

## Chapter 3

### DESCRIPTION OF THE STUDY AREA

#### 3.1 General

The area under investigation is the land drained by Mae Sa river, a tributary of Mae Ping river. The study area may therefore be termed "The Mae Sa Watershed" which lies mainly in Mae Rim district of Chiang Mai province (Figure 4), but also includes a small part of Muang, and Samoeng districts. It is situated at  $18^{\circ} 50'$  and  $18^{\circ} 57'$  N latitude and  $98^{\circ} 47'$  and  $98^{\circ} 58'$  E longitude. The study area consists of part of Doi Pui, Doi Mae Sa Nai and Doi Daeng in the south, the Pong Yaeng valley in the center, Mae Sa valley in the east and Doi Pa Kia in the west (see Figure 5).

The highest point of the Doi Pui is 1,685 m above sea level. Toward the east, the land gradually drops to an altitude of 340 m above sea level and the north part of Doi khom Rong with elevation 1,370 m above sea level.

The greater part of the study area was covered by forest. Irrigated rice field formed most important type of agricultural land in the Pong Yaeng valley, non irrigated cropland covered most the hills and mountainous area and small part was irrigated cropland using sprinkle methods at Nong Hoi.

The Pong Yaeng valley is a large alluvial fan lying between Huai Mae Cha in the west, Huai Pang Mi and Huai Mae Langun in the south, Huai Mae Na Phra in the north. Alluvial fans have been formed by run down material from surrounding slopes.

### 3.2 Climate

The climate of the northern Thailand region is monsoonal and characterized by three distinct seasons : the wet season from mid-May to November when the region comes under the influence of the southwest monsoon; cool dry season from November to the end of February during which time the north east monsoon brings dry cool air from continental Asia and hot dry summer from the end of February until mid-May when the region comes under the influence of the southeast monsoons.

About 90 percent of total precipitation fall during mid-May to November with August and September usually the wettest months with peak rainfall intensities of 45 mm per hour recorded at Nong Hoi station, 76.6 mm at Doi Pui rainfall station and 60.3 mm at Mae Rim rainfall station, respectively.

The annual rainfall throughout the greater part of the study averages 1,065.5 to 2,146.5 mm (see Table 1). The higher rate has been registered on higher land of Doi Pui. Generally, storm rainfall is heaviest near the top of Doi Pui and decreases towards the Pong Yaeng valley. Rainfall also

decreases from west to east. The higher the elevation, the greater is the amount of rainfall received.

According to Watnaprateep (1981), annual evaporation is rather higher compared with annual rainfall. Mean yearly rainfall at Di Mi is 1,330.1 mm while mean yearly pan evaporation is 1,313.3 mm (98.7 percent of rainfall). At Phong Khrai, mean yearly rainfall is 1,523.2 mm while mean yearly pan evaporation is 1,408.4 mm (92.5 percent of rainfall). Daily average pan evaporation ranges between 2.5 mm to 5.70 mm. Average pan evaporation in the wet season (May -October) and the dry season (November to April) are 667.6 mm and 753.1 mm respectively.

Table 1. Average monthly rainfall (mm) at Mae Sa Watershed.

Month	Mae Rim * 1980-1986	Mae Mae 1980-1986	Nong Hoi 1986-1992	Doi Pui 1969-1981
January	21.0	19.7	0.0	23.5
February	3.0	2.2	5.1	2.3
March	9.7	24.0	13.0	31.5
April	76.7	58.1	74.9	52.1
May	197.5	213.2	185.6	285.7
June	144.3	200.5	204.7	242.4
July	155.8	179.7	189.6	335.5
August	196.1	235.7	305.6	392.8
September	129.5	218.7	239.8	319.2
October	100.1	126.9	166.4	213.1
November	5.7	25.6	64.3	109.3
December	22.1	26.4	18.5	40.2
Total	1,061.5	1,330.7	1,467.5	2,146.5

Source : 1. Mae Sa Watershed Project 2. Fac.of Agriculture, Chiang Mai University

\* Elevation : Mae Rim 340 m, Mae Mae 520 m, Nong Hoi 1100 m and Doi Pui 1550 m above sea level.

### 3.3 Hydrology

Mae Sa river is the most important river in the study area, flowing from west to east. At present, the Mae Sa river receives most of water from tributaries. There are 15 main tributaries : 1. Na Phra, 2. Mae Cha, 3. Pang Mi, 4. Mae Langun, 5. Suai, 6. Nong Hoi, 7. Mae Luat, 8. Di Mi, 9. Phan Si, 10. Pha Ta, 11. Tat, 12. Mae Sa Noi, 13. Mae Mae, 14. Mae Nai and 15. Mae yen.

