I. INTRODUCTION

1.1 Statement of Problem

Rising pressures of population and resource use in the highlands make the establishment and maintenance of more productive and yet sustainable highland agricultural systems ever more necessary. This is particularly so for the upland farmers who form a part of the poor population in many developing countries (Charlton 1987). In examining some of the key components of sustainable agriculture, it is readily apparent that many lessons can be drawn from the great variety of traditional agricultural systems.

In Thailand, one of the primary resources is the forest-covered areas such as the Hill Evergreen Forest of the north. Various upland cultivation systems are practiced by the Thai and tribal people in these areas and one of them is the traditional forest-tea agroforestry system which is considered a permanent highland agricultural system.

Tea being cultivated in many places in the northern part of Thailand is indigenous and is to be found growing wild in many forests. This indigenous tea and the seeds from it have been used by the hilltribes and the local growers to develop their "tea gardens". This type of tea is *Camellia sinensis* which grows naturally in a very extensive area covering the mountains of Northeast India, Burma and Thailand (Figure 1).

Tea grows freely and apparently "wild" in North

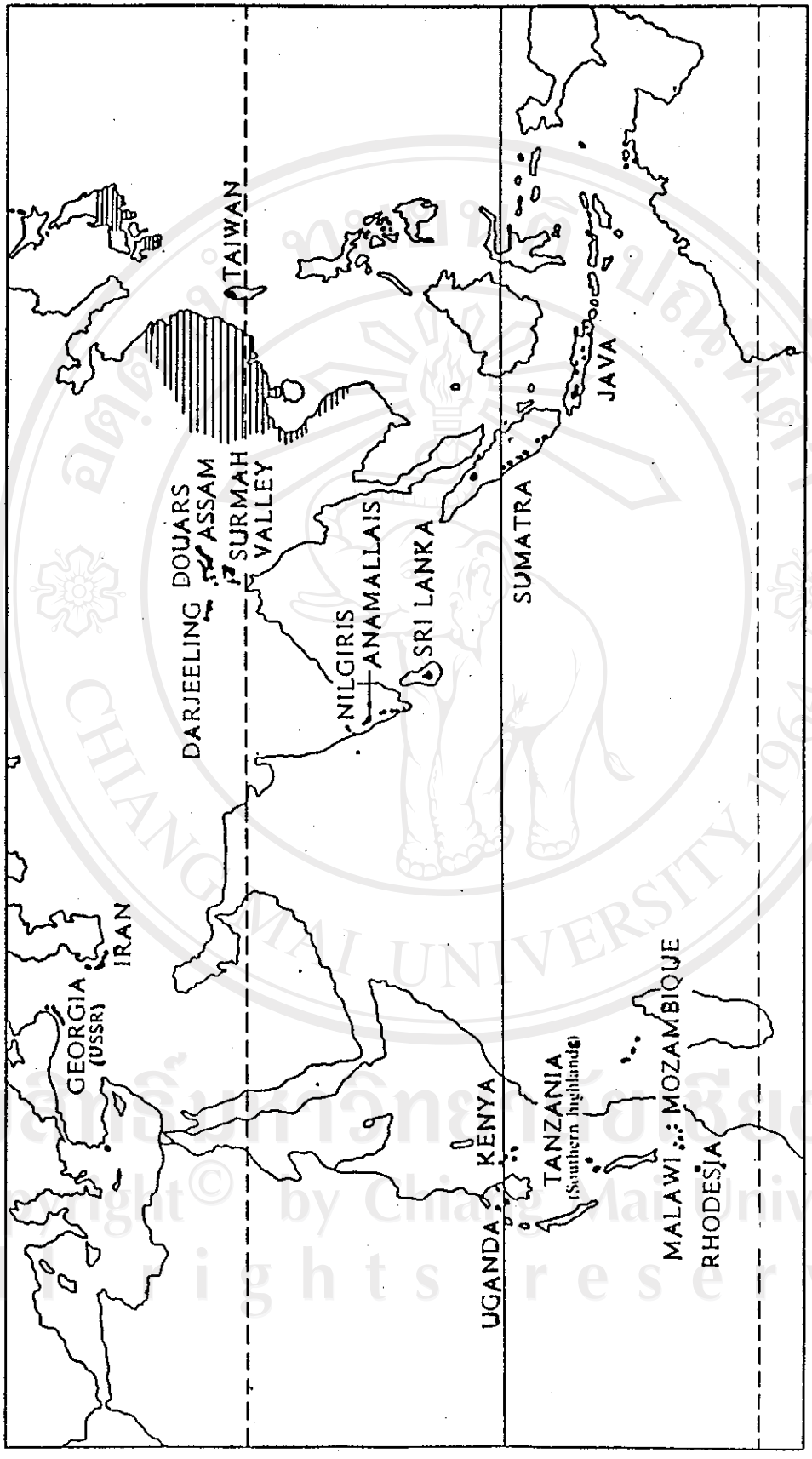

Figure 1. Map showing main tea growing areas (Eden 1976)

Thailand, but in the light of the very considerable migrations which have taken place in Southeast Asia over the last two generations, it is impossible to say for certain how far man has been responsible for its presence (Keen 1970). The plant is quite small, rarely more than five meters high, with large, smooth, shiny and slightly serrated leaves, bearing characteristics of both Assam and Cambodian strains (Eden 1976). Both soil and climate in North Thailand are suited to the needs of tea, as the growing rhythm induced by the wet and dry monsoons and the somewhat acid soils contribute to a flavour improvement (Harler 1964).

Since the past, the Karen, one of the many ethnic minorities in the northern highlands, and some northern Thai people (*Khon Muang*) have been cultivating tea in the hill evergreen forest (Figure 2) of Doi (mountain) Sam Mun and Doi Mon Ang Ket which are located in between the provinces of Chiang Mai and Mae Hong Son. These mountains, consisting of several watershed areas such as the Mae Loei Basin, Pang Khum Basin and Mae Sa Basin, are presently under the jurisdiction of the UN/Thai Sam Mun Highland Development Project[1].

The term "forest-tea" refers to tea naturally grown and

[1] This is a joint project by the United Nations and the Thai government (implemented by the Royal Forest Department) which aims at improving the quality of life among the hill tribes through the implementation of an integrated rural development project.

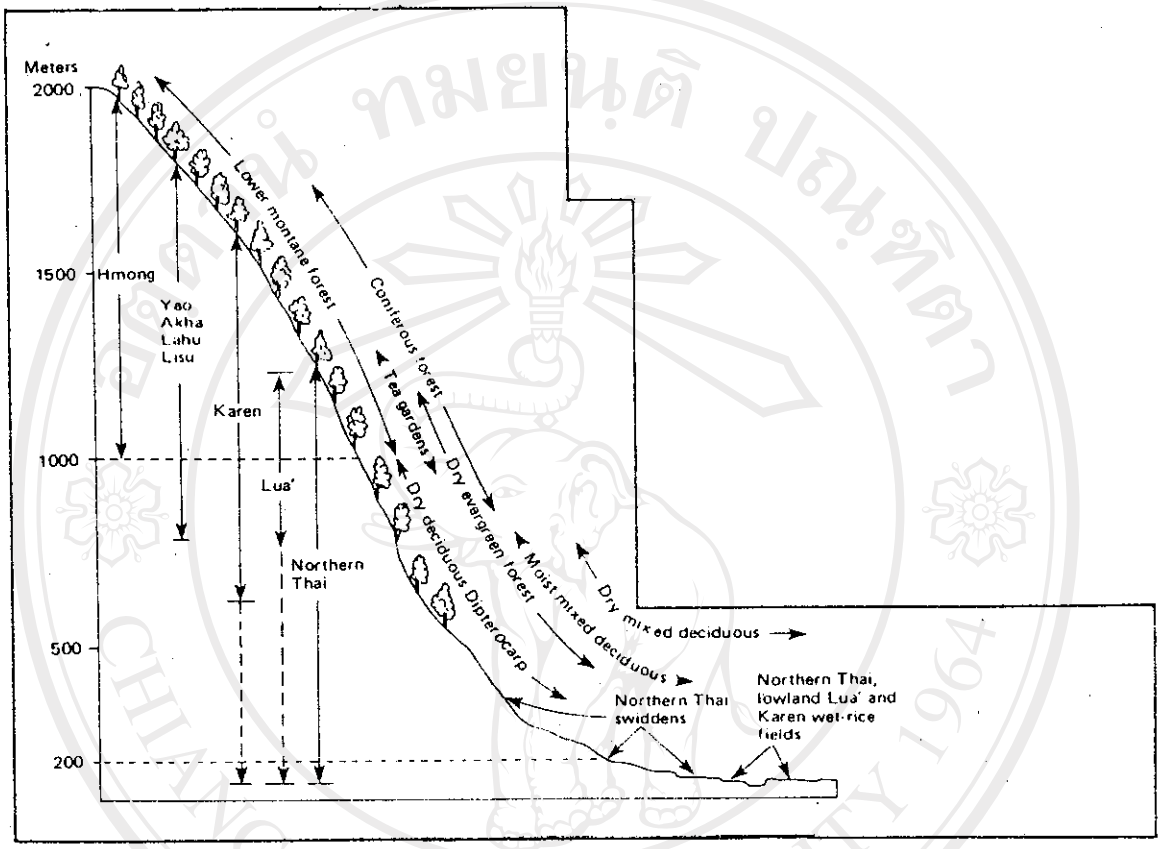

Figure 2. Land forms, land-use systems, and vegetation in northern Thailand (Kunstadter 1978)

now planted by the local people in the forest which is an agroforestry system and has been existing for about 100 years (Preechapanya: Personal Communication 1988). It has been the people's main source of income although the forest-tea production system is low productive (Keen 1970). There are two products derived from tea which are of value and importance - Chinese tea and fermented tea which is commonly known in the north as *miang*. Chinese tea is a deeply institutionalized drink while miang is consumed by both men and women in the manner of a social habit, like cigarette smoking, or beer drinking.

Miang, also called as "pickled" tea, is largely concentrated in the provinces of Chiang Mai, Chiang Rai, Mae Hong Son and Phrae. Its production is a traditional and strongly institutionalized operation. The customary method of establishing a miang orchard, at least in the past, has been simply to clear the forest from around already growing trees (Keen 1970).

For this study, the focus of the research will be on miang since the people of Ban Kui Tuai, the study area, are not mainly engaged in Chinese tea production. Most of the Chinese tea also are already commercially produced by private tea companies such as the Raming Tea Factory.

The Karen and the northern Thai population in the highlands are very dependent upon the production of tea (Table 1). For example, a study conducted by Oughton and Imong (1970) shows that for resettlement of hilltribes in Chiang Dao district, there were 30 villages of northern Thai people occupying uplands, with

Table 1 Percentage of Agricultural and Other Products Sold and Consumed by the Hilltribes, and Seasonal Labor Required

Product	Percent Sold	Percent Consumed	Labor Days Required	Percent of Work Year
Rice	10-	90+	105	36
Corn, millets	0	100	15+	5
Peppers	60+	40-	18+	6
Opium *	85+	15-	65+	24
Potatoes, yams	5	95	5	2
Tea (miang) **	90+	10	50+	17+
Fruits	10	90	10	4
Vegetables	5	95	7	3
Spices	30	70	5	2
Swine	10-50	50-90	25+	10+
Cattle	50+	50-	10+	4+
Poultry	5	95	15+	5+
Nuts	80	20	3-5	2
Mushrooms	10	90	1	-
Wild yams	0	100	1-10	3+
Wild vegetables	0	100	1-5	1+
Wild meats	5+	95-	10-60	4+
Barks, herbs	20	80	1-10	2+
Orchids	100	0	2+	1-
Beeswax	10	90	2+	1
Honey, larvae	40	60	2+	1-

* Applies only to opium growing tribes, i.e. Meo, Lisu, Yao, etc.

** Applies only to tribes working wild tea tracts, i.e. Htin, Karen, Kha Mu.

Source: Young (1962)

a total of 2,416 people. Of these, 24 villages comprising 1,382 people were almost wholly dependent on miang for their livelihood (Table 2 & 3).

One disadvantage of 'miang' production is that the *miang* steaming process consumes quite a big number of firewood (Khemnark, *et al.* 1971). With increase in tea production, there is a high demand for firewood which causes the expansion of forest areas cut. Here, the common forest tree species such as the Quercus species which are the dominant ones and mature trees are cut for firewood. Thus, the demand for firewood eliminates the best forest specimens and also the trees that are important as suppliers of seeds for the future (Keen 1972). A study by Keen (1969) in Ban Pang Ma O can be used as a specific evidence for the depletion of forest by a miang village[1].

There is also another evidence discovered by Khemnark, *et al.* and the Tribal Center (1970) that most of the timbers from the hill evergreen forest were used not only for firewood in miang production but also for household cooking.

The total demand for firewood comes from three major sources: the household energy consumption which will increase when its population increases; demand for energy to produce miang; and demand for energy for other productions. As a consequence,

[1] Ban Pang Ma O is a well-established village of 36 families set in a steep mountainous country in Amphoe Chiang Dao, 19 km. from Chiang Dao town. About 85 percent of the village land is actually in miang orchards; the remainder is forest land in the steepest gullies.

Table 2. Individuals Supported by Various Occupations at Nikhom Doi Chiang Dao

	Ethnic Group							
	Upland Thai		Lowland Thai		Tribal		Total	
Main Occupation	No.	%	No.	%	No.	%	No.	%
Miang growing	1,382	75.9	–	–	–	–	1,382	40.9
Opium growing	–	–	–	–	596	63.6	596	17.6
Wage labor	379	20.8	104	16.8	19	2.0	502	14.9
Swiddening	34	1.9	158	25.5	263	28.1	455	13.5
Irrigated cropping	–	–	332	53.6	8	0.9	340	10.1
Plantation culture*	19	1.9	10	1.6	46	4.9	75	2.2
Government employment**	6	0.3	13	2.1	–	–	19	0.6
Trading	1	0.05	2	0.3	5	0.3	8	0.2
Totals	1,821		619		937		3,377	100.0

Source: Oughton and Imong, (1970)

* Mixed garden and tree crops, supplemented by livestock and swiddening

** Includes Royal Irrigation employees and school teachers.

Table 3. Villages in Doi Chiang Dao Hilltribe Settlement (Nikhom)

Ethnic Group	No. of Vil.	Village Size: Alti. (ms.) Mean	Households: Total No.	Households: Mean per Vil.	Persons: Total No.	Persons: Mean per Vil.	Main Cash Economy (No. of Vil.)	Vil. Age Mean
Northern Thai	30	807	490	16.3	2,416	80.5	miang(24) wet rice(4) labor(2)	26.7
Blue Meo (Hmong Njua)	3	1,200	61	20.3	462	120.7	opium(3)	11.7
Lahu Nyi	3	1,000	28	9.3	163	54.3	opium(3)	7.0
Northern Thai/ Lahu Nyi	1	900	5	5.0	29	29.0	miang	15.0
Lahu Na	1	900	30	30.0	200	200.0	plantation	15.0
Lahu Sheleh	1	1,100	14	14.0	81	81.0	opium	5.0
Skaw Karen	1	700	6	6.0	26	26.0	wet rice	8.0
Totals	40		634		3,377			

Source: G.A. Oughton, and Niwat Imong, "Nikhom Doi Chiang Dao: Resources and Development-Potential Survey Report 2: Village Location, Ethnic Composition, and Economy," Chiang Mai, Tribal Research Center, June, 1972.

availability of firewood is declining.

Aside from these, the forest-tea production system has other long-term detrimental effects. One effect is that, according to the Chiang Dao Resources and Development Survey (1969), fifty-seven percent of the households in the twenty- six miang villages contained within the area of the Chiang Dao Nikhom have moved into these villages in the last ten years; and while many of these families consist of only a young couple, they represent a rate of increase in miang village population greater than the national average, and much of the increase is in the working age group on arrival. Keen (1970) noted that it was most probable that the ratio of producers to consumers was increasing; which implied a future decline in per capita income for the producers, and a corresponding need for alternatives.

Another immediate threat to the forest-tea production system lies in other economic prospects. Previous sample studies indicated that population growth in the industry is far above the national average, at over 5% per annum from migration alone, during the last decade, 1960-1970 (Kunstadter 1978). The rapid population growth may be expected to cause maladjustment between the supply and demand levels for miang and hence, falling in prices. Some of the product may be unsaleable, a serious matter where the majority of the producers are already living at base subsistence levels. In this situation, the people might be forced to seek alternative forms of land-use and are likely to turn to swiddening as the only known alternative within their

technological and economic capability (Kunstadter 1978).

According to the various issues mentioned, the following questions could be addressed:

1. What are the social, economic and ecological interrelationships existing in the forest-tea production system?
2. What are the estimated demand for firewood under the present structure of socio-economic activities, i.e., the forest-tea production system?
3. What are alternative combinations of economic activities that could make the system sustainable and conserve natural resources and are also conformable to its social structure?

The results of this study can serve as the basis for policy makers in solving the problems of the highlands particularly, the forest-tea production system. With these, agroecosystem development measures can be carried out in the form of economic and social development in the rural areas in conjunction with environmental development known as "Ecodevelopment" involving the use of plans for natural resources development, ensuring non-destruction of the environmental balance because it generally helps rural development and in turn helps the people in their efforts to preserve economic and natural balances, including development of fauna and plants that are essential for mutual existence, resulting in the stability of the environment

and the economy of the hilltribes and the northern Thai people.

This could be proven sustainable if a careful study on the system's interactions will be worked out, thus, assisting the policy makers in resolving the problems of the highlands in the north. It is therefore important that a sustainable forest-tea production system be developed - one which produce good results economically, a system which could normally lasts a long time and at the same time, improve environmental conditions. And, developing of such sustainable system would depend on the social conditions and culture of the people.

1.2 Objectives

1. To identify and understand the key relationships existing in the forest-tea production system, the forest and the people as well as the villagers' tree cut practice.
2. To investigate the villagers' demand for firewood and other wood uses.
3. To determine and analyze the social, economic and ecological factors which influence the sustainability of the forest-tea production system.
4. To explore alternative measures that would make the forest-tea production system more sustainable given the key factors and their relationships.

1.3 Literature Review

1.3.1 The Tea Plant (*Camellia sinensis*)

Harler (1964) accounted the geographical distribution of the tea plant covering extensive areas of Asia's uplands. East and West it has been found from Assam to the Southern hills of Eastern China along latitude 29 N approximately, while from Northeast Burma at about longitude 98 E, it spreads southward through Yunan, the Shan States of Burma, North Thailand and Laos, down to Cochin, China in what is now called South Vietnam. From these origins, tea has been taken to many parts of the world including Africa, Southern India and South America, where it has long maintained popularity, mainly as a beverage.

He further added that present day studies of tea originated from these primary types; the China variety which is small leafed and bushy, the Assams - large glossy leafed, and the Cambodian type with long, narrow turned-up leaves, commercial strains of tea, and even many "wild" types are hybrids of these basic plants.

Keen (1978) stated that *"tea grows freely and apparently "wild" in Northern Thailand, but in light of the very many human migrations have been taking place over the last two or three millenia, it is impossible to say for certain how far man has been responsible for its presence"*. He described it as a plant which grows up to five meters high and has large, smooth, shiny, and

slightly scented leaves, bearing characteristics of both Assam and Cambodian strains.

Van Roy (1971) characterized *Camellia sinensis* var. *assamica* (the tea bush) as a native to Northern Thailand. He further said that :

"Today, *miang* (or tea) groves are found growing "wild" in the highland jungles. Whether there are natural biotic communities or the offspring of long-abandoned garden can not be answered. Whatever their origins, they often serve as the nuclei around which upland Thai villages are formed. Clearing the jungle growth from around such a grove is one way in which a peasant may enter the industry. The alternative is clearing suitable land and planting tea seed or seedlings, which take five years and more to mature to producing age. The investment of time and energy in such a venture is formidable for the ordinary Thai peasant, whose economic time horizon in his risk-laden environment and peasant- oriented society is ordinarily limited to weeks and months rather than years and decades."

For those Thailand people who migrated from the lowlands to the highlands, they just occupy an area in the forest where miang gardens are abundant. Keen (1978) related that the customary method of establishing a miang orchard, at least in the past, has been simply to clear the forest from around already growing trees. He said that an "orchard", may be only a walking path, perhaps twenty feet wide, cut through the forest for several hundred meters, wherever the tea trees may be growing.

1.3.2 **The Forest and Tea as a Highland Agroforestry System**

Since there has been no study on the agroforestry systems in the highlands in northern Thailand, Preechapanya, *et al.* (1985) conducted a research on 30 agroforestry systems to determine the degree of suitability of each system with the different biophysical and social conditions existing at high altitudes in the northern region; particularly on watershed development areas. In the analysis, the 30 agroforestry systems including the forest-tea system, were classified into three groups: 1) Agroforestry systems suitable for highlands; 2) Agroforestry systems requiring adjustments for highlands suitability; and 3) Agroforestry systems not suitable for highlands. The classification was based on three factors: durability, acceptability and benefits. Results showed that the forest-tea agroforestry system was rated with overall high mark of 7 which makes it as one of the 11 agroforestry systems highly suitable in the highlands (Appendix A & B).

Preechapanya, *et al.* described each classification as follows:

1) **Agrofoestry systems suitable for highlands**

This system must be capable of utilization over a long period of time intrinsically, and with the environment. It must be capable of increasing farmer's income, and it should be acceptable to the farmer. The agroforestry system includes backyard gardening systems and forest-agriculture systems such as *Camellia sinensis* with the Hill Evergreen Forest (forest- tea), coffee with

leucaena leucocephala and others;

2) **Agroforestry system requiring adjustments for highland suitability**

These systems give economic benefits which are moderate, that is, they give an income of about 3,501 baht per rai per year. If they are better managed and improved to give long-term benefits and acceptance from the farmers themselves. In essence, these systems should become suitable for use in the highlands. They can be developed and utilized efficiently in the watershed areas. Adjustments for highland suitability includes conservation of soil and water, assistance to the farmer in terms of money and knowledge. Such agroforestry systems are coffee with *Rancis kesiya, Acacia omnimaliformis* with lemon, etc.; and

3) **Agroforestry system not suitable for highlands**

Some of the agroforestry systems not suitable for the highlands include *Oryza sativa Linn.* with *Melia azedaroch Linn.*, range management with dry dipterocarp forest and swidden farming system. The said systems were rated for their local collection, longetivity, acceptance and production, and efforts to improve their productivity were found to be not worthwhile in terms of labor and investment.

1.3.3 Economic History of Miang

References on miang in northern Thailand have been mentioned as early as 1890 (Van Roy 1971). According to Van

Roy, miang consumption was investigated by Lilian Curtis (1903), Reginald le May (1926), and Frik Seiderfacler (1958), who were early Western visitors to Thailand. Such scattered remarks indicate that miang production, distribution, and consumption were well established in Burma and Thailand when first noticed by Western adventurers during the eighteenth and nineteenth centuries. Keen (1978) explained the miang production process.

Van Roy also found that Thai peasants during the early times have forsaken Thai lowland villages to spend a new life in the hills because of more economic opportunities. This is especially true if the demands of the government became too great and then, the farmer had only to escape to the forest and clear new lands. In the hills, the traditional wet-rice agricultural techniques of the Thai peasants proved unproductive. The sole alternative was frequently miang production.

An alternative theory of the economic history of miang has been developed by Frank le Bar (1967). Four Austroasiatic hilltribes - the Khmer and T'in of North Thailand and Laos produce and consume miang. Because various processes in miang production (steaming, storage and fermentation) and consumption are similar to Austroasiatic traditions, Le Bar infers "*that miang production may well have originated among these tribes, that the lowlanders long acquired the fininshed product for their own consumption through a widespread pattern of quasi politico-economic exploitation of their tribal neighbors, and the Thai peasants have themselves only recently turned to its production as*

population pressures have mounted in the valleys."

In "The Record" (1922), it describes the most telling proof of the traditional importance of miang in northern Thai economy which is the first hand evidence gathered by a 1920-1922 botanical survey (sponsored by the Ministry of Commerce) of the dispersion of "miang villages" in the North. The article stated that the cultivation of miang in Siam seems to be wholly confined to that portion of the country north of latitude 18 (roughly, the North), but within that area, the cultivation is widespread. It was also mentioned that the statement was confined by a map published by the survey group showing clusters of miang villages scattered throughout the hills along the North's four major rivers.

Past surveys of potential tea-growing areas in the North identify a number of locales in which miang cultivation continues. Campbell (1963) indicated that a comparison of these sites with those discovered by the 1920-1922 survey shows a high degree of consistency. He added that miang village clusters of the 1920s, have continued apparently undisturbed into the present.

