (14)
Total		100 (97)
Khon Kaen:		
Shorea obtusa Wall	Teng	53.0 (35)
Barringtonia acutangula Green	Jik	24.2 (16)
Shorea siamensis Miq	Rung	9.1 (6)
-	Fluai	3.0 (2)
Cassia siamea Britt. &	Khee lex &	1.5 (1)
Azadirachta indica Juss	Sadao	
Other		9.2 (4)
Total		100 (66)
Chachoengsao:		
Mangifera indica Linn	Ma muang (Mango)	26.7 (16)
Lagerstroemia cuspidata Wall	Tabac	10.0 (6)
Irvingia malayana Oliver	Kabok	10.0 (6)
Peltophorum pterocarpum Back Ex. heyne	Nonsee	8.3 (5)
Leucaena Leucacephala De Wit	Kratin Thai	5.0 (3)
Eucalyptus camaldulensis	Eucalyptus	3.3 (2)
Psidium guajava Linn	Farang	3.3 (2)
Other		33.3 (20)
Total		100 (60)

Table 44. Species Still Available to Make Charcoal.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Tamarindus indica Linn	Ma khaam	50.0 (5)
Dipterocarpus tuberculatus Roxb	Yang	30.0 (3)
Irvingia malayana Oliver	Kabok	10.0 (1)
Shorea obtusa Wall	Teng	10.0 (1)
Total		100 (10)
Khon Kaen:		
Shorea obtusa Wall	Teng	40.7 (37)
Barringtonia acutangula Gaertn	Jik	20.9 (19)
Xylia kerrii Craib & Hutch	Daeng	8.8 (8)
Shorea siamensis Miq	Rung	5.5 (5)
Combretum quadrangulare Kurz	Sakae	2.2 (2)
Other		21.9 (20)
Total		100 (91)
Chachoengsao:		
Irvingia malayana Oliver	Kabok	26.0 (19)
Leucaena leucocephala De Witt	Kratin Thai	13.7 (10)
Peltophorum pterocarpum Back. Ex-heyne	Nonsee	9.6 (7)
Lagerstroemia cuspidata Wall	Tabac	4.1 (3)
Tamarindus indica Linn	Ma khaam	4.1 (3)
Xylia Kerrii Craib & Hutch	Deng	4.1 (3)
Other		38.4 (28)
Total		100 (73)

Table 45. Species Actually to Make Charcoal

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Tamarindus indica Linn	Ma khaam	50.0 (5)
Shorea obtusa Wall	Teng	20.0 (2)
Irvingia malayana Oliver	Kabok	20.0 (2)
Mangifera indica Linn	Ma muang	10.0 (1)
Total		100 (10)
Khon Kaen:		
Shorea obtusa Wall	Teng	40.8 (29)
Shorea siamensis Miq	Rung	19.7 (14)
Barringtonia acutangula Gaertn	Jik	15.5 (11)
Xylia kerrii Craib & Hutch	Daeng	12.9 (9)
Tamarindus indica Linn	Ma khaam	2.8 (2)
Cratoseylon nerrifolium Kurz	Tiew	2.8 (2)
Other		5.7 (3)
Total		100 (71)
Chachoengsao:		
Irvingia malayana Oliver	Kabok	32.8 (20)
Mangifera indica Linn	Ma muang	8.2 (5)
Peltophorum pterocarpum Back. Ex Heyne	Nonsee	6.6 (4)
Xylia kerrii Craib & Hutch	Daeng	6.6 (4)
Streblus asper Lour	Khoi	4.9 (3)
Lagerstroemia cuspidata Wall	Tabac	3.3 (2)
Tamarindus indica Linn	Ma khaam	3.3 (2)
Pterocarpus macrocarpus Kurz	Pra du	3.3 (2)
Other		31.0 (18)
Total		100 (61)

