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MISCELLANEOUS SOIL REPORTS

of the

Department of Agriculture, Department of Rice

and the

Royal Irrigation Department



No. 10. REPORT ON THE SOIL SURVEY OF THE SITE OF THE  
PROPOSED AGRICULTURE CENTRE NEAR SATANI NAM PHONG  
(KHON KAEN PROVINCE)

by

Tanit Thongchuta, Somnug Nonthabund

and

F.R. Moormann

Bangkok, Dec. 1962

17 pages, 3 maps 1 fig

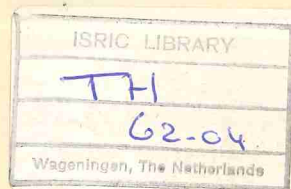
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No. 10 Report on the Soil Survey of the Site of the  
proposed Agriculture Centre near Satani Nam Phong (Khen Kaen Province)

by

Tanit Thongchuta, Samnang Nonthabund and F.R. Moormann

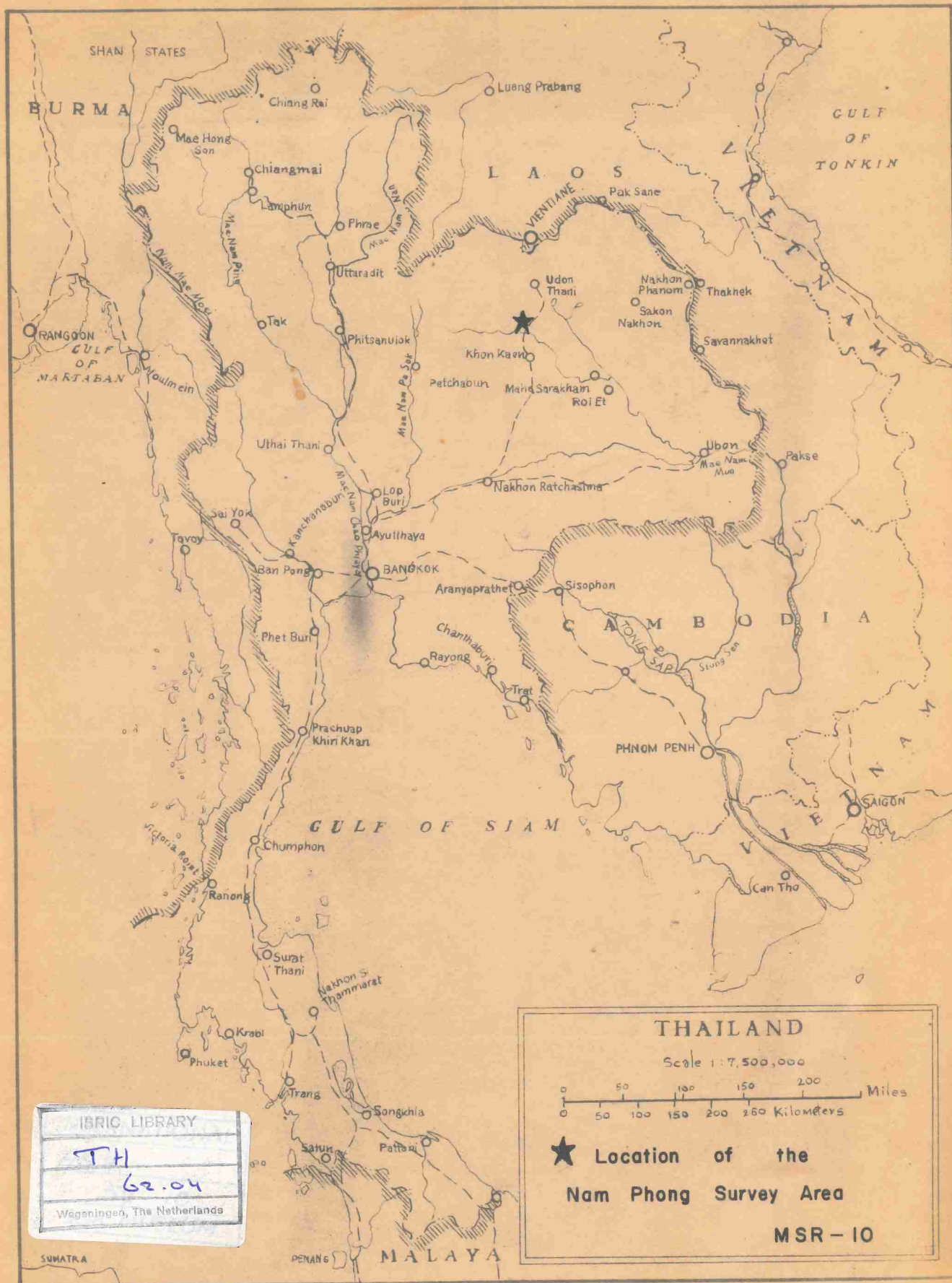
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# C O N T E N T S