According to Watnaprateep (1981), the average annual stream flow of Mae Sa river is only 20 percent of annual rainfall. Monthly dry season flow averages 1.69 million m<sup>3</sup>. with the lowest level at 1.13 million m<sup>3</sup> while monthly wet season flow averages 2.78 million m<sup>3</sup>. This means that Mae Sa watershed's dry season flow is 40 percent less than wet season flow. It would be better if we could increase the amount of dry season flow by means of watershed rehabilitation and conservation because in the dry season farmers need water to irrigate their lands, not like in the wet season when rain water is ample.

### 3.4 Soils

Soil investigations were carried out mainly on the basis of the soil map compiled by Department of Land Development, Ministry of Agriculture and cooperative.

Soils were classified according to national classification which was based on "Major Soils of Southeast

Asia" by R. Dudal and F.R. Moormon (1964) and USDA classification (1970). The following large groups of soil were found in the study area : Alluvial Soils, Red Yellow Podsollic Soils and Reddish Brown Lateritic Soils.

The alluvial soils cover most parts of Pong Yaeng valley, Erawan resort and Mae Sa valley. On the basis of soil color differences, these soils can be further differentiated into dark grayish brown alluvial soils, grey alluvial soils and the association of grey and grayish brown alluvial soils. These soils have been formed in recent deposits derived from the slope around of the Pong Yaeng valley. Their physical and chemical properties are in most cases greatly influenced by the nature of the parent materials. Structure is moderately fine and medium sub angular blocky; moderately permeable; texture is sandy clay loam and pH 5.5 - 6.5 (top soil).

In the lowland of Mae Sa valley, soils are generally dark grayish brown, over brown to dark grayish brown with brownish mottles throughout, fine loamy deposit with some coarse layer in sub soil. Surface runoff is slow due to the gentle slope, moderate permeability and medium organic matter. According to the USDA classification, these soils are classified as Aeric Tropaquepts. The red yellow podsollic soils cover the undulating to rolling phase of Mae Rim where they have been formed from granite. These soils are characterized as very-dark grayish brown or dark brown over yellowish red or

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reddish yellow. Texture is sandy loam or loamy sand over gravelly or very gravelly clay loam or clay . Most of the soils have very deep (>150 cm) profile. They are well drained with a moderate permeability and medium to rapid runoff. Reaction ranges from very strongly acidic to slightly acidic (pH 5.5 - 6.5). Potassium (K) availability is medium to high while phosphorus is moderately low to very low. The red yellow podsollic soils are equivalent to Paleustults in USDA classification.

The reddish brown lateritic soil covered most of the upper and middle slopes of Phong Khrai, Ban Dong Nok. They are formed from gneiss (Moorman and Rajanasothon, 1972). These soils are characterized as dark brown or dark reddish brown, over dark reddish brown, dark red or red, sandy loam or loam over clay loam to clay. Reaction ranges from very strongly acidic to slightly acidic (pH : 4.5 - 6.5). The reddish brown lateritic soils have widely vary in soil profiles . In the lower slope they are thick (>150) cm and uniform but on the steep slopes they are moderately deep (50 - 100) cm and stony and often have been eroded down as far as weathered rock. These soils have agricultural favorable physical properties such as crumbly structure and a relatively permeable top soil. But the soils covered by forest or Scrubland, the structure is moderately fine and medium subangular blocky , moderately permeable, and medium to rapid runoff. Potassium (k)

availability is very high, phosphorus availability ranges from low to very low and cation exchange capacity (CEC) varies from moderately high to high. The reddish brown lateritic soils are equivalent to Orthoxic palehumults in USDA classification.

### 3.5 Vegetation and Landuse

According to Kraayenhagen (1981), over 200 hectares of forest lands are cleared yearly for new cultivation within the Mae Sa Project area. The original vegetational cover is destroyed and replaced by some form of "permanent agriculture" till the crop yields decline and new forests are cleared.

Generally, most of the land at Mae Sa watershed with flat to moderate slopes are covered by rice field. Rice cultivation is practiced by northern Thais in the plains and lowlands while on strongly sloping to very steep slopes covered by dryland, or shifting cultivation is practiced by the hilltribes. The effect of shifting cultivation on the promotion of grassland or scrubland as secondary climax vegetation apparently depends on details of the cultivation methods. Kunstadner et al. (1978) have described landuse system and vegetation in northern Thailand concerning ethnic groups. They pointed out that landuse in northern Thailand by ethnic group are classified into three types of shifting cultivation and 1 type of permanent upland cultivation which are : (1). short cultivation - short fallow (often used by

northern Thai); (2). short cultivation - long fallow or "forest fallow" (often used by upland Karen and Lua'); (3). long cultivation - very long fallow or abandonment (by Hmong and other opium growing hill groups); (4). permanent field tree crops associated with use of forest for swidden rice and fuel. The pattern of landuse system concerning ethnic group is shown in Figure 6.

The following landuse descriptions of the study area were obtained by field observation, and simplified on the landuse map (Figure 7), due to scale of the map and necessity for soil loss calculation. Mapping classes of landuse types often contain a mixture of cropland and trees, which cannot be separated at the mapping scale used (1 : 25,000). In such cases the most dominant cover type is taken into consideration for evaluating the erosion hazard.

The landuse comprises mainly, cropland with good conservation measures (paddyfield), cropland with simple conservation measures, scrubland, grassland, deciduous and evergreen forests.

Croplands with good conservation measures (paddyfields) cover an area of 1203.5 hectares (8.9 percent of the study area). They are distributed mostly on flood plain (F1), fluvial terraces or low terraces (F2), infilled valley bottom (D4), Fans (D5), foot slopes (D6) and small part on denudational slopes and hills (D2) and denudational hills and

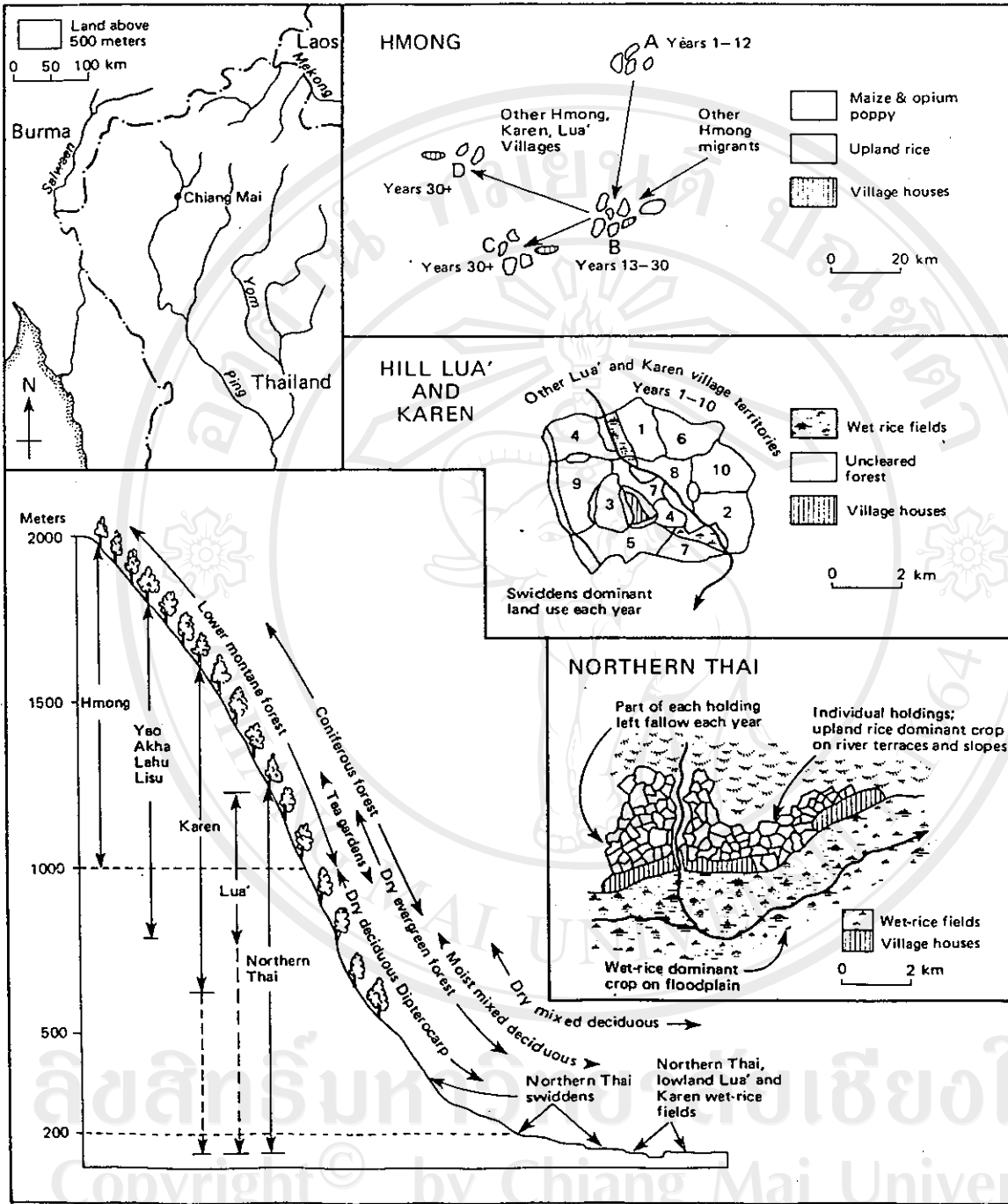


Figure 6. Landform, landuse system and vegetation in northern Thailand (Kunstadner et al. 1978).

mountains (D3) at Pong Khrai District. Most of them are situated in areas with relatively fertile soils, and availability of good water. On the basis of the available quantity of irrigation water, the ricefields can be planted with different crops, thus producing at least two crops per year. That is, the farmers growing rice in the wet season and vegetable, and fruits (strawberry) in the dry season. Most of these landuse types are situated on fans (D5), infilled valley bottom (D4) at Pong Yaeng, Pong Yaeng Nok district and Mae Langun subwatershed. The ricefields dependent on rainfall are irrigated only through inundation by rainwater which are sometimes supplemented by water from very localized runoff collection systems. They only produce one rice crop per year in the rainy season. This type of landuse is situated on the fluvial terraces (F2) and foot slopes (D6) at lower part of Mae Sa watershed.

Croplands with simple conservation measures (dryfields) cover about 3340.9 ha (25.5 percent of the study area). They are areas permanently used for growing any kind of drycrop, including upland rice. The main drycrops are cabbages, carrots, upland rice, maize, garlicks, chilies, flowers, peanuts, sweet potatoes and etc. The dryfields are found on the denudational hills and mountains (D3). This type of landuse is practiced by hilltribes on the strongly slopy (15 -25 %) to steep slopes (35 - 45 %). Small part is irrigated

by using sprinkle method and produces at least 2 crops per year at Nong Hoi.

Scrubland covering 2094.8 ha (15.5 percent of the study area) is area predominantly covered by young perennial woody plants which usually do not reach tree size. Scrubland, formerly a shifting cultivation area is often colonized by bamboo, while a higher dense scrubland tangle of *Eupatorium odoratum* and other species come in. However the areas which have had intensive cultivation for a long period are often dominated by *Imperata cylindrica* which in landuse are classified as grassland, covering 700.6 hectares (5.2 percent of the study area).

Deciduous forest covers 1511.3 hectares (11.2 percent of the study area). This includes teak plantation, mixed deciduous, and dry dipterocarp forest. Deciduous forest can be found on high or old terraces (F3), denudational slopes and hills (D1) and (D2), denudational hills and mountains (D3) which consists of the forest soils particularly on the gray podsollic soils, relatively sandy and rocky soils. Most types of these soils are not suitable for agriculture due to the lack of moisture. This is widespread at elevation of 300 to 700 meters above sea level. According to Mae Sa project report (1985), this type of forest is composed of the following tree species : *Tectona grandis*, *Xylia kerrii*, *Terminalia mucronata*, *Pterocarpus macrocarpus*, *Lagerstroemia calyculata*,