A study by the Nikhom Doi Chiang Dao Reservoir and Development Survey (1969) revealed that in terms of people and land, miang production is the major tree crop economy of upland Chiang Mai Province, even perhaps of the northern hills if forestry itself is exempted. For example, in the area of 211 m^2 set aside for resettlement of hill tribes in Amphoe Chiang Dao, there were (in October 1969) 30 villages with Khon Muang

people occupying the uplands, a total of 2,496 people. Of these, 26 villages comprising 1,880 people were almost wholly dependent on miang for livelihood.

The future of the traditional miang is said to be deteriorating dimmer. Oughton and Niwat (1971) discussed the increasing problems among (tea) growers in the Chiang Dao area of Chiang Mai Province, as indicated by the low return from labor, decreasing availability of land in the hills, and high land rents in the hills. Keen (1978) found out that the market for miang appears to be declining due to lack of popularity with the younger generation. He added that population pressure has resulted in an increase in the number of miang farmers thus, causing the market to a possible over supply.

HASD (1988) presented another problem in miang production. It was said that both miang and green tea have a large labor requirement and the ability of the family to provide their own labor seems to be an increasing problem. This was further supported by studies of Van Roy (1971) and Pitackwong (1988) in which the system of miang production is labor intensive.

Furthermore, miang production requires quite large amounts of firewood and this is contributing to the decline in forest areas (TRC 1970, Khemnark, *et al.* 1971, Keen 1978, HASD 1988, and Preechapanya 1988). It was said that, it takes the most common species, and owing to the traditional system of letting informal contracts for the cutting of trees with some maturity. In this way, the firewood demand eliminates the best forest specimen, and

also the trees which are important as supplies of seeds for the future.

1.4 Research Methodology

1.4.1 Data Collection

The research study employed two main survey methods - Rapid Rural Appraisal (RRA) and a formal questionnaire survey. For RRA, there were three techniques used in order to achieve a comprehensive understanding of the complex issues and relationships under study. These were: 1) direct observation, 2) physical measurement, and 3) semi- structured interviewing. Not only RRA was employed to achieve the main purpose of the study, but its findings were also used to revise the questionnaire so that the survey questions became increasingly concise, and non-sensitive. On the other hand, the formal questionnaire survey was used primarily to collect selected quantitative data.

The RRA work was carried out four four consecutive weekends before the formal questionnaire survey. The information from the RRA was used to organize important topics and subtopics on the forest-tea production system and refine questions for the questionnaire. A pretest was then carried out and throughout this process, questions were regrouped and reorganized. The final version of the questionnaire was used in the formal survey which employed two enumerators. The survey covered 26 respondents composed of all 26 households in the study area.

1.4.1.1 **Objective 1**

An initial understanding of the forest-tea production system must be developed and this was done by reviewing existing sources of information. Thus, available literature and other sources of information on the secondary data such as climate, soil types, topography as well as maps and transects were collected and examined. Aerial photos and topographic maps of the study site were also used to note rapid changes in topography and natural conditions especially that the site is situated on rugged terrains. Specifically, the bio-physical data of the study area were mostly acquired from the UN/Thai Sam Mun Highland Development Project (UN/Thai SMHDP) located at the Watershed Development District office under the Royal Forest Department, Chiang Mai. In addition, more data were obtained from the RMDP (Resource Management and Development Project) office. Preliminary data particularly on the history, culture and the livelihood system of the northern Thai people and the Karen were acquired from the Faculty of Social Science and the Tribal Research Center of Chiang Mai University.

1.4.1.2 **Objective 2**

The three RRA field methods and the formal survey were employed. To examine the demand for firewood as well as other demand for wood, direct harvesting of tea leaves, the processing of miang, on the general scarcity or abundance of tree and other

forest resources and tea within the study area, on the density and species of trees in the hill evergreen forest. In addition, this method helped in determining the sizes and conditions of firewood/fuelwood sources currently exploited by the village since this might affect the availability of fuelwood and its exploitation; patterns of fuelwood acquisition (in terms of distance travelled, timing, method and responsibility) which might reflect both the availability of nearby sources and adjustments to it; and usage of fuelwood in cooking and other household and village activities.

Photos in the form of color slides were used to document the forest tea production systems activities such as the harvesting of tea leaves, miang processing and the market of miang.

The direct but simple measurement (RRAFM 2) is the second technique that was used to determine the size and volume of fuelwood (per household) in processing miang and other demand for wood (e.g. cooking, etc.).

The semi-structured interviewing (RRAFM 3) of the villagers including miang merchants and consumers was employed to collect the vast majority of the field data. There were two types of individuals to be interviewed - the individual respondents and the key informants. Individual respondents include rich and poor villagers based on the size of landholdings particularly tea gardens and the assets they have. Key informants were asked about the operations of the broader systems (i.e. neighbor villages,

projects, lowlands, etc.). Such informants include the tea garden owners, government officials, miang merchants, and agricultural extension agents.

To investigate the villagers' tree cutting practice, both the semi-structured interviewing and the formal questionnaire survey were practiced. Moreover, the following subtopics were noted: 1) firewood acquisition (wood sources, species of trees preferred, time of collecting firewood), 2) firewood usage (miang processing, cooking and other usages of firewood), 3) decision-making in collecting firewood, and 4) attitude of the villagers towards tree cutting.

The formal questionnaire survey was used after the semi-structured interviewing to obtain certain quantitative, and statistically more precise information such as on the size and volume of firewood used for each household and the amount of tea leaves collected every year.

During the course of the field work, a research assistant was employed to assist the researcher in collecting data and to act as translator as the villagers mostly speak the northern Thai language. There were also two persons who were hired to help in the formal questionnaire survey.

1.4.2 Data Analysis

1.4.2.1 Objective 3

To determine and analyze the social, economic and ecological factors which influence the sustainablity of the forest-tea production system, existing secondary data and documents were summarized. Those field data gathered from the three RRA techniques and the results of the formal survey questionnaire were combined with the secondary data in analyzing the system.

An understanding of the dynamic interactions between the socio-economic as well as cultural and biophysical factors was looked into. The existing major components involved are tea, the forest, the people (i.e. Karen, Khon Muang, merchants) and the environment. Economic interactions simply meant that the tea, forest and the cattle each supply part of the farmers' needs; or could involve for example, tea being the main source of income through the selling of its product in the form of fermented tea. Factors such as human population pressure, availability of labor or exchanged labor and accessibility and proximity of market sources played in this interaction.

Some ecological interactions discovered by the researcher were also present in such interactions. The trees cut in the forest provide firewood used for miang production. There is an important connection among the tea, the forest and the livestock. The grasses present in the area were being eaten by the cows while

cows provide manure for tea plantation. Shade from trees was available for the cows which helps them in reducing tension and helps in their growth process.

On social interactions, some were on labor utilization and interrelationship of the landless and the rich tea farmers; engagement of the roles of the landless and poor farmers in firewood supply management; the marketing of tea products wherein the local Thai people sell them in the lowlands and to the miang merchants; migration of the lowlanders to the highlands, etc.

Mixed interactions involving the socio-economic and biophysical factors which were included descriptively are: effects of forest destruction to the soil, the lowlands, vegetation, people; effects of high rate of population to demand for firewood, land, tea, etc.

Data processing and management were made using Lotus 1-2-3. Transformed data were inputted to SYSTAT program for analysis of frequency distribution and cross tabulation. Regression analysis was used in determining the significance of relationship between age and volume of the fast-growing species using the ESP program.

1.4.2.2 **Objective 4**

Alternative solutions were identified based on the analysis of the forest-tea production system with special reference to the key factors and their relationships.

1.4.3 A Brief Methodological Note

The succeeding paragraphs discuss the advantages as well as the limitations of using RRA experienced by the researcher.

Rapid Rural Appraisal (RRA) is defined as: a study used as the starting point for understanding a local situation; carried out by a multidisciplinary team; lasting at least from days but not more than three weeks; and based on information collected in advance, direct observation and interviews where it is assumed that all relevant questions can not be identified in advance (Beebe 1985).

One of the characteristics of RRA is that it is carried by a multidisciplinary team. In other words, RRA can not be done by one person (Beebe 1985). Altough the research study is carried out by the researcher himself for his masteral thesis, the author employed a three-man team composed of a sociologist and anthropologist (the researcher's research assistant), a forester (from RFD) and the researcher himself during the RRA field work.

The sociologist and the forester work as a researcher for the Research Management and Development Project of the Faculty of Social Science at CMU and is chief of the Agroforestry section of the UN-Thai SMHDP under the Watershed Office of the RFD, respectively. Since the study area has but under these two projects for three years, both members have been familiar not only with the area but also with the villagers especially for the sociologist who had conducted surveys for RMDP. This sociologist

assisted in the construction of the questionnaire because of her knowledge in miang production of the village. She also acted as a translator especially during the semi-structured interviewing. Her ability to speak the northern dialect used in the village made the informal interview illuminating thus allowing the researcher to acquire more information such as on the villagers' tree cutting practice and miang production as well as the attitude of the villagers towards tree cutting. On the otherhand, the forester provided information on the existing forest situation and its problems in the area.

Throughout the research process, the author consulted with his interdisciplinary thesis committee composed of an agricultural economist, a sociologist and anthropologist, a forest ecologist and a soil scientist. The difficulty of dealing with the research in the agricultural systems context was eased out mainly by these experts which started from framing the very key questions which have good combination of socio-economic and ecological questions to the analysis stage.

There was one limitation which the author has encountered during the research which is the language. The interviews would have been more effective in communicating with the villagers if the author understands the language well enough to be more accurate with the interpretation of the data.

1.5 Village Profile of Kui Tuai

1.5.1 Physical Characteristics

1.5.1.1 Topography

Ban Kui Tuai, the village selected as a study site for this thesis research (Figure 3), is located in the northern hills at the altitude between 800-1,300 meters above sea level (A.S.L.), and lies approximately 75 kilometers to the northwest of the provincial capital of Chiang Mai, in the district (amphoe) of Mae Taeng, subdistrict (Tambon) of Pa Pae (Figure 4). It is about two kms. away from Ban Lao Pa Han in the east, five kms. from Ban Pang Khum in the southwest and five kms. from Ban Pang Ma O in the north. The site covers a total area of 17.07 km^2 or 1,067.36 rai approximately between latitude 5° - 8° north and longitude 64° - 68° east. Agroecologically, it is classified as a forest-tea production system of the Mae Loei Watershed/Basin (Figure 5). The hierarchical setting of Ban Kui Tuai is shown in Figure 6.

The village of Kui Tuai has an undulating topography. It is situated within the Mae Loei Basin which contains the Hill Evergreen Forest dominated by the *Quercus* species with tea plants scattered among them. The shape of the village is like a very narrow bowl in which the village proper is located at the lowest point of two adjoining mountains. The feature makes what this village is named after. The term *kui* means a narrow shape and *tuai* refers to a small bowl used for putting soup. This is the reason

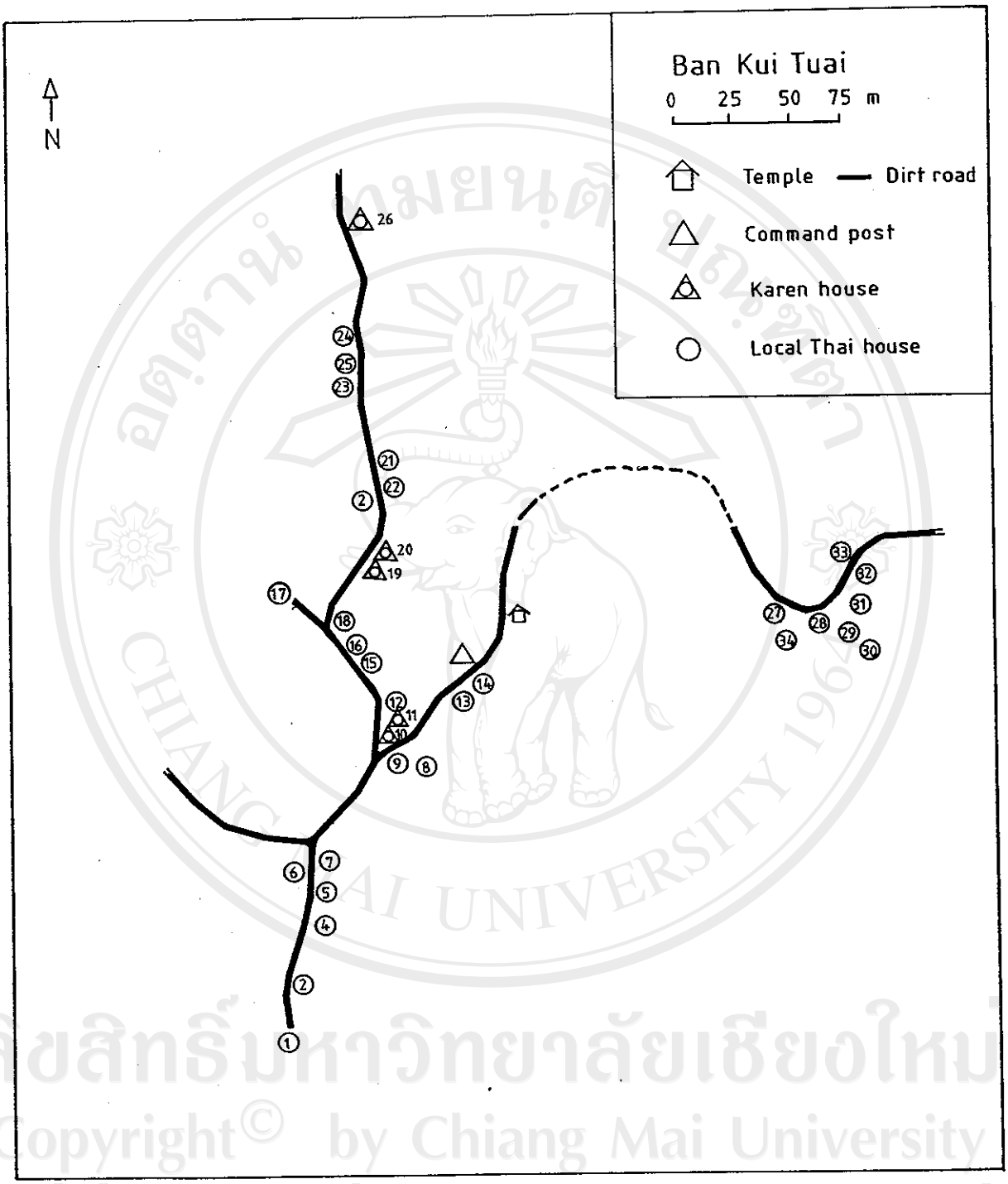

Figure 3. Village map of Ban Kui Tuai (RMDP 1989)

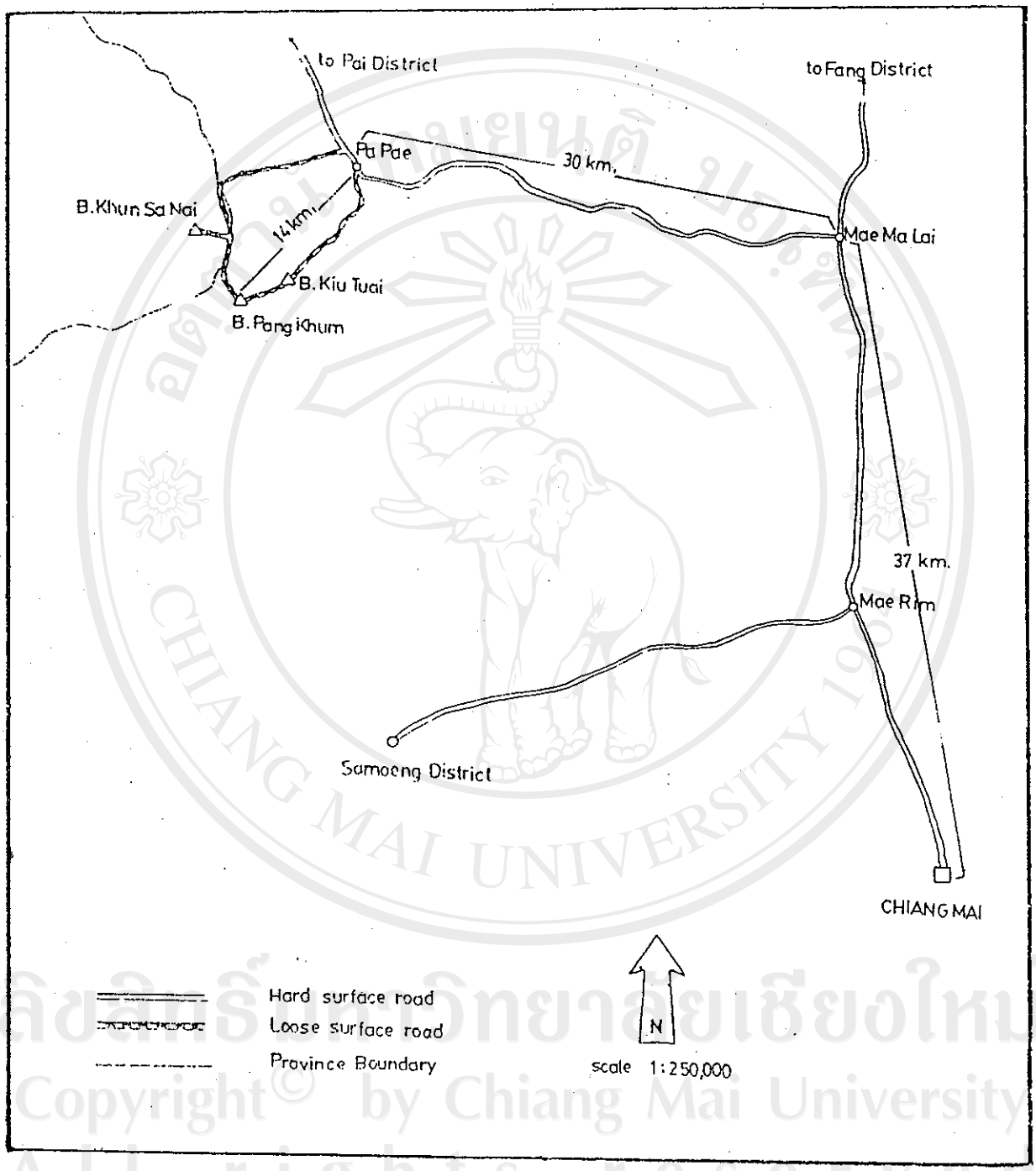

Figure 4. Road map from Chiang Mai to Ban Kui Tuai (RMDP 1989)

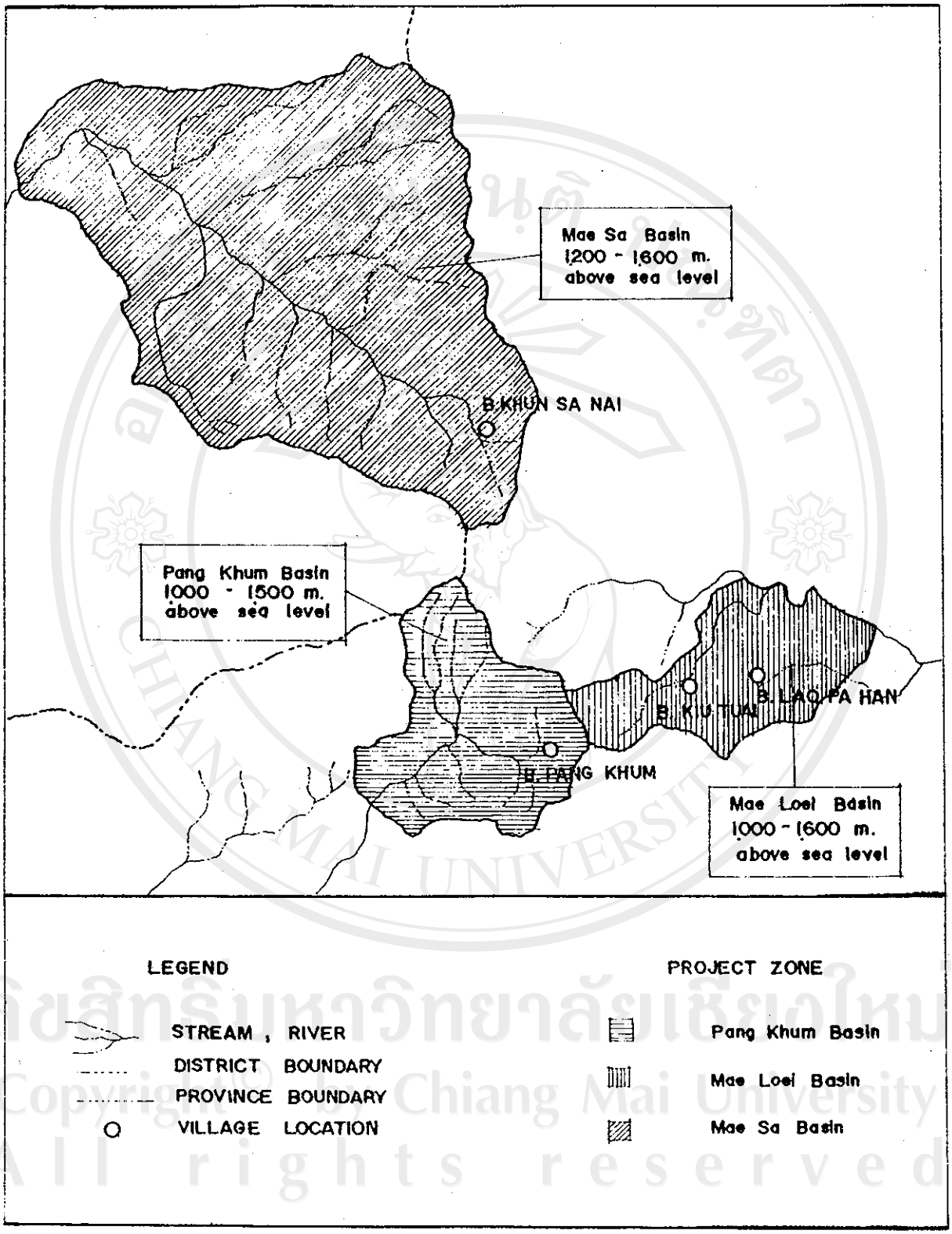

Figure 5. Sketch map of Mae Loei Basin (RMDP 1989)

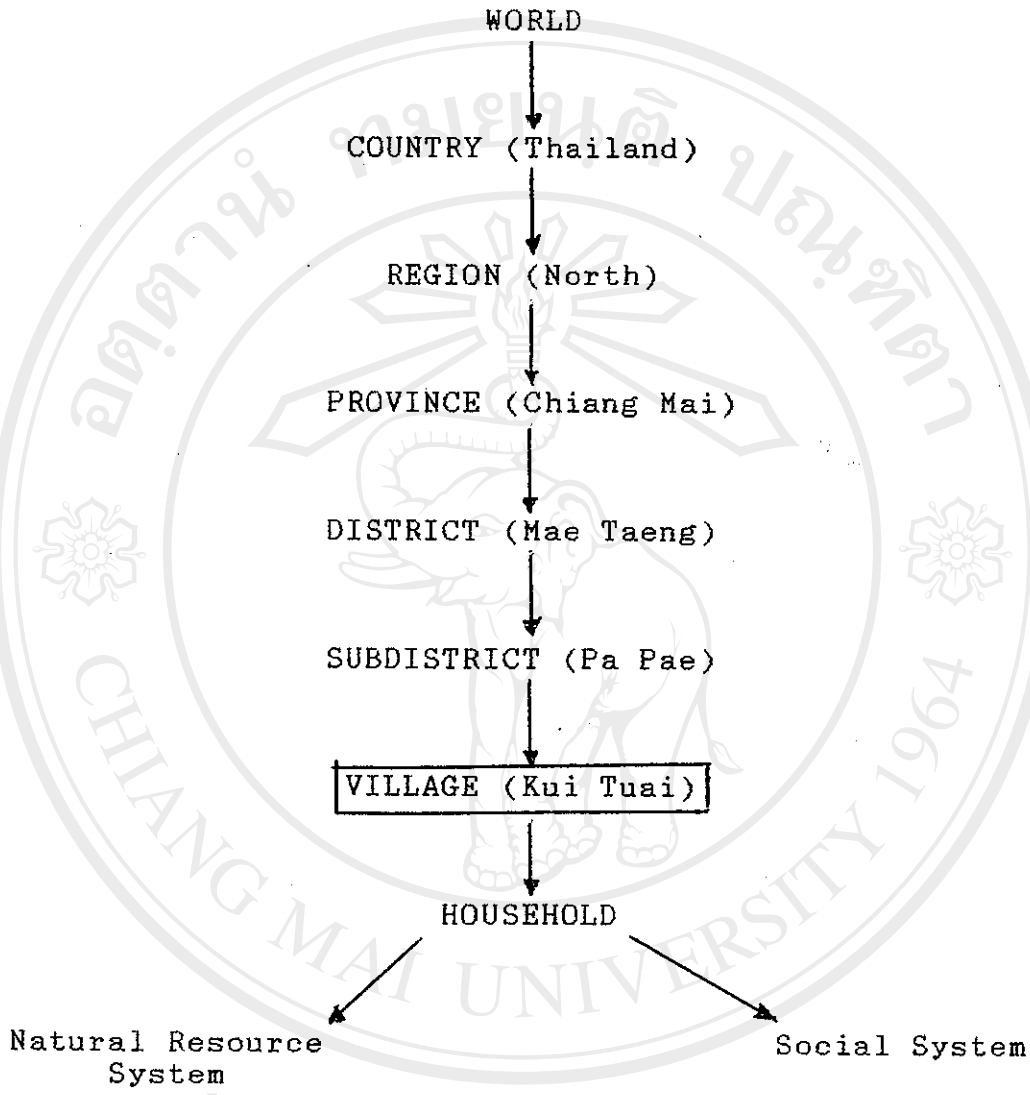

Figure 6. Hierarchical setting of Ban Kui Tuai

why this village is named *Kui Tuai*.

1.5.1.2 **Soil**

Generally, the soil is loose to sticky, mixed with sand. It is classified as red-yellow podzolic and grey podzolic Great Soil Group on the parent materials of granite, sandstone, shale and gneiss on the geologic structure of northwest continental highland.

The slope is estimated between 12-85% and mean slope about 44%.

1.5.1.3 **Climate**

The climate is characterized by two seasons: summer, March to September, and winter, October to February. Summer and wet season are influenced by south-west wind, and winter by northeast wind. For climatic data, please refer to Table 5.

1.5.1.3.1 **Rainfall**:

The average annual rainfall measured at Watershed Development Unit 1 (Tung Jor), Mae Taeng District, Chiang Mai, is 1,536 mm. with the maximum 293.9 mm. in September and no rain in February and March. Total number of rainy days is 128 days with maximum of 23 days in June, July and August.

Table 4. Summarized climatic data of Tung Jaw Forest Watershed Development Unit as recorded during June 1980 to May 1983

Month	Rainfall (mm.)			Temperature (C)					Relative Humidity (%)	Wind Velocity (km/hr)	Evap. (mm)
	Ave. Rainfall	Max. rain/day	Ave. no.of rainy days	Ext. Max.	Ext. Min.	Ave. Mean	Ave. Max.	Ave. Min.			
Jan.	7.0	15.2	1	18.0	0.5	9.2	13.5	4.9	44.0	29.6	114.0
Feb.	0.0	0.0	0	22.0	4.0	12.8	18.3	7.3	33.1	45.8	156.5
Mar.	0.0	0.0	0	22.5	6.0	15.9	21.9	10.0	34.4	49.9	210.5
Apr.	62.9	28.0	7	28.5	5.0	16.5	21.9	11.1	38.7	47.4	191.8
May	236.9	51.0	16	25.0	8.0	15.7	20.5	10.9	46.1	37.4	215.5
Jun.	227.9	37.0	23	19.0	9.0	13.2	16.4	10.0	55.7	32.5	199.9
Jul.	253.6	50.5	23	21.0	8.5	13.5	16.8	10.2	57.3	45.0	127.7
Aug.	230.9	44.0	23	20.0	8.5	13.5	16.4	10.5	57.0	47.1	99.6
Sep.	293.9	67.0	18	20.0	8.5	13.9	17.1	10.6	53.7	32.0	96.5
Oct.	146.4	29.0	10	21.0	8.5	13.6	16.9	10.2	49.6	20.1	94.9
Nov.	58.6	38.0	5	19.5	4.0	12.2	15.8	8.5	49.9	15.2	76.0
Dec.	17.9	36.2	2	25.0	1.0	9.0	13.6	4.4	44.6	18.8	77.2
Total	1536.0	-	128	261.5	71.5	159.0	209.1	108.6	564.1	420.8	1660.1
Ave.				21.8	6.0	13.3	17.4	9.1	47.0	35.1	138.3

Source: Yoda (1988)

1.5.1.3.2 **Temperature:**

Mean annual air temperature is 13.3 °C with extreme maximum 28.5 °C in April and extreme minimum 0.5 °C in January. The average extreme maximum and minimum were 22.0 °C and 6.0 °C, respectively. Daily differences between maximum and minimum air temperature ranges from 10 to 24 °C.

1.5.1.3.3 **Relative Humidity:**

Humidity has an average of 47% with maximum in July at 57.3% and minimum in March at 33.1%.

1.5.1.3.4 **Wind Velocity:**

The mean annual wind velocity is about 35.1 km./hr. with the maximum in March (49.9 km/hr) and minimum in November (15.2 km/hr.).

1.5.1.3.5 **Evaporation:**

The average annual evaporation is 1,660.1 mm., with maximum of 215.5 mm. in May and minimum of 76.0 mm. in November. Average daily evaporation is approximately 4.6 mm.

1.5.1.4 **Vegetative Cover**

A clear natural forest type, the Hill Evergreen Forest, occurs within the locality of Kui Tuai village. It is composed of

Oaks (*Quercus* spp.) and False Chestnut (*Castanopsis* spp.). Of the forest tree species, *Lithocarpus calathiformis* and *Schima wallichii* are the most widespread. Species of tea (*Camellia sinensis*) are dominant in the area which are planted in between the forest trees. Patches of bamboo occur throughout the forest, but seem to be more widespread in lower elevation areas. At low sloping areas, there are some agricultural areas such as wet rice and upland rice, corn, coffee, taro, mango and other fruit trees. Denuded areas are found sparsely with the coverage of Ya Ka (*Imperata* sp.), Ya Khon (*Coelorachis striata*) and Sarb Sue (*Eupotorium odoratum*).

1.5.2 **Social-Demographic-Economic Profile**

1.5.2.1 **History**

Ban Kui Tuai was established approximately a hundred years ago. A number of the Karen tribe used to stay in the area before but some have migrated already leaving four households at present. The oldest Karen (85 years old) has stayed in this village since 1950 (Table 6).

Apparently, people from the lowlands and uplands or the local Thais (about 3 families) moved to the village site between 1955 and 1960 and over time, immigration and population growth has expanded this to the current level of 26 households. These people came from different districts of Chiang Mai Province such as ones

Table 5. Number of households migrating within each 10-year range & their reasons, 1950-1988

Year	No. of HHs			Sub-	Reason[1]			
	Karen	Local Thai		Total	LA	EO	FD	M
1941-1950	1			1		1		
1951-1960		3		3	2	1		
1961-1970	1	7		8	5	2	1	
1971-1980	2	4		6	2	3	1	
1981-1988[2]		8		8	2	2	3	1
Total	4	22		26	11	9	5	1

1 There were four reasons for migrating to Kui Tuai: 1) LA - land availability, 2) EO - economic opportunity, 3) FD - family decision, and 4) M - marriage.
2 Latest year of migration

Table 6. List of districts of Chiang Mai Province where migrants come from (Descending order)

District	No. of HHs
Mae Taeng	11
Chiang Dao	5
Chomtong	4
Samoeng	3
Mae Rim	2
Fang	1
Total	26

shown in Table 6. There are four reasons for migrating to Kui Tuai stated by the respondents with land availability as the most stated followed by economic opportunity, family decision and married as the least stated (Table 5).

The village was formerly planted with large areas of opium. However, since the Thai government started implementing the eradication of opium fields, its cultivation was stopped. This is the reason why the village used to have a military post.

1.5.2.2 **Population**

The population structure is shown in Tables 7 & 8. At the time of the survey, there were 99 persons with 26 households. Fifty-four (54.5%) are males and 45 (45.5%) are females. So far, there has been no major migratory events since 1988.

1.5.2.3 **Social Structure & Religion**

Kui Tuai comes under the control of a headman who is based in a nearby village, Pang Ma O. The leadership situation in the village is somewhat confusing since the headman is seldom around. Based from the interview with the village headman, Ban Pang Mao O was composed of two other neighboring villages 14 years ago which are Ban Kui Tuai and Ban Mae Kai. He became headman since then. In 1987, the district of Mae Taeng divided Pang Ma O into the three villages - Ban Pang Ma O, Ban Kui Tuai and Ban Mae Kai. At present

Table 7. Population & size of households

Village	No. of HHs	Pop'n.	Ave. Size of HHs
Kui Tuai			
(Local Thai)	22	83	4
(Karen)	4	16	3.8
Total	26	99	-

Table 8. Kui Tuai villagers by sex and age, 1990

	Actual	Percentage (%)	Ave./HH
Sex Classification			
Male	54	54.54	2.07
Female	45	45.45	1.73
Total	99	100.00	-
Age Classification			
0 - 11	28	28.28	1.07
12 - 55[1]	63	63.63	2.42
> 55	8	8.08	0.30
Total	99	100.00	-

[1] Labor force is defined as persons between 12-55 years.

present, he heads these villages. The village of Kui Tuai is mostly run by an assistant village headman who is the younger brother of the village headman.

Kui Tuai is composed mainly of ethnic Thai (Local Thai or Khon Muang) and some Karen. Of the 26 households, four are Karen with 16 persons. The rest are Local Thais (Table 8). From the formal survey, 23 households are Buddhists while the other three do not have any religion. There is one temple in the village headed by a monk.

1.5.2.4 **Household Structure & Labor**

The family size ranges from 3 to 8 with the average around 4 persons for all households in general which is relatively higher than the Thai average of 5.6. For the local Thais, the average household size is 4 while that of the Karen is 3.8 persons (Table 7). The rate of population increase of Ban Kui Tuai is 0 - 1% during the last four years. A population projection was made by World Bank (1980) that the annual growth rate from 1975-1990 in the northern region is 1.3% (natural increase) and 1.6% with migration (Table 9).

The classification of population by age group indicates that 28.28 percent of the population is under 11 years of age. The labor force (12-54 years old) comprises only 63.63 percent of the population. The rest of the population (= or > 55) consists of 8.08 percent.

Table 9. Projected population of the northern region of Thailand

Region	(1975 to 1990) Projected Annual Growth Rate (%)	
	Natural increase only	With migration
North	1.3	1.6

Source: Thailand: Toward a Development Strategy of Full Participation, World Bank, 1980.

Agricultural labor force, however, as officially defined by the Ministry of Agriculture and Cooperatives includes population aged more than 11. The actual labor force should thus be larger than what appears in Table 8 considering the fact that children who already reach the age of 11 (in fact even younger) and some are not attending school usually provide additional labor in many agricultural activities as well as performing many domestic tasks. Many elderly villagers interviewed in the RRA study who are presently in their early 60's and early mid-70's classified themselves as full time farmers. Some also assist in taking care of working animals and preparing food for the family and the neighbors in case of exchange labor. Taking all these into account, it is likely that the real labor force is greater than 63 percent of the population in Ban Kui Tuai.

1.5.2.5 **Land Ownership & Tenure**

It is very difficult to determine the extent of individual holdings accurately. In most cases, the information given by the villagers was only the area currently being cropped and no accurate information could be gathered.

No one in the village has legal title to the lands be it a tea garden, paddy field or an orchard. However, certain forms of land-use rights were given to the villagers, namely: *Sor Kor Neung, Por Bor Tor* 5 and *Por Bor Tor* 6 (Table 10A).

Form S.K. 1, known as *Sor Kor Neung,* is the former

certificate of land occupancy, issued before the promulgation of the 1954 Land Code. The S.K. 1 certificate cannot be transferred although it can be inherited. Holders must obtain a [1]N.S. 3 document.

Form P.B.T. 5, known as *Por Bor Tor Ha*, is a receipt of tax payment paid by a villager who occupies any piece of land. The taxes are paid to the Ministry of Interior the municipality (der Meer 1982).

Form P.B.T. 6, known as *Por Bor Tor Hok*, is also the same as P.B.T. 5, except that P.B.T. 6 was imposed recently.

Based from the interview of a key informant who is an agricultural extension officer for two years in Kui Tuai, the certificates were issued in 1974 by the district office of Mae Taeng.