page

I. INTRODUCTION	1
II. GENERAL DATA	1
1. Topographical description of the area	1
2. Geomorphology and parent material	3
3. Climate	5
4. Vegetation and landuse	6
5. Hydrography	6
III. SOILS	7
IV. CONCLUSIONS AND RECOMMENDATIONS	14
1. General aspects of agriculture	14
2. Productivity of the surveyed area	15
3. Soils of the area in relation to general soil conditions in North-Eastern Thailand	15
4. Irrigation possibilities	16
5. Forestry	17

REPORT ON THE SOIL SURVEY OF THE SITE OF THE PROPOSED  
AGRICULTURAL CENTRE NEAR SATANI NAM PHONG (KHON KAEN PROVINCE)

I. INTRODUCTION

The surveyed area was indicated as one of the prospective sites for the establishment of the Agricultural Research Centre for North-East Thailand. The soil survey of this site was carried out on request of the D.G. of Agriculture by a survey party of the Agricultural Chemistry Division in the second half of 1962. Members of the survey party were Tanit Thongchuta (in charge) Somnug Nonthabund, Sirichai Kitiyarug and Udon Kengrugsas. During the initial phase of the survey, Wichai Boonyawat (Department of Rice) cooperated with the survey party. Dr F.R. Moormann (FAO) and Samarn Pranichapong assisted in the establishment of the legend and in the field control. Report and map were edited by Dr. F.R. Moormann

Soil survey of this area is of the semi-detailed type. Soil observations were carried out by means of boring and study of profile-pits and roadcuts. As a base map, 4 x enlargements of airphotos were used; the drafting of the final soil map was done on 2 x enlarged airphotos with an approximate scale 1:19000. Several terrain features and certain soil units were delineated by means of stereoscopic airphoto interpretation.

II. GENERAL DATA

1. Topographical description of the area

The area, proposed as a site for the Agricultural Centre, is situated between the Huai Yang and Ban Nong village. The Western boundary of the zone is a line, parallel to the Khon-Kaen-Udon road at some one kilometer West of this road. The Eastern boundary is roughly the Khon Kaen-Udon railroad. The surveyed area however includes additional land to the East, South and West of the proposed site.

The villages of Ban Non Phayom, Ban Nong Ben, Ban Nong Khum and Ban Bung Kae are situated in the surveyed area. Besides the main Khon Kaen-Udon road, a number of village roads is found, part of which become impassable during the wet season. A multitude of tracks and footpaths crosses the area.

The Nam Phong river borders the surveyed area in the North-East. Several creeks drain the area towards the Nam Phong, the main ones being the Huai Yang and the Huai Hin Lat.

The general topography of the area is undulating with, locally, flat or rolling parts. The highest part, slightly over 200 meters elevation, is found along the Khon Kaen-Udon road, West of Satani Nam Phong. The lowest portion of the area is observed in the valley of the Nam Phong, which is situated at approximately 155 meters elevation near Ban Nong Ben. The higher portions of the terrain present themselves as low ridges with a general North-South direction. These ridges are not continuous, but are interrupted by the creeks which cross them from West to East. The topography along these creeks is fairly strongly sloping. The relief of the transition zone between the high parts and the low Nam Phong valley is rather irregular in spots, with high and low parts alternating at a short distance. The area between Huai Hin Lat and Satani Nam Phong is the most typical of these irregular transition zones. The form of the creek valleys varies. Where the valleys cut through the above mentioned ridges, they have a V shape with a very narrow valley bottom. Both upstreams and downstreams, the valley bottoms widen considerably, and the whole valley takes a U shape. The topography of the Huai Hin Lat may serve as an example for this.

The micro-topography in the Nam Phong valley is classic for the rivers of North-East Thailand. Along the Nam Phong stream, a zone, varying in width is found, in which higher and lower lands, parallel to the river alternate. Behind, the land is lower with the lowest parts being occupied by intermittent lakes.



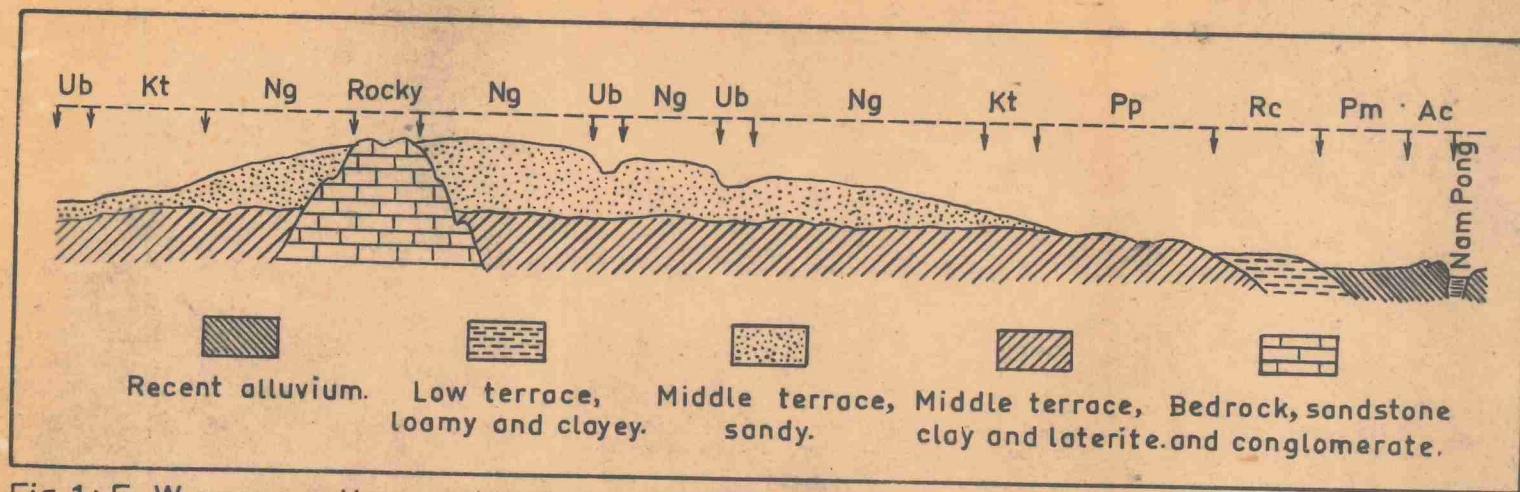


Fig.1: E-W cross-section, north of Ban Nan Payak.  
(Horizontal scale appr. 1: 20,000; vertical scale exaggerated)

## 2. Geomorphology and parent material

The geomorphologic construction of the surveyed area is, schematically, represented in figure 1. At the base of the landscape are the rock formations, belonging to the geologic Korat Series. The rocks consist of alternative layers of sandstone and conglomerate with all intermediate forms. Even the rock, qualified as sandstone contains some rounded pebbles which form the majority of the rock mass in the most typical conglomerates. These layers are, as far as observed, slightly tilted. The surface of the rocky substratum is composed of alternating higher ridges and lower depressions, which have a general North-East direction and which are at the base of the ridged aspect of the present-day surface. The highest rocky ridge outcrops are found along the Khon-Kaen-Udon road, most conspicuously near the Huai Yang. Other rock outcrops can be observed in several valleys, where erosion washed away most or all of the covering material. In the rail road-cut, just North of Satani Nam Phong, the same rock formations, but highly weathered, can be studied also.

Whereas the rock formations are thuswise present at a rather shallow depth in most of the surveyed area, the surface-materials, both sandy and clayey are not directly derived from these rocks. On the contrary, most of the surface materials are river deposited in different periods and thus are transported or alluvial sediments.

Three more or less distinct levels of sedimentation can be observed e.g., the present-day alluvial plain, the low terrace and the middle terrace(1)

The alluvial plain is composed mainly of clayey sediments, which are being deposited even now.

The low terrace in this area is, at most, a narrow zone between the middle terrace and the alluvial plain. In most places, however, the low terrace is absent and here, the alluvial plain goes immediately over to the middle terrace. The low terrace formations are mostly medium textured (loamy)

(1) For a more complete description of these terraces, see M.S.B. 9: A Key to the soil survey of North-Eastern Thailand.



The middle terrace occupies the larger part of the area. As elsewhere in the North-East (1), the middle terrace formations are composed of a sandy upper part and a sandy-clay or clayey lower part, with a more or less pronounced layer of lateritic gravel on the boundary between the sand and the clay. The lower layers of the sandy stratum usually contain slightly more clay and have a loamy sand or sandy loam texture. Most of the soils of the surveyed area are formed on the sandy middle terrace material. Where the sand has been eroded away, that is on the lower slopes valleys and in the transition zone between the high land and the alluvial plain of the Nam Phong, the lateritic gravels and the clayey lower stratum of the middle terrace occur close to or at the surface. This situation is schematically represented in figure 1.

\* \* \* \* \*

According to lithology and geologic origin, following soil forming materials can be distinguished.

#### RESIDUUM.

Some weathering products from sandstones and conglomeration are found where the rocky substratum comes close to or at the surface. However, as a soil forming material, the residuum is only of minor importance. The residuum has a sandy loam or sandy clay loam texture and contains varying amounts of rounded pebbles, disintegrating pieces of sandstone as well as some lateritic gravels.

#### TRANSPORTED MATERIALS

Recent alluvium. This found in the valleys of the Nam Phong and its tributary creeks. The Nam Phong alluvium is mainly composed of clay or heavy clay. The creek-alluvium is usually medium textured, but both sand and clay layers may occur. Part of the material in the creek-valleys may be colluvium, locally derived from the slopes.

Old alluvium. The low terrace old alluvium is mainly medium textured, but some sandy clay loam or clay loam is found.

The middle terrace old alluvium has, as stated above, a widely varying texture. It is sandy (sand, loamy sand and sometimes sandy loam) in its upper layers and clayey (clay loam, sandy clay loam, sandy clay) in its lower layers. Lateritic gravels occur on the boundary between the two layers.

Part of the surface materials of the middle terrace formations are composed of more recent colluvium, washed down from the higher parts towards the lower slopes and the narrow valleys. This colluvium, which is mostly sandy, usually cannot be distinguished in the field from the original sandy old alluvium.

### 3. Climate.

No exact climatic data for this area are available. Rainfall is probably intermediate between Udon Thani (1428 mm) and Khon Kaen (1189 mm), e.g. in the neighbourhood of 1300 mm annually. Average annual temperature is around  $27^{\circ}$ , with a minimum in December-January ( $22.5^{\circ}$ ) and a maximum around April-May ( $29.5-30^{\circ}$ ). Most of the rainfalls from late April to medium October, with maxima in May (appr. 200 mm) and in September (appr. 270 mm). The period from October to early May is dry with only occasional showers. Variation of rainfall from year to year is great. In some years 30 to 50 % less or more than the average may fall. The distribution of dry spells during the rainy season also is variable; periods with two to three weeks of dry weather not being exceptional.

The bio-climate of the region is, accordingly, sharply divided. Most growth and production of agricultural crops takes place in the wet season. In the dry season, growth and production come very much to a standstill, except in places where groundwater is near or at the surface. The wet-dry cycle is especially pronounced on the high sandy soils (Nam Phong series). The forest here takes a "steppe-like" aspect in the dry season with most of the sparse ground-cover dying back.



#### 4. Vegetation and landuse

The map nr 1 indicates the principal vegetation and landuse types of the area, as they presented themselves in 1945, the year in which the air-photos of the area were made.

Most of the area is under forest. On the sandy parts, the forest-stand is poor and mainly composed of dipterocarps, often with a stunted growth. Undergrowth is sparse with no complete groundcover. On the less sandy parts, undergrowth is denser with a predominance of shrubs, some of which are spiney.

All forest seems to have been exploited to a certain degree but only a relatively small part was at one time or another destroyed entirely for shifting cultivation. Again, on the sandy soils, little shifting cultivation has taken place.

Some better quality forest and shrub land is found in the valley of the Nam Phong, along the stream (alluvial complex). In this area, the low spots usually bear a marshy vegetation without trees.

The remainder of the land is mainly in use for cultivating rice (one crop a year) whereas in and around the villages the land is in use for gardens.

#### 5. Hydrography

The main stream of the surveyed area, the Nam Phong river, contains water the year round. Its valley has a relatively high groundwater level and is more or less deeply flooded during part of the rainy season. The creeks of the area are intermitten streams. Only in the lower part of their course do they contain water the year round. More upstreams, however they either dry up in the later part of the dry season or they are reduced to a mere trickle, fed by an occasional shower. The side-valleys of these creeks, do not usually contain water, unless it is impeded in rice fields. Only during and immediately after the rains, running water is found in these valleys.



Whereas groundwater is high in the valley of the Nam Phong, it is low or even absent in most of the higher part of the surveyed area. The sandy character of these higher parts causes the water to infiltrate quickly beyond the reach of most plant roots. This very dry character of most of the surveyed area is reflected in the plant growth.

### III. SOILS.

Following units are distinguished on the soil map (no 2) :

LOWLAND SOILS (Soils of the alluvial plains, subject to flooding)

#### Pm : