

**Description of the field trip site in Kham Muang village,
Khao Suan Kwang district, Khon Kaen**

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Introduction

Village of Kham Muang or Ban Kham Muang is a representative village in the Khorat basin of Northeast Thailand in terms of its physical, and biological and socio-economic characteristics. It was first selected as the study site of the research project, 'Land-use pattern and associated land degradation in undulating terrain of Northeast Thailand' because of its biophysical characteristics. Physically, it is situated on undulating terrain typical of that of the Khorat basin and its past and present land use are typical of patterns in this region. In terms of biological characteristics, the land used to be covered with forest that was gradually cleared to establish crop-based agriculture, first paddy rice for subsistence, and later, upland cash crops.

Characteristics of Kham Muang village

Physical characteristics

Settlement and population

Kham Muang village is situated at latitude 16° 48' - 16° 49' north and longitude 102° 52' - 102° 53' east. It is approximately 45 km north of Khon Kaen city and 6 km from the municipality of Khao Suan Kwang (Figure 1) and conveniently accessible by concrete road (43.5 km of Friendship highway and 1.5 km of village newly-constructed concrete road). It is one of 12 villages of Kham Muang subdistrict of Khao Suan Kwang district. It shares its northern boundary with Kham Sombat village and Sap Somboon village; southern boundary with Kham Muud Nua village; eastern boundary with Kham Muud Nua village and None Tong village and western boundary with Friendship highway and Kham Sombat village (Figure 2).

The village has 137 households and total population of 768 of which 408 is males and 360 is females. This brings about 5.6 labour per household.

Land of the village

Kham Muang village occupies an area of 3,600 rai (576 hectare). The settlement occupies 475 rai (76 hectare) or 13.2% of total land area. Agricultural lands occupy 2,500 rai (400 hectares) or 69% of total land area. They are located to the east and west of the settlement. The eastern part is undulating while the western part is relatively flat lowland. The ratio of upland to lowland (paddy fields) is 3:2. Public lands, which are mainly cemetery and reserved land (forest) occupy 529 rai (84.6 hectares) or 15% of total village land. The size of land holding is on the average 18 rai (2.9 hectares) per household. There are 5 landless households.

Soils of the village are mostly of sandy texture and has low fertility.

Climate

The weather is influenced by the Southwest monsoon in summer and rainy season and the Northeast monsoon in the cool dry season. It is very hot and humid in summer (February - April) with the mean maximum temperature in the range of 32.2 -

35.9 °C; mean minimum temperature of 19.0 - 24.3 °C and mean temperature of 25.1 - 29.6 °C. While in cool dry season (November - January) the maximum temperature range is 29.2 - 30.4 °C; the minimum temperature range is 16.0 - 19.7 °C and the mean temperature range is 22.4 - 24.6 °C (data from 30 years, 1961 - 1990) average temperatures of Khon Kaen and Udon Thani provinces). Rainy season is during April to October. The total annual rainfall is approximately 1,000 mm.

In 1999, total rainfall was 1,016.3 mm with number of rainy days of 137.

Characteristics of the miniwatershed study site

Location

The area where the study site is located is known locally as Hom Bak Heb. Hom in Esarn language indicates a kind of landform resembles a saddle, where the bottommost part used to be a stream. The land rises gently along slopes to higher grounds on both side of the stream. This kind of landform is considered a mini watershed. It is commonly practised that the stream part is transformed into paddy fields. The bottom part becomes lower paddy fields and the upper part of the Hom becomes upper paddy fields. Areas beyond the upper paddy fields are at late stages transformed to upland fields where field crops are grown.

The study site, Hom Bak Heb, is located in the southeastern part of the village approximately 2 -3 km from the settlement (the temple). Information from the GPS studies have shown that it is situated between the latitude of 16° 48' - 16° 49' north and the longitude of 102° 52' -102° 53' east (Figure 2). The total area of the study site is 88 rai (14 hectares). The longest part is in north-south direction which is 600 m, while the widest part in east-west direction is approximately 250 m (Figure 3). The northern boundary is the forest reserve (Pa Khok Tham Lay) which is dry dipterocarp forest commonly found in the undulating terrain of the Northeast. The southern boundary is the dirt road connecting Kham Muang village and Kham Muud Nua village. The eastern and western boundaries are cultivated land of Ban Kham Muang (Figure 2).

Geology

Geology of Hom Bak Heb miniwatershed consists of layer of bedrocks situated at 10 -12 m depth from soil surface (information from seismographic study). The bedrock lays itself out in almost paralel fashion to the surface topography. Most of the rocks found are sandstone with some shales inclusion. The rock belongs to Khok Kruat formation (Kkk) which was formed during Cretaceous geological period (Groundwater map of KK province, Dept. of Mineral Resources).

Information on surface lithological compositions down to 8 m from well log obtained through drilling of 9 bore holes (Figure 4 positions of the bore holes) which form piezometer network in the study site has shown that it has sandy to sandy loam texture down to 80 - 1.30 m below which it becomes clay. There are also layers of laterite and materials of gravel size below clay layer.

Topography

The study site is gently undulating with the slope of on a whole 2.8 % north - south direction. The elevation at the lowest part in the outlet pond next to lower paddy is 190 m above sea level (asl) to 208 m asl. in the upper most part in the forest reserve (Figure 3 and 5). However, the slope is not uniform.

Soils

Soil profile study down to 1.50 m employing boring technique was conducted at 8 different positions (as shown in Figure 4) in the study site. These positions covered all kinds of land use, i.e. forest, upland fields, and paddy fields. It has pointed out that the soils are derived from transported parent materials which are of sandstone origin. The mode of transport was likely to be water, hence they are alluvium. In general, the soils have coarse texture (loamy sand to sandy loam). Where there is no accumulation of clay at depth, they are considered Quartzipsamment, however if there is a horizon of clay accumulation they belong to Great Group Paleustult. There are 3 soils series found, i.e. paddy soil : Ubon series (Aquic Quartzipsamment); upland soils, Khorat series and Satuk series (Oxic Paleustults). Soil profile descriptions are shown in Appendix 1.

Vegetation and land use

Vegetation and agriculture land use in the study site of Hom Bak Heb can be categorized into forest land and agricultural land.

Forest : A patch of reserved forest remains at the northern part of the Hom Bak Heb miniwatershed. It is dry dipterocarp forest consisting of common species including Pluang (*Dipterocarpus tuberculatus*), Teng (*Shorea obtusa*); and Rang (*Shorea siamensis*). This type of forest found is a common type found in the undulating terrain of the Northeast. Most tree species are deciduous which shed their leaves in dry seasons (November - January).

Agricultural land: These are lands that have been cleared from forest 3 decades ago to establish agriculture. They are located on lower elevation relative to the forest, i.e. at 204 m asl and lower. In the upland fields sugarcane and cassava are grown while in lower fields it is rice paddy fields. The paddy fields can be categorized into 2 types, they are lower paddy fields on the lower part and upper paddy fields on the upper part adjacent to the upland fields. Connecting each adjacent plots of land, especially between plot on upper slopes and those on lower slopes are idle areas, where natural vegetation, such as grasses and other weeds, grow freely. These areas are used mainly for cattle grazing. Some are upper paddy fields which are not in use for many years due to inadequate rainfall.

In agricultural land there are some native forest trees scattering in upland fields. They are mainly *D. tuberculatus*. However, they are gradually cut down or they gradually die of natural cause with time.

Past land use

The land of the study site was previously covered with forest before being turned into agricultural fields about 30 years ago. The lower land, next to the southwest border, was deforested first and was used for paddy field. The bottom part of the paddy field later on was turned to farm pond. The rest of the area was progressively cleared to grow field crops. The first field crop planted was kenaf then followed by cassava and later on by sugarcane. The bottom half of paddy fields at the southwest border were changed into a farm pond in 1992 for the purpose of raising fish.

Present land use

Farmlands in the selected site are owned by 6 households, three of which come from the same kinship. As mentioned earlier that the land used to be covered with forest before being turned into agricultural fields about 30 years ago. The lower land, next to the southwest border, was deforested first and was used for paddy field. The bottom part of the paddy field later on was turned to farm pond. The rest of the area was progressively cleared to grow field crops. The first field crop planted was kenaf then followed by cassava and later on by sugarcane.