All landowners in the village have certificates of land-use rights except that not all of their lands are accounted for these certificates. Table 10A shows that 16 or 100% of the landowners have received certificates. For the 16 miang garden owners, all of them were issued certificates, 10 or 90.90% for the paddy field owners, 8 or 72.72% for the orchard owners. For the other lands, owners do not have certificates. At present, there are 27 certificates issued: S.K. 1 - 8, P.B.T. 5 - 3, and P.B.T. 6 - 16.

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1 Form N.S. 3, known as *Nor Sor Saam*, or exploitation testimonial. This certificate is not transferrable, and can be obtained by the holder of a N.S. 2 certificate after a survey showing that 75 percent of the land has been brought under cultivation.

In looking at land tenure in Ban Kui Tuai, there are three groups of villagers who are to be considered: miang owners, non-miang owners and the landless. Miang owners not only include "owning" tea gardens but also paddy fields, orchards and others. Non-miang owners are those who "own" lands except tea gardens. For the landless, they are the ones who do not own any land at all.

For those "landowners", 53.84 percent are miang owners with 231 rai, 42.30% are paddy field owners with 40 rai, 42.30% have orchards with 48 rai, and 15.38% own other lands with 4 rai. The average landsize holdings per household for each landuse is as follows: tea garden - 16.5 rai, paddy field - 4.44 rai, orchard - 5.33 rai and others - 1.33 rai. For all land-uses, the average landsize holdings per household is 20.1 rai. It appears that the maximum landholding is about 78 rai while one of the poorest farmers has one rai.

Table 10A shows that 61.53% of the farmer households "own" lands at an average of 16.5 rai per household while 38.46% are landless who rent miang gardens mostly from large miang landowners. The rate of the rent could reach up to 2000 Baht for 3 rai. For those villagers who cannot afford this amount would work for the landlord himself for a certain time based on an agreement. For example, a villager who rents a land would give half of the harvest of miang leaves to the miang garden owner in exchange for cash for the whole year.

During the semi-structured interview, there were two households who claimed that each of them cannot account for the

lands that they have because they own vast tracts of land. Both of them said that they own a *doi* or a mountain. In the case of [1]Uy Dee, the first time she arrived in the village, she bought the land from a Karen who used to stay there before for a long time, for just a very cheap price of 100 Baht for one mountain 26 years ago.

Another case is that of the oldest woman in the village, Uy Tep, who is 78 years old and settled in Kui Tuai for the past 44 years. The Karen sold the miang gardens to her because of an epidemic present in the area which is . She said that the epidemic was caused by the presence of Japanese soldiers during World War II. Other local Thais bought many miang gardens and rice fields at a low price of 100 Baht.

The villagers have acquired these lands in three different ways: 1) buy the land, 2) inherit the land, and 3) clear the land. Of the 14 landowners, 2 bought the land, 3 inherited the land, 6 cleared the land, and 3 bought and cleared the land (Table 11). The lands were bought from the Karen tribe who used to stay in the village for a long time. For those who inherited the land, the villagers got them from their relatives in the area. For the last way of acquiring lands, the villagers claim that they own the land because they cleared by themselves.

1 Uy (grandmother) Dee who is 68 years old is the mother of the village headman and the assistant village headman.

Table 10A. Land tenure & ownership in Ban Kui Tuai

	Land-Use							
	Miang Garden		Paddy Field		Orchard		Others*	
	No.	%	No.	%	No.	%	No.	%
No. of HHs								
Miang owners	12	46.15	9	34.62	9	34.62	3	11.54
Non-miang "			2	7.69	2	7.69	1	3.85
Total	12	46.15	11	42.31	11	42.31	4	15.38
Area (rai)								
Miang owners	245	66.58	66	17.93	38	10.33	5	1.36
Non-miang "			5	1.36	10	2.72	6	1.63
Total	245	66.58	71	19.29	48	13.04	11	2.99
Ave. landsize holdings	26.29		7.88		5.33		2.75	
Min. area/HH	2		2		1		1	
Max. area/HH	61		20		8		5	
Tenure Status								
S.K. 1	4		2		2			
P.B.T. 5	1		0		2			
P.B.T. 6	6		6		4			
Subtotal	11		8		8			
Total	27 certificates (owned by 14 HHs)							

* Includes taro, chilli & corn

Table 10B. Summary of landholdings in Ban Kui Tuai

	No. of HHs	%	Area (rai)	%
Landowners				
Miang owners	12	46.15	347	94.29
Non-miang owners	2	7.69	21	5.71
Subtotal	14	53.85	368	100
Landless	12	46.15		
Total	26	100	368	100

Note: Average landsize holdings for all land-uses in Ban Kui Tuai = 26.29 rai

Table 11. Means of acquiring land

No. of HHs	Means of Acquiring Land
2	bought the land
3	inherited the land
6	cleared the land
3	bought and cleared the land

1.5.2.6 **Farming System**

1.5.2.6.1 **Cropping Pattern:**

Miang production is the main occupation of the people although there are also crops grown in the village such as wet rice, upland rice, taro, chilli, corn and some vegetables (carrots, radish, cabbage, ginger, squash, *pakad kuantung*, *makuakua*). All of these crops are used for the villagers' subsistence or home consumption. Land-use allocation for these crops are presented in Table 12 & Figure 7. For fruits and vegetables, refer to Table 13.

Wet rice is planted within the period of May to August and the harvesting takes place from September to November. The season for upland rice is from May to October. The average yield per rai is about 500 kg. The planting and harvesting activities of rice falls between the hot season and wet season. Sometimes, a number of small frogs and crabs are found in paddy fields which are usually collected by the children.

Taro which is planted by only one household is planted in February and harvested in September. For Chilli, the planted season is during the months of October and November while harvesting is March or April. During hot season, corn is planted in May and harvested in August. The cool season for vegetables starts from December to May. The cropping pattern is shown diagrammatically in Figure 8.

Table 12. Land-Use of Ban Kui Tuai

	Miang Garden	Paddy Field		Orchard						Others		Tot-tal
		Wet	Upl	Man	Cor	Lyc	Cof	Jap	Pum	Taro	Chi	
rai	245	58	13	10	7	5	17	5	4	2	2	368

Note: Wet - wet rice, Upl - upland rice, Man - mango, cor - corn, lyc - lychee, cof - coffee, Jap - Japanese apricot, Pum - pummelo, chi - chilli

Table 13. Fruits and vegetables grown in the village

Fruits		Vegetables	
Common Name	Scientific Name	Common Name	Scientific Name
Jap. Apricot	*Prunus mume*	Ginger	*Zingiber officonale* Roscoe
Mango	*Mangifera indica*	Taro	*Colocasia esculenta*
Lemon	*Limon citrus*	Corn	*Zea mays*
Jackfruit	*Artocarpus hetero-phyllus*	Chilli	*Capsicum* spp.
Passion fruit	*Passiflora* spp.	Pumpkin	*Cucuzbita moschata*
Pummelo	*Citrus maxima* Merr.	Cabbage	*Brassica oleracea* L.
Coffee	*Coffea arabica*	Tomato	*Lycopersicon escul-entum*
Lychee	*Litchi chinensis*	Garlic	*Allium sativum* L.
		Onion	*Allium cepa* L.

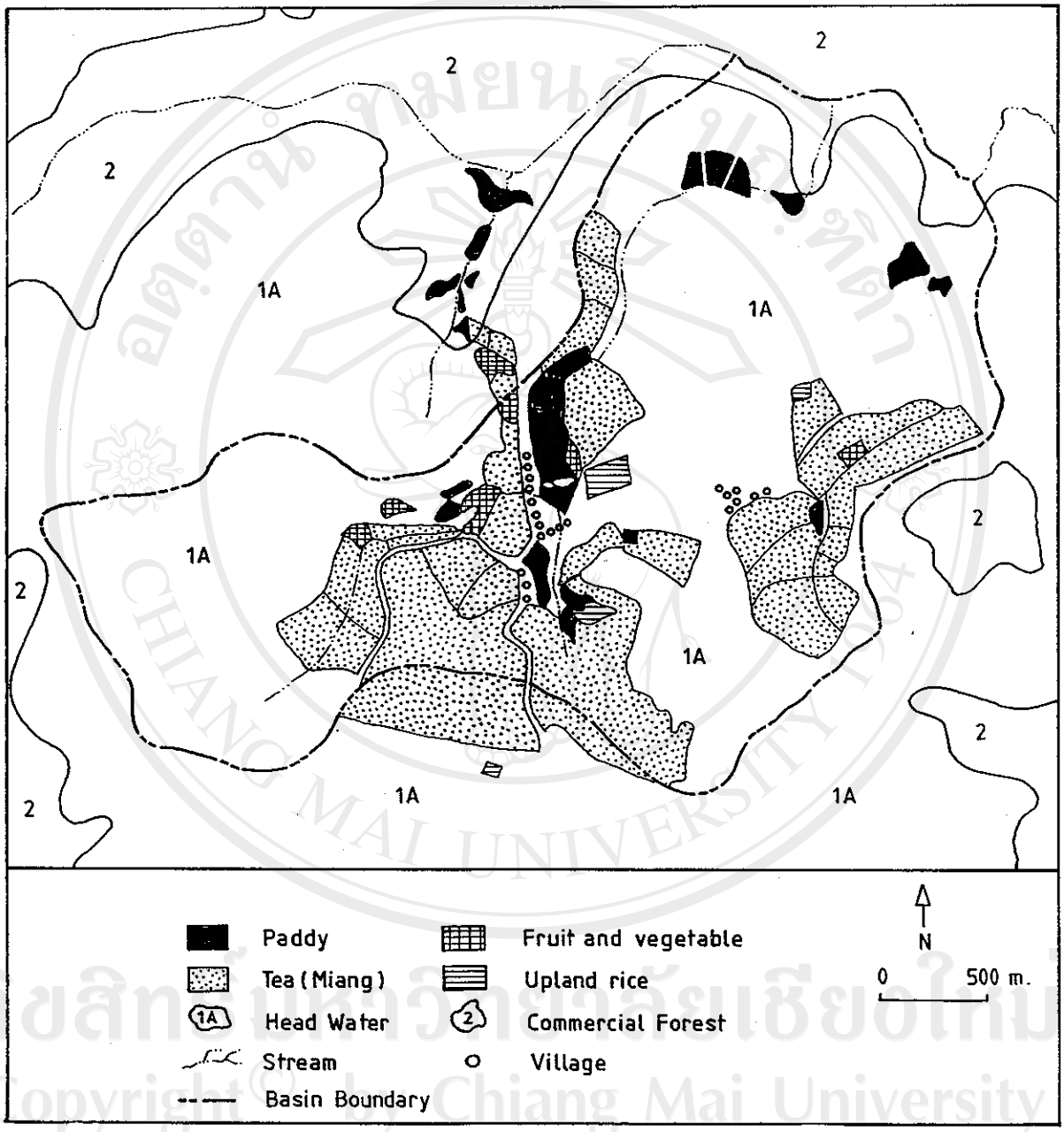

Figure 7. Land-use map of Ban Kui Tuai (RMDP 1989)

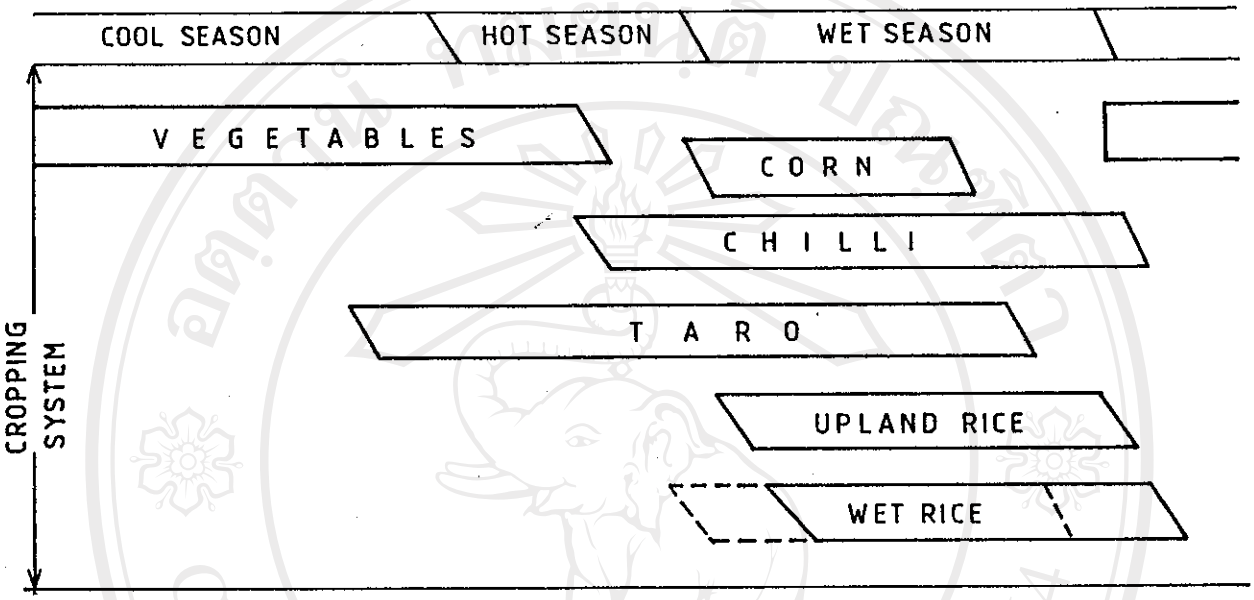

Figure 8. Highland cropping schedules of Ban Kui Tuai

There are no inputs such as fertilizers and pesticides applied to any crop. Inspite of this fact, there has been no problem with crops concerning pests and diseases.