Table 46. Species Still Available to Make Fences and Poles.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Bambusa arundinacea Wild	Phai	60.4 (29)
Shores obtusa Wall	Teng	18.8 (9)
Dipterocarpus tuberculatus Roxb	Yang	8.3 (4)
Other		12.5 (6)
Total		100 (48)
Khon Kaen:		
Shorea obtusa Wall	Teng	28.6 (22)
Barringtonia acutangula Gaertn	Jik	22.1 (17)
Xylia kerrii Craib & Hutch	Daeng	20.8 (16)
Shorea siamensis Miq	Rung	10.4 (8)
Bambusa arundinacea Wild	Phai	6.5 (5)
Other		11.6 (9)
Total		100 (77)
Chachoengsao:		
Bambusa arundinacea Wild	Phai	55.4 (31)
Pterocarpus macrocarpus Kurz	Pra du	7.1 (4)
Irvingia malayana Oliver	Kabok	5.4 (3)
Xylia kerrii Craib & Hutch	Daeng	5.4 (3)
Dialium cochinchinense	Klang	3.6 (2)
Other		23.1 (13)
Total		100

Table 47. Species Actually Used to Make Fences and Poles.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Bambusa arundinacea wild	Phai	41.1 (23)
Shorea obtusa Wall	Teng	21.4 (12)
Dipterocarpus tuberculatus Roxb	Yang	17.9 (10)
Xylia kerrii Craib & Hutch	Daeng	5.4 (3)
Shorea siamensis Miq	Rung	3.6 (2)
Other		10.6 (6)
Total		100 (56)
Khon Kaen:		
Shorea obtusa Wall	Teng	24.5 (12)
Bambusa Arundinacea Wild	Phai	22.4 (11)
Barringtonina acutangula Gaertn	Jik	20.4 (10)
Xylia kerrii Craib & Hutch	Daeng	18.4 (9)
Shorea siamensis Miq	Rung	6.1 (3)
Other		8.2 (4)
Total		100 (49)
Chachoengsao:		
Bambusa arundinacea Wild	Phai	58.6 (41)
Leucaena leucocephala De Wit	Kratin Thai	12.9 (9)
Vatica spp.	Phunjump	5.7 (4)
Pterocarpus macrocarpus Kurz	Pra du	4.3 (3)
Dipterocarpus tuberculatus Roxb	Yang	4.3 (3)
Mangifera indica Linn	Ma muang	2.9 (2)
Shorea siamensis Miq	Rung	1.4 (1)
Other		9.9 (7)
Total		100 (70)

Table 48. Species Available to Make Small Timber.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Dipterocarpus tuberculatus Roxb	Yang	76.0 (19)
Shorea siamensis Miq	Rung	8.0 (2)
Xylia kerrii Craib & Hutch	Daeng	4.0 (1)
Dipterocarpus tuberculatus Roxb Var	Tueng	4.0 (1)
Tectona grandis Linn F.	Sak	4.0 (1)
Bambusa arundinacea Wild	Phai	4.0 (1)
Total		100 (25)
Khon Kaen:		
Barringtonia acutangula Gaertn	Jik	27.3 (9)
Shorea obtusa Wall	Teng	21.2 (7)
Xylia kerrii Craib & Hutch	Daeng	15.2 (5)
Lagerstroemia cuspidata Wall	Tabac	9.1 (2)
Pterocarpus macrocarpus Kurz	Pra du	6.0 (2)
Other		21.2 (7)
Total		100 (33)
Chachoengsao:		
Lagerstroemia cuspidata Wall	Tabac	36.7 (11)
Dipterocarpus tuberculatus Roxb	Yang	33.3 (10)
Pterocarpus macrocarpus Kurz	Pra du	6.7 (2)
Other		24.4 (7)
Total		100 (30)

Table 49. Species Preferred for Small Timber.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Dipterocarpus tuberculatus Roxb	Yang	52.0 (13)
Shorea siamensis Miq	Rung	16.0 (4)
Pterocarpus macrocarpus Kurz	Pra du	8.0 (2)
Dipterocarpus tuberculatus Roxb Var	Tueng	8.0 (2)
Lagerstroemia cuspidata Wall	Tabac	4.0 (1)
Bambusa arundinacea Wild	Phai	4.0 (1)
Other		8.0 (2)
Total		100 (25)
Khon Kaen:		
Xylia kerrii Craib & Hutch	Daeng	45.5 (15)
Shorea obtusa Wall	Teng	24.2 (8)
Barringtonia acutangula Gaertn	Jik	12.1 (4)
Dipterocarpus tuberculatus Roxb	Yang	6.1 (2)
Other		12.1 (4)
Total		100 (33)
Chachoengsao:		
Lagerstroemia cuspidata Wall	Tabac	41.4 (12)
Dipterocarpus tuberculatus Roxb	Yang	24.1 (7)
Pterocarpus macrocarpus Kurz	Pra du	20.6 (6)
Other		13.9 (4)
Total		100 (29)