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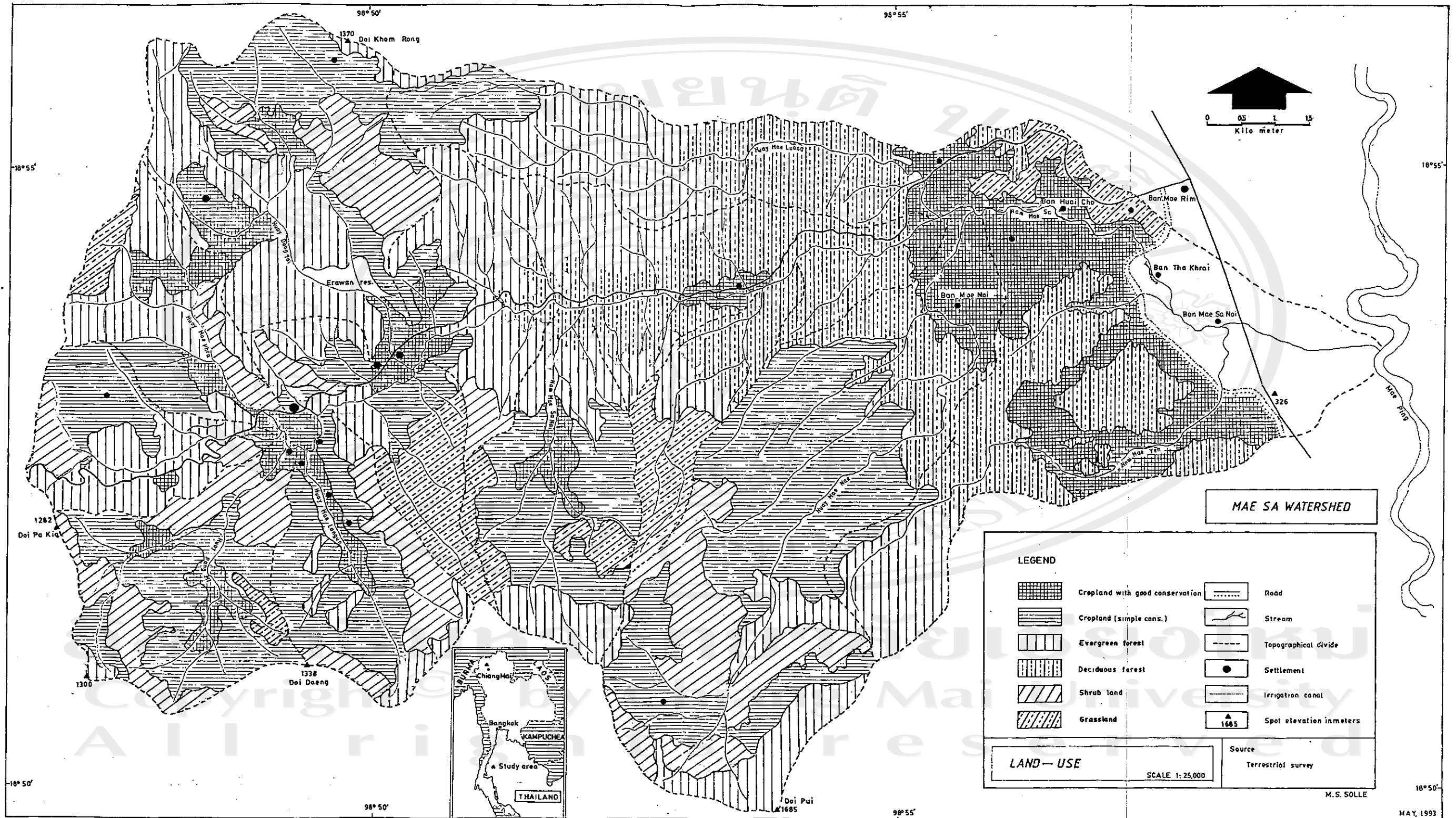


Figure 7. Landuse map

*Dipterocarpus tuberculatus*, *Shorea obtusa*, and *Pentacma suavis*.

Evergreen forest covers an area of 4562.2 hectares (33.7 percent of study area). This type of forest includes evergreen forest, lower montane evergreen forest, lower montane moist valley forest, and pine forest. The evergreen forest occupies the elevation of 700 to 1685 meters above sea level. In Doi Pui, it can be found on denudational hills and mountains (D3), with reddish brown lateritic soils, relatively clay to loam and high soil moisture contain. This type of forest is composed of the following tree species : *Quercus spp.*, *Castanopsis spp.*, *Schima wallichii*, *Michelia champaca*, *Melia spp.* and *Pinus kesiya* ( Mae Sa report, 1985).

### 3.6 Population

The Mae Sa Watershed is 20 km from Chiang Mai city. Villages are distributed over the Watershed (see Figure 5).

The total population in the Mae Sa Watershed is about 9,011. On the average, a family has 2.83 or 3 children of which 1.47 are males and 1.36 are females. The local lowland Thai represent 78 percent (7011), the Hmong hilltribe 20 percent (1800) and the Karen hilltribe 2 percent (200) of the population. Ninety-nine percent of the population is Buddhist and 1 percent is Christian. People continue to migrate into the watershed (Pattaruma, 1985).