1.5.2.6.2 *Animal Raising*

Animals raised by the villagers are cattle, pigs, chicken and water buffaloes with populations at 180, 42, 75 and 13, respectively. More detailed statistics are shown in Table 14.

Cattle and water buffaloes are usually raised as farm animals. They are used for ploughing and transporting. However, they are sold and replaced by young ones. Of the 26 households, about 46 percent or 12 households own cattle with an average of 15 heads per household. Cattle are used both for sale and for home use. When they are not in use or after the agricultural crops are harvested, these animals are grazed in a controlled manner in the forest from one place to another. At the onset of the rainy season, they are kept in their stables usually under houses and are fed on a cut and carry system. Fodder is collected from the surrounding forest as well as the roadslides.

There are about 16 households or 62% who own pigs with 2.6 as the average number per household. Pigs are raised both for home consumption and for sale or trade as a source of additional cash income which does not contribute much to the family income.

For chicken, 27 percent or 7 households are owners in the village with an average of 11 heads per household. They are raised

Table 14. Animals raised in the village

	Cow		Pig		Chicken		Water Buffalo	
	No.	%	No.	%	No.	%	No.	%
Total	180	100	42	100	75	100	13	100
No. of HHs with	12	46.15	16	61.53	7	26.92	2	7.69
No. of HHs without	14	53.84	10	38.46	19	73.07	24	92.30
Min./HH	4		1		3		3	
Max./HH	60		7		30		10	
Ave./HH	15		2.6		10.7		6.5	
House consumption	11	78.57	9	34.61	7	26.92	2	7.69
For sale	3	21.42	7	26.92				

only for home consumption.

Both animals are fed on corn, rice husks and food scraps. Chickens and smaller pigs often "free range" on plants and seeds around the village.

1.5.2.6.3 Collection of Forest and Non-forest Products

The collection of forest products such as the firewood used for miang production and others will be discussed fully in the discussion part. For non-forest products, the villagers collect mushrooms, chestnuts, bamboo shoots and herbs. All of these products are for home consumption. A list of foods gathered from the surrounding forest is shown in Table 15.

1.5.2.7 **Income**

The main source of income of the Kui Tuai villagers is from miang production (See section 2.5.1). Other sources of income are from selling fruits, taro, pigs, cattle and sometimes, hard labor in ploughing fields.

The average family income (including miang) is about 2,300 Baht per month ranging from 300 Baht earned by the poorest farmer to 6,000 Baht per month which are earned by the rich miang garden owners.

Table 15. List of non-animal forest products collected from the forests around Ban Kui Tuai

Name	Comments
Mushrooms	A no. of species, usually in wet season
Chestnuts	From *Castanopsis* sp. available around October
Bamboo shoots	Usually available in wet season
Herbs	Herbs to cure headaches and stomach problems are commonly collected

1.5.2.8 **Credit**

Credit from within the village is commonly given. There are 21 households or 80.26% use credit. Two sources of credit are available: Christian Community Fund (CCF) and Bank of Agriculture and Cooperatives (BAAC). Both have a 13% interest rate per year. Of the 21 credit uses, 16 HHs get their credit from CCF while the rest are from BAAC. From the semi-structured interview, two reasons were stated by the farmers on why they use credit: 1) to purchase cattle, miang garden and pigs; and 2) to spend for personal inputs such as trade and house construction.

1.5.2.9 **Education**

No school is present in the area. The children of Kui Tuai attend schooling at the nearby village called Pang Ma O. Most of the villagers have attained *prathom* (primary) ranging from one to nine and/or *mathayom* (secondary) from one to two. Of the adult household members, very few have been formally educated. There are times that children have to help their parents in the field or take care of younger brothers and sisters. This causes a high percentage of absenteeism in school.

There is one exceptional case wherein the two children of the assistant village headman attend school in the city of Chiang Mai.

1.5.2.10 **Public Health**

The closest health center is located in Ban Pang Ma O which is three kms. away from Kui Tuai. Health officials from the district visit the area for immunization and other health services.

In case of serious illnesses or emergency, the villagers go to clinics or hospitals in the Chiang Mai proper for medication or treatment. During the interview, most of the villagers said that they need a health center for the village.

1.5.2.11 **Infrastructures**

The main problem especially during the rainy season is poor roads which are steep, muddy, zigzag and slippery. Erosion along the roads and formation of gullies are very evident. The villagers have tried to repair these roads but the occurence of these erosion cannot be stopped. Normally, the *silo* or taxi do not make trips to the village because of the road condition. In special cases, people who wants to go to the village can hire one of these *silo* at Pa Pae district for 200 Baht round trip.

Electricity has not reached the area yet. In the village, there are only two television sets (powered by car batteries), five pick-up vehicles, five motorcycles and almost every household has a radio. Radios are very useful for the farmers during working hours such as in picking miang leaves, planting and harvesting

rice, processing miang and household chores to keep them at ease from the tedious work.

According to the village's agricultural extension officer, two water storage tanks have been constructed upstream on a clean water source. There is also a stream water which is commonly used for irrigation purposes in the dry season. Small areas of paddy rice are also irrigated from streams via bamboo pipelines or waterways.

1.5.2.12 **Market**

There is internal trading, buying and selling within the village and other nearby villages. As mentioned earlier, taro and pigs which are the only products for sale besides miang are sold in the village. Two small stores also owned by the miang landowners are the ones providing a limited number of basic needs to the villagers which are mostly purchased in Pa Pae subdistrict proper or downtown Chiang Mai.

1.5.2.13 **Off-Farm Employment**

There are two small stores which are owned by two households, selling basic needs to the villagers. Their presence in the village is also important as it lessens their trips to the subdistrict of Pa Pae (which is 13 kms. away from the village with poor roads) where they used to purchase most of the villagers'

needs.

Collecting tea leaves is also another source of income in Ban Kui Tuai. But, only two households do this practice in which they sell leaves of tea to Chinese tea factories such as the Raming Tea Factory.

1.5.3 **Ban Kui Tuai under the UN/Thai SMHDP and the USFPP**

Ban Kui Tuai is one of the many villages which are under the jurisdiction of the UN/Thai Sam Mun Highland Development Project (SMHDP). It is located at Doi Mon Ang Ket in Tambon Pa Pae, Mae Taeng District, Chiang Mai Province (Fig. 9 & 10). Under the project's watershed classification, the village is controlled by Watershed Development Unit 3, Doi Mon Ang Ket, and is classified as number 2 (Fig. 11, 12 & Appendix C). The main objective of the UN/Thai SMHDP is to improve the quality of life among hilltribes through the implentation of an integrated rural development project. The project is implemented by the Watershed Development Office of Chiang Mai under the Royal Forest Department which is funded by the United Nations Food and Drug Abuse Center (UNFDAC).

The Resource Management and Development Project (RMDP) of the Faculty of Social Sciences at Chiang Mai University, is currently implementing the Upland Social Forestry Pilot Project

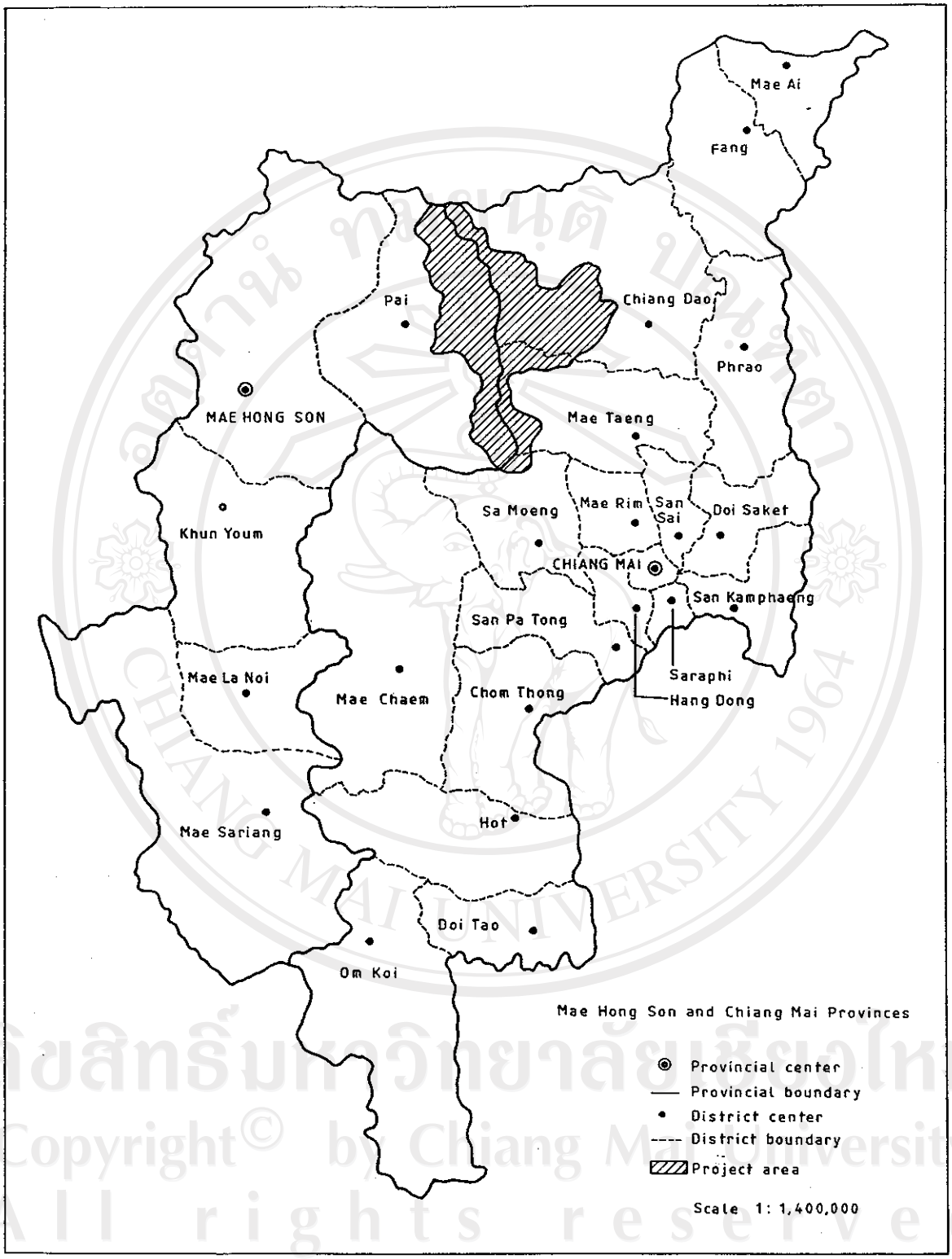

Figure 9. Location & setting of UN-Thai SMHDP area (UN-Thai SMHDP 1988)

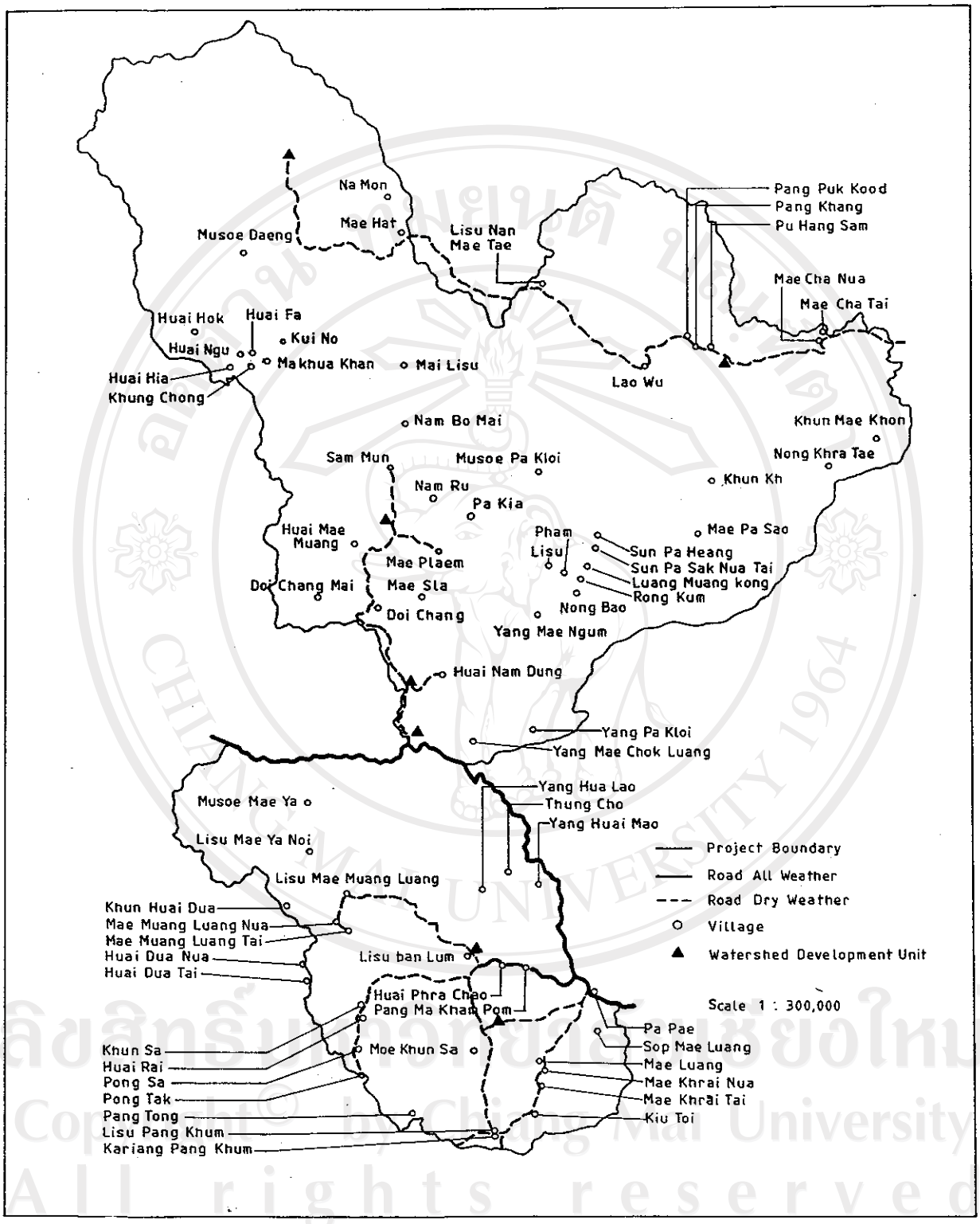

Figure 10. Map of project area - villages and roads (UN-Thai SMHDP 1988)

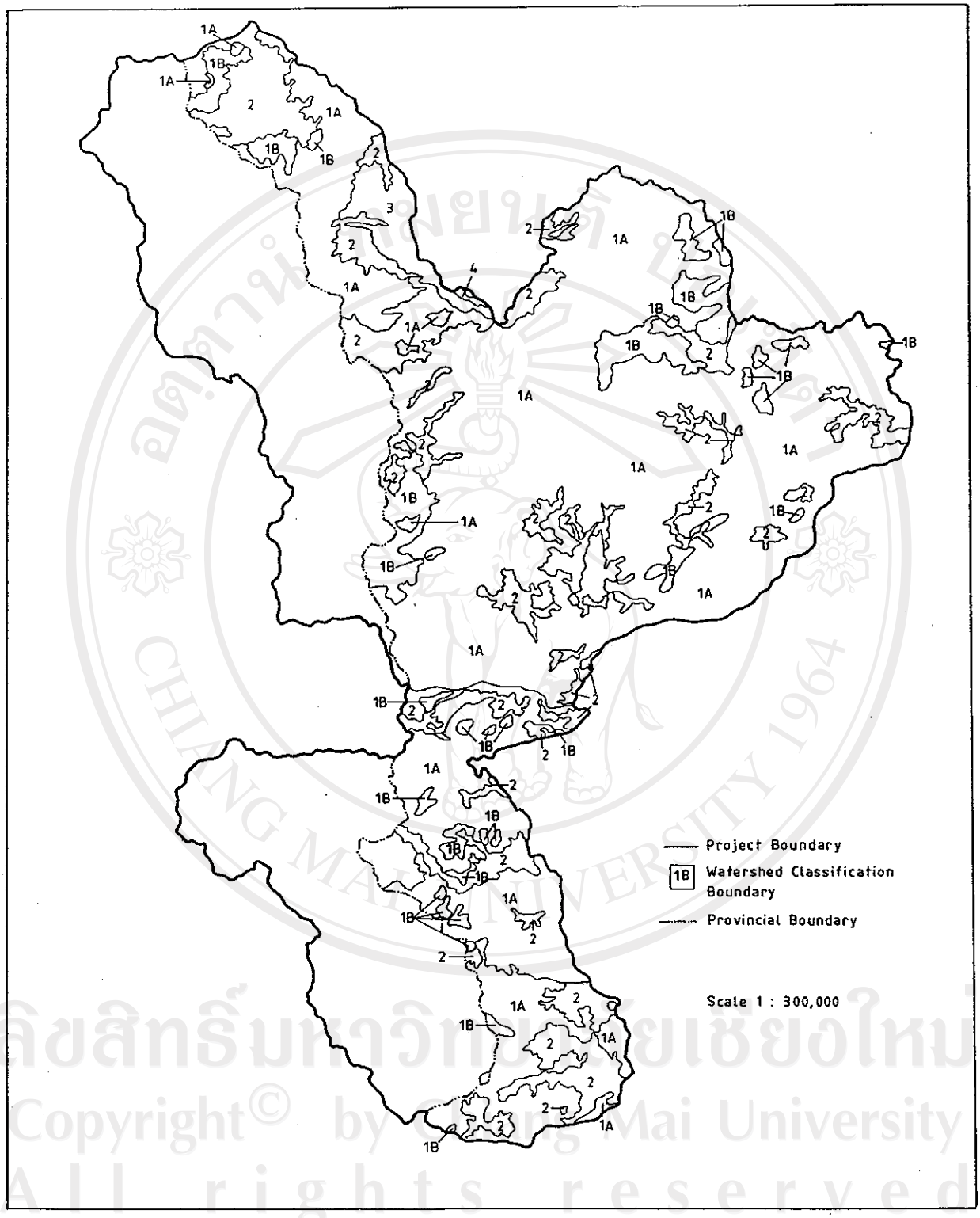

Figure 11. Map of project area - watershed classification and provincial boundary (UN-Thai SMHDP 1988)

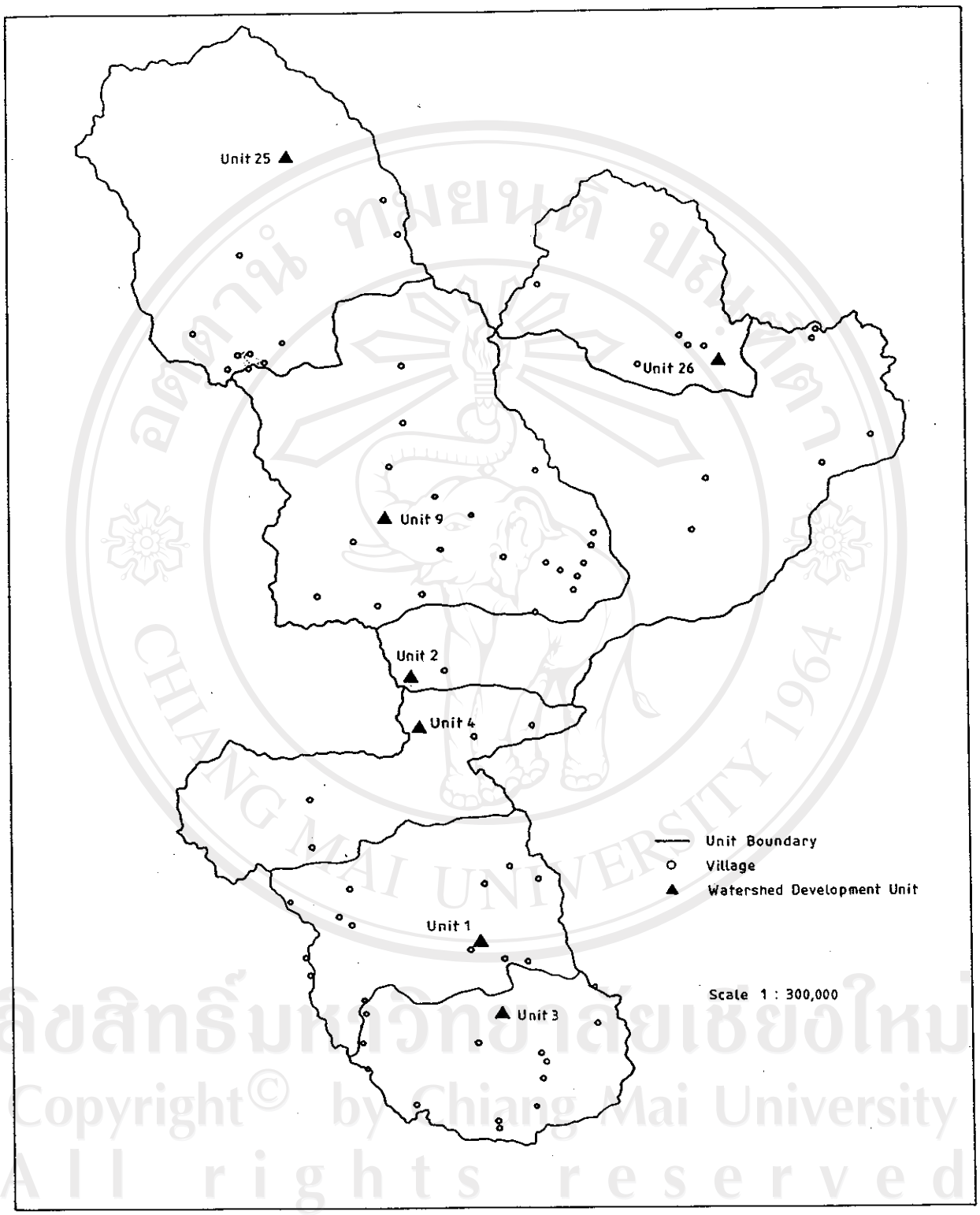

Figure 12. Map of project area - unit boundaries and watershed development units (UN-Thai SMHDP 1988)

(USFPP) in northern Thailand which is financially supported by the Ford Foundation since 1987. In line with the Thai Government's thrust on Social Forestry as a means of slowing down if not stop the depletion of forest resources, the project selected Kui Tuai as one of the study sites. The USFPP is aimed at experimenting with a method in land-use and management planning as a solution to poverty and resource use and encourage the active participation of local communities in forest development. The RMDP is closely coordinating with the Royal Forest Department and particularly, with the UN/Thai SMHDP.

1.6 Organization of the Study

Chapter 2, sections 2.1 to 2.2, begins the discussion of miang production in Ban Kui Tuai by examining the major actors in the forest-tea production system. Description of fermented tea or "miang" was presented in section 2.3. Section 2.4 and 2.5 describe and sequentially trace the various steps in the miang production beginning with the collection of firewood through the marketing of miang. The villager's tree cutting practice is emphasized in section 2.6. In sections 2.7 to 2.9, the role of fast-growing species as alternate sources of firewood is investigated including the estimation on the supply of firewood in meeting its future demand in the research area. The study's major findings, implications, conclusion and recommendations are presented in Chapters 3 and 4. Tables, figures, and appendices complete the thesis.

The first half of the presentation of data analysis leads to several management aspects concerning both production and the marketing system of miang. The second half was heavily focused on firewood use and mangement related to sustainability of the forest-tea production system. Furthermore, the research only deals in-depth on the firewood management aspect and its threat to sustainability. This explains why other topics such as on labor supply management and income generated from miang were briefly discussed.