Table 50. Tree Species Used for Food

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Bambusa arundinacea Wild	Phai	68.8 (11)
Cratoseylon nerrifolium Kurz	Tiew	6.3 (1)
Other		24.9 (4)
Total		100
Khon Kaen:		
Bambusa arundinacea Wild	Phai	61.7 (50)
Leucaena Leucocephala De Wit	Kratin Thai	14.8 (12)
Cassia siamea Britt, &	Khee lek, &	11.1 (9)
Azadirachta indica Juss	Sadao	
Tamarindus indica Linn	Ma khaam	3.7 (3)
Other		8.7 (7)
Total		100 (81)
Chachoengsao:		
Leucaena leucocephala De Wit	Kratin Thai	55.6 (60)
Cassia siamea Britt, &	Khee lek, &	14.8 (16)
Azadirachta indica Juss	Sadao	
Bambusa arundinacea Wild	Phai	10.2 (11)
Sesbania grandiflora Desv.	Khae	5.6 (6)
Acacia pennata (L.) Wild	Cha-om	3.7 (4)
Cratoseylon prunifolium Kurz	Tae	2.8 (3)
Moringa Oleifera Lamk	Marun	1.7 (2)
Other		5.6 (6)
Total		100(108)

Table 51. Tree Species Used for Fodder.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Leucaena leucocephala De Wit	Kratin Yak	50.0 (1)
Mangifera indica Linn	Ma muang	50.0 (1)
Total		100 (2)
Khon kaen:		
Leucaena leucocephala De Wit	Kratin Thai	90.0 (9)
Sandoricum koetjape Merr	Kathon	10.0 (1)
Total		100 (10)
Chachoengsao:		
Streblus asper Lour	Khoi	66.7 (60)
Leucaena leucocephala De Wit	Kratin Thai	11.1 (1)
Mangifera indica Linn	Ma muang	11.1 (1)
Bambusa arundinacea Wild	Phai	11.1 (1)
Total		100 (9)

Table 52. Tree Species Commonly Found in Homestead Areas

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Mangifera indica Linn	Ma muang	68.4 (67)
Tamarindus indica Linn	Ma khaam	10.2 (10)
Euphoria longan Lour	Lumpyai	7.1 (7)
Dipterocapus tuberculatus Roxb Var	Tueng	1.0 (1)
Bambusa arundinacea Wild	Phai	1.0 (1)
Glochidion daltonii Kurz	Krie	3.1 (3)
Other		9.2 (9)
Total		100 (98)
Khon Kaen:		
Mangifera indica Linn	Ma muang	46.3 (37)
Tamarindus indica Linn	Ma khaam	15.0 (12)
Leucaena leucocephala De Wit	Kratin Thai	11.3 (9)
Annona squamosa Linn	Noyna	3.8 (3)
Bombox beiba Linn	Noon	3.8 (3)
Cocos nucifera Linn	Maprao	2.5 (2)
Other		17.3 (14)
Total		100 (80)
Chachoengsao:		
Mangifera indica Linn	Ma muang	54.4 (62)
Leucaena leucocephala De Wit	Kratin Thai	8.8 (10)
Tamarindus indica Linn	Ma khaam	8.8 (10)
Artocarpus lakoocha Roxb	Mahad	6.1 (7)
Bambusa arundinacea Wild	Phai	5.3 (6)
Streblus asper Lour	Khoi	1.8 (2)
Other		14.8 (21)
Total		100(114)

Table 53. Non-fruit Tree Species Commonly Planted on Cultivated Land.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Dipterocapus tuberculatus Roxb Var	Teng	29.0 (9)
Tectona grandis Linn	Sak	12.9 (4)
Xylia kerrii Craib & Hutch	Daeng	9.7 (3)
Syzygium spp.	Waa	9.7 (3)
Leucaena leucocephala De Wit	Kratin Thai	6.5 (2)
Bombax ceiba Linn	Noon	6.5 (2)
Bambusa arundinacea Wild	Phai	3.2 (1)
Other		22.5 (7)
Total		100 (31)
Khon Kaen:		
Shorea obtusa Wall		
Xylia kerrii Craib & Hutch	Daeng	25.2 (34)
Barringtonia acutangula Gaertn	Jik	9.6 (13)
Pterocarpus macrocarpus Kurz	Pra du	7.4 (10)
Other		47.4 (56)
Total		100(135)
Chachoengsao:		
Mangifera indica Linn	Ma muang	22.9 (17)
Peltophorum pterocarpum Back ex. Heyne	Nonsee	12.1 (9)
Hevea brasiliensis Wild ex. A Juss	Yangpara	9.5 (7)
Irvingia malayana Oliver	Kabok	9.5 (7)
Dipterocarpus turberculatus Roxb	Yang	9.5 (7)
Eucalyptus camaldulensis	Eucalyptus	6.8 (5)
Leucaena leucocephala De Wit	Kratin Thai	2.7 (2)
Other		27.0 (20)
Total		100 (74)

Table 54. Fruit Tree Species Commonly Planted on Cultivated Land.

Botanical Name	Local Name	Percentage (household)
Chiang Mai:		
Mangifera indica Linn	Ma muang	81.3 (78)
Cocos nucifera Linn	Maprao	6.3 (6)
Euphoria longan Lour	Lumyai	5.2 (5)
Tamarindus indica Linn	Ma khaam	4.2 (4)
Other		3.0 (3)
Total		100 (96)
Khon Kaen:		
Mangifera indica Linn	Ma muang	44.8 (30)
Tamarindus indica Linn	Ma khaam	43.3 (29)
Annona squamosa Linn	Noyna	4.5 (3)
Phyllanthus acidus Skeels	Mayom	2.9 (2)
Sandoricum koetjape Merr	Kathon	1.6 (1)
Other		2.9 (2)
Total		100 (67)
Chachoengsao:		
Mangifera indica Linn	Ma muang	58.8 (10)
Artocarpus beterophyllus Lamk	Khanoon	27.6 (3)
Tamarindus indica Linn	Ma khaam	11.8 (2)
Litchi chinensis Linn	Linchee	5.9 (1)
Other		5.9 (1)
Total		100 (17)

Table 55. Percentage of Households with Experience Growing MPTS Species and Reasons for Growing or not Growing MPTS.

	Chiang Mai	Khon Kaen	Chachoengsao
Ever Grow MPTS			
Yes	16.0 (16)	57.1 (60)	49.6 (57)
No	84.0 (84)	42.9 (45)	50.4 (58)
N	100	105	115
Reasons for Planted them			
For Fuelwood	12.5 (2)	6.7 (4)	22.8 (13)
For Charcoal	-	6.7 (4)	12.2 (7)
For Fodder	-	78.3 (47)	1.7 (1)
Sale	-	16.7 (10)	29.8 (17)
Other (consumption)	87.5 (14)	5.0 (3)	49.1 (28)
N	16	60	57
Reasons for not Planting Them			
No land	66.7 (56)	44.4 (20)	62.1 (36)
No Time	14.3 (12)	8.9 (4)	6.9 (4)
No Seedlings	6.0 (5)	13.3 (6)	10.3 (6)
Lack of Transportation	-	-	1.7 (1)
Lack of Labor	1.2 (1)	-	5.2 (3)
Never know that one could grow trees	21.4 (1)	-	5.2 (3)
Can find from natural sources	3.6 (2)	15.6 (7)	3.4 (2)
Other	14.3 (12)	22.2 (10)	15.5 (9)
N	84	45	58

Table 56. Percentage of Households Having Received Advice on Seedlings, Source of the Advice, Source of Seedling.

Most	Chiang Mai	Khon Kaen	Chachoengsao
Ever Received any Advice			
Yes	12.5 (2)	31.7 (19)	40.0 (23)
No	87.5 (14)	68.3 (41)	59.6 (34)
N	16	60	57
Source of Advice			
None	87.5 (14)	63.3 (38)	54.4 (31)
Forester	-	6.7 (4)	3.5 (2)
Extension worker	12.5 (2)	23.3 (14)	24.6 (14)
Other Government officer	-	5.0 (3)	14.0 (8)
NGO	-	1.7 (1)	3.5 (2)
Source of Seedling			
Forestry Officer	6.3 (1)	15.0 (9)	7.0 (4)
Private Nursery	6.3 (1)	-	8.8 (5)
Public Nursery	68.7 (11)	6.7 (4)	17.5 (10)
Neighbourhood	6.3 (1)	3.3 (2)	14.0 (8)
Other	12.3 (2)	75.0 (45)	52.7 (30)

Table 57. Preferred MPTS Species Among Farmers Who have Already Grown Trees.

Local Names	Scientific Names	Total
Chiang Mai:		
Eucalyptus	*Eucalyptus camaldulensis*	60.0 (3)
Kratin	*Leucaena leucocephala De Wit*	20.0 (1)
Makhaam	*Tamarindus indica Linn*	20.0 (1)
Total		100 (5)
Khon Kaen:		
Ma muang	*Mangifera indica Linn*	37.9 (14)
Eucalyptus	*Eucalyptus camaldulensis*	21.6 (8)
Phai	*Bambusa arundinacea Wild*	10.8 (4)
Kratin	*Leucaena leucocephala De Wit*	8.1 (3)
Kanoon	*Artocarpus heterophyllus Lamk*	8.1 (1)
Noyna	*Annona squamosa Linn*	2.7 (1)
Makhaam	*Tamarindus indica Linn*	2.7 (3)
Other		8.1 (3)
Total		100.0 (37)
Chachoengsao:		
Ma muang	*Mangifera indica Linn*	48.3 (14)
Eucalyptus	*Eucalyptus camaldulensis*	27.6 (8)
Yangpara	*Hevea brasiliensis Wild ex. A Juss*	10.4 (3)
Yang	*Dipterocarpus tuberculatus Roxb*	6.9 (2)
Padu	*Pterocarpus macrocarpus Kurz*	3.4 (1)
Phai	*Bambusa arundinacea Wild*	3.4 (1)
Total		100.0 (29)

Table 58. Seedling Information

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Adequacy of Seedlings: (percent)			
- Adequate	50.0 (8)	38.3 (23)	50.9 (29)
- Inadequate	43.8 (7)	43.4 (26)	29.8 (17)
- Never received	6.3 (1)	18.3 (11)	19.3 (11)
No. of Seedlings Received	23	23	558
Where Grown:			
- Tree Plot	-	5.0 (3)	7.0 (4)
- Plot Previously used for Crops	-	1.7 (1)	17.5 (10)
- Bunds, Fencing	12.5 (2)	23.3 (14)	28.1 (16)
- Home Plot	50.0 (8)	58.3 (35)	42.1 (24)
- Other	37.5 (6)	11.7 (7)	5.3 (3)
Transportation of Seedling:			
- Truck	6.3 (1)	6.7 (4)	26.3 (15)
- Locally Made Vehicle	-	1.7 (1)	1.8 (1)
- Hand Carried	81.3 (13)	60.0 (36)	47.3 (27)
- Other	12.5 (2)	30.0 (18)	24.6 (14)
Distance from Home to Plot (k.m.)	2.8	5.2	6.2
Family Labor Used (person-days)	1.4	1.6	1.7

Table 59. Type of Seedlings Received.

Unit: Percentage (Household)

Local Names	Scientific Names	Total
Chiang Mai:		
Eucalyptus	*Eucalyptus camaldulensis*	43.8 (7)
Kratin	*Leucaena leucocephala De Wit*	18.7 (3)
Sadao	*Azadirachta indica Juss*	12.5 (2)
Khae	*Sesbania grandiflora Desv.*	6.3 (1)
Other		18.7 (3)
Total		100.0 (16)
Khon Kaen:		
Ma muang	*Mangifera indica Linn*	37.5 (21)
Makhaam	*Tamarindus indica Linn*	16.1 (9)
Eucalyptus	*Eucalyptus camaldulensis*	14.3 (8)
Noyna	*Annona squamosa Linn*	5.4 (3)
Phai	*Bambusa arundinacea Wild*	7.1 (4)
Other		100.0 (56)
Chachoengsao:		
Eucalyptus	*Eucalyptus camaldulensis*	35.2 (19)
Ma muang	*Mangifera indica Linn*	31.5 (17)
Yangpara	*Hevea brasiliensis Wild ex. A Juss*	12.9 (7)
Kratin	*Leucaena leucocephala De Wit*	7.4 (4)
Yang	*Dipterocarpus tuberculatus Roxb*	3.7 (2)
Phai	*Bambusa arundinacea Wild*	1.9 (1)
Other		7.4 (4)
Total		100 (54)

Table 60. Reason for the Decision to Continue Growing Trees.

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Decision to Continue:			
- Yes	25.0 (4)	93.3 (56)	50.9 (29)
- No	50.0 (8)	7.7 (3)	33.3 (19)
- Not Sure	25.0 (4)	2.6 (1)	15.8 (9)
Total (N)	100.0 (16)	100.0 (60)	100.0 (57)
Reasons not to Continue:			
- Already have enough	16.7 (1)	-	29.4 (5)
- No more land	-	100.0 (3)	47.1 (8)
- Easily damaged	-	-	5.9 (1)
- Switch to other crops	83.3 (5)	-	17.6 (3)
Total (N)	100.0 (6)	100.0 (3)	100.0 (17)
Ever Felled Own Planted Tree:			
- Yes	6.2 (1)	8.3 (5)	10.5 (6)
- No	93.8 (15)	91.7 (55)	89.5 (51)
Total (N)	100.0 (16)	100.0 (60)	100.0 (57)

Table 61. Knowledge of Social Forestry and Perceived Benefits and Losses of Promoting MPTS Species on Public Land.

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Ever known about Social Forestry Program			
Yes	74.0 (74)	90.0 (94)	71.3 (82)
No	26.0 (26)	10.0 (11)	28.7 (33)
Losses			
No losses	76.5 (78)	86.2 (94)	78.8 (93)
Reduce grazing area	-	1.8 (2)	1.7 (2)
Reduce cultivation area	4.9 (5)	7.4 (8)	16.1 (19)
Other	18.6 (19)	4.6 (5)	3.4 (4)
Benefits			
More fuelwood	61.4 (70)	61.9 (73)	65.7 (88)
More fodder	0.9 (1)	6.8 (8)	0.7 (1)
Others	37.7 (43)	31.3 (37)	33.6 (45)

Table 62. Rank the F/FRED Priority MPTS Species

Unit: Percentage (Household)

	Chiang Mai	Khon Kaen	Chachoengsao
Eucalyptus camaldulensis	58.9 (43)	53.0 (53)	67.6 (69)
Leucaena leucocephala	26.0 (19)	20.0 (20)	7.8 (8)
Acacia auriculiformis	9.6 (7)	25.0 (25)	19.6 (20)
Acacia mangium	5.5 (4)	2.0 (2)	5.0 (5)
Total*	100.0 (73)	100.0 (100)	100.0 (102)

* Missing some households who did not know these four species.

Table 63. Farmers' Perception of the Most Important Benefits of Growing F/FRED Priority MPTS Species.

Unit: Percentage (household)

Most Important Benefit	Eucalyptus camaldulensis	Acacia auriculiformis	Leucaena leucacephala	Acacia mangium
Chiang Mai:				
Fuelwood	43.0 (43)	49.0 (49)	54.0 (54)	9.0 (9)
Charcoal	1.0 (1)	1.0 (1)	2.0 (2)	-
Timber	21.0 (21)	6.0 (6)	2.0 (2)	1.0 (1)
Fodder	-	3.0 (3)	6.0 (6)	1.0 (1)
Food	1.0 (1)	-	1.0 (1)	-
Sale	6.0 (6)	1.0 (1)	1.0 (1)	-
Do not know	28.0 (28)	40.0 (40)	34.0 (34)	89.0 (89)
Total	100.0 (100)	100.0 (100)	100.0 (100)	100.0 (100)
Khon kaen:				
Fuelwood	20.0 (21)	32.4 (34)	22.9 (24)	2.4 (13)
Charcoal	30.5 (32)	31.4 (33)	25.7 (27)	1.4 (12)
Timber	19.0 (20)	1.9 (2)	0.9 (1)	-
Fodder	-	9.5 (10)	21.0 (22)	4.8 (5)
Food	-	3.8 (4)	10.5 (11)	-
Sale	22.9 (24)	6.7 (7)	12.3 (7)	-
Do not know	7.6 (8)	14.3 (15)	6.7 (13)	71.4 (75)
Total	100.0 (105)	100.0 (105)	100.0 (105)	100.0 (105)
Chachoengsao:				
Fuelwood	17.4 (20)	33.0 (38)	19.1 (22)	8.7 (10)
Charcoal	13.0 (15)	29.6 (34)	13.0 (15)	3.5 (4)
Timber	17.4 (20)	3.5 (4)	1.7 (2)	0.8 (1)
Fodder	-	0.9 (1)	4.3 (5)	-
Food	0.9 (1)	-	0.8 (1)	-
Sale	36.5 (42)	13.9 (16)	7.8 (9)	6.1 (7)
Do not know	14.8 (17)	19.1 (22)	53.3 (61)	80.9 (93)
Total	100.0 (115)	100.0 (115)	100.0 (115)	100.0 (115)

Table 64. Rights to Use Trees on Community or Public Land.

Unit: Percentage (Household)

Rights to Use	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves:			
- Yes	95.0 (95)	83.8 (88)	87.8 (101)
- No	5.0 (5)	16.2 (17)	12.2 (14)
Lop Branches:			
- Yes	20.0 (20)	26.7 (28)	46.1 (53)
- No	80.0 (80)	73.3 (77)	53.9 (62)
Fell Trees:			
- Yes	15.0 (15)	1.9 (2)	27.8 (32)
- No	85.0 (85)	98.1 (103)	72.2 (83)
Can villagers from other village use tree in your village:			
- Yes	22.0 (22)	3.8 (4)	33.9 (39)
- No	78.0 (78)	96.2 (101)	66.1 (76)
Can villagers grow trees on public land:			
- Yes	12.0 (12)	27.6 (29)	28.7 (33)
- No	88.0 (88)	72.4 (76)	71.3 (82)
N	100	105	115

Table 65. Rights to Own or Us Trees on Other Private Lands.

Unit: Percentage (Household)

Rights to Use Tree	Chiang Mai	Khon Kaen	Chachoengsao
Rights to own trees on other private land?			
- Yes	5.0 (5)	1.9 (2)	5.2 (6)
- No	95.0 (95)	98.1 (103)	94.8 (109)
Rights to collect fallen branches/ leaves:			
- Yes	57.0 (57)	36.2 (39)	53.0 (61)
- No	43.0 (43)	63.8 (66)	47.0 (54)
Rights to lop branches:			
- Yes	6.0 (6)	12.4 (13)	14.8 (17)
- No	94.0 (94)	87.6 (92)	85.2 (98)
Rights to fell tree:			
- Yes	1.0 (1)	3.8 (4)	1.7 (2)
- No	99.0 (99)	96.2 (101)	98.3 (113)

Table 66. Rights to Use Planted Trees on Rented-in Land

Unit: Percentage (Household)

Rights to Use	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves			
- Yes	17.0 (17)	21.0 (22)	13.0 (15)
- No	83.0 (83)	79.0 (83)	87.0 (100)
Lop Branches:			
- Yes	8.0 (8)	17.1 (18)	10.4 (12)
- No	92.0 (92)	82.9 (87)	89.6 (103)
Fell Trees for Own Use:			
- Yes	1.0 (1)	11.4 (12)	8.7 (10)
- No	99.0 (99)	88.6 (93)	91.3 (105)
Fell Tree for Sale:			
- Yes	-	3.5 (8)	6.1 (7)
- No	100.0 (100)	96.5 (97)	93.9 (108)

Table 67. Rights to Use Trees Growing Wild on Rented-in Land.

Unit: Percentage (Household)

Right to Use Natural Trees	Chiang Mai	Khon Kaen	Chachoengsao
Fallen Branches/Leaves:			
- Yes	81.0 (81)	86.7 (91)	90.9 (104)
- No	19.0 (19)	13.3 (14)	9.6 (11)
Lop Branches:			
- Yes	14.0 (14)	49.5 (52)	53.0 (61)
- No	86.0 (86)	50.5 (53)	47.0 (54)
Fell Trees for Own:			
- Yes	3.0 (3)	24.9 (26)	39.3 (44)
- No	97.0 (97)	75.2 (79)	61.7 (71)
Fell Tree for Sale:			
- Yes	2.0 (2)	9.5 (10)	13.9 (16)
- No	98.0 (98)	90.5 (95)	86.1 (99)