Land use and management in this watershed study site mimicked the patterns found at the village level. At the time of the survey, only 2 field crops, cassava and sugarcane, were grown on the upland and rice on the lowland (Figure 3). In the northern part of the watershed, next to the forest, 3 plots of cassava and one small plot of sugarcane were managed by 3 farmers. Two large plots were found at the center of the watershed, one was planted to cassava and another was covered by sugarcane. Two upland plots, planted to cassava and sugarcane, were found at the southern bottom of the watershed. The only one paddy-field area of the watershed was located around the pond at the southwest corner. Both upper and lower paddy fields were planted to the same medium-duration rice variety, RD6. A small orchard was situated at the southeast corner of the watershed. Fruit trees inside the orchard included mostly mango and jackfruit. The 2 ponds in the watershed were located next to the southwest and southeast borders. The water in the two ponds was kept for fish catching and supplementary irrigation to the crops in the rainy season. Two uncropped plots were located next to the paddy fields at the northern and southern sides.

Land and crop management

All farmers in the study site adopted new technologies provided that they gave beneficial returns. They tested and planted new crop varieties, used two-wheel tractors to plough the land and put chemical fertilizers to stabilize and increase crop yield.

Cassava

The farmers has adopted new variety “Rayong 60” and has used in combination to the old improved variety to make more flexible planting and harvesting dates. Before the introduction of the new variety, most farmers planted cassava at two planting dates; i.e. early rainy season (March-May) and end of rainy season (October-mid-November) (Figure 6). The latter date was made possible by capillary water rising from shallow water table underneath the sandy soil of the study site. At the time of survey, the farmers at the study site also planted new variety “Rayong 60” in mid-rainy season (July-early August). The farmers told that this new variety grew very fast provided that significant amount of chemical fertilizers was added and the soil had sufficient moisture. The new cassava variety could be harvested for selling to the market as early as 6 months after planting. As a consequence, some farmers planned to grow 2 cassava crops within 12-16 months.

One farmer was asked whether the planting date in the mid-rainy season might cause serious soil erosion if the heavy rain arrived after cassava planting. He said that he expected a no-rain period of 7-14 days after planting, which was the usual pattern of local rainfall. Furthermore, cassava was planted in row on the ridges and the row direction was arranged along the gradient of the slope. The farmer observed that planting cassava in ridges with row direction along the slope helped to reduce erosion as water was freely drained in numerous furrows between ridges.

Planting cassava along the gradient of the slope also helped to reduce the problem of waterlogging to cassava, a sensitive crop to such condition. Furthermore, he adopted some land management to reduce erosion. As his plot was next to the forest the farmer built a ridge to direct the water flow from the forest away from his plot. Furthermore, cassava was planted on the ridges which were arranged along the gradient of the slope. The farmer observed that planting cassava in ridges along the slope helped to reduce erosion as water was freely drained in numerous furrows between ridges. Planting cassava along the gradient of the slope also helped to reduce the problem of waterlogging to cassava a sensitive crop to such condition.

This new cassava variety also allowed planting at higher population density and, as a result, might produced higher yield than the old variety. The planting distance of the new cassava variety was about 1 x 0.7 – 0.8 x 0.8 m. whereas that of the old variety was 1 x 1 m..

However, the new cassava variety seemed to require higher chemical fertilizer inputs. At the time of the interview (1998) the farmers at the study site applied fertilizers at the rate of 25-50 kg per rai. Even the old variety also needed higher chemical fertilizer inputs after planting continuously for a few years on the same location . As the price of chemical fertilizers increased gradually the farmers tried to find other alternatives to reduce the cost of fertilizer inputs. Some farmers bought filter cake, an organic manure, from the sugarcane refinery factory and applied it to the plot planted to cassava. Another alternative was to rotate planting of cassava with other crops which needed high fertilizer inputs, i.e. watermelon, sugarcane, hoping that cassava would receive fertilizer residues from the preceding crop.

After planting cassava for 1 month, the farmers applied chemical fertilizers immediately after weeding. The farmer cut down weeds by plough drawn by either a 2-wheel tractor or buffalo between rows of cassava. Then, he put in chemical fertilizer along the ridge and plough under the fertilizer with the freshly cut weed. The remaining weeds between the plants within rows had to be eliminated manually. Labour requirement for weeding then could be the problem in cassava production for low-labour household if cassava was planted at the beginning or in the middle of rainy season. For the old variety, farmers preferred to plant it at the end of rainy season provided that the soil was sandy and had shallow subsurface water table. Planting cassava at the end of rainy season reduced both weeding intensity and soil erosion.

Similar to the village level, the yield of cassava grown at the study site was from 2 to 5 tons per rai. The average cassava yield in the Northeast is 2.5 ton/rai. The variation of yield per area was due mainly to growth duration, planting season and labour available for weeding.

Sugarcane

At the time of the survey, only one sugarcane plot at the northern part of the study area was planted and managed by one farmer (Mr. Bunmee) as shown in Figure . Two sugarcane plots owned by Mr. Kong had been rented to someone staying outside the village. All farmers were not in favour of planting sugarcane at that time as the market price was low and the chemical fertilizer price was relatively high. The purpose of planting sugarcane by Mr. Bunmee was to produce propagating stem stock for selling to other farmers.

The farmers described the regular cropping pattern and management as related to sugarcane before the market price dropped as follows.

If the market price of cassava was not so low (less than 50 satang) and capital was available the farmer would grow both sugarcane and cassava at the same time and also in rotation. The farmer divided the upland into 2 parts and cultivated each field crop on each part. Normally, he would grow sugarcane (one main crop plus one ratoon) for 2 years and rotate it with cassava (2 crops) for 2 years. Apart from avoiding risk due to low market price, the farmers observed that sugarcane seemed to provide fertilizer and crop residue benefits to subsequent cassava. Sugarcane crop was heavily fertilized at the rate of 75-125 kg/rai of the commercial combined N-P₂O₅-K₂O fertilizer. At harvesting, leaves of sugarcane was either cut off or burned and left over with roots as crop residue for following cassava. The farmer mentioned that cassava was not good source for crop residue for subsequent sugarcane as almost all parts of the plant were taken away. However, growing cassava before sugarcane planting made the soil easy for ploughing and penetration by root of subsequent sugarcane.

Other crop management of sugarcane in the study area was similar to those at the village level. Similar to cassava, sugarcane was also planted in row on ridge arranged along the slope.

Rice

All paddy fields, about 5 rai, at the southern end of the watershed belong to one kinship group. One brother and one sister takes turn each year to grow rice in the fields. The rice grain harvested is shared by the mother and the family who has planted the crop. The purpose of rice production is for home consumption.

Although the paddy fields have been managed by different families each year the patterns of management are similar. The 2 families plant only one rice variety, RD6, a glutinous one. Transplanting period is mostly from early to late July. Labor for transplanting is from own kinship system. Chemical fertilizers are applied about 1-1.5 month after transplanting (also depending on rainfall). The fertilizer rate is about 30 kg/rai. The chemical fertilizers consist of either 2 bags of the 16-8-8 combined N-P₂O₅-K₂O fertilizer and one bag of urea or 1 bag of the former with 2 bags of the latter, depending on the household economic condition at the time.

Rice is harvested in mid-November. The rice yield per area is about 300 kg/rai (250-350 kg/rai). The problems for rice planting are: lack of water for upper paddy fields during mid-rainy season drought, weed infestation in the upper paddy fields, flooding on the lowest paddy field, infestation of a snail called "Cherry", etc. Among these problems, lack of water and weed infestation in the upper paddy fields are the most serious one, resulting in crop failure. Occasional flooding may cause over-elongation of rice stem and results in some yield loss at harvesting. "Cherry" snail may not be a serious problem if the water can be drained from the field at the early growth stage.

For further information:

Vityakon, P., S. Subhadhira, V. Limpinunthana, S. Srila, V. Trelo-ges and V. Sriboonlue. 2004. From forest to farmfields: Changes in land use in undulating terrain of Northeast Thailand at different scales during the past century. *Southeast Asian Studies* 41(4) 444-472.
(Southeast Asian Studies issues can be obtained on-line at www.cseas.kyoto-u.ac.jp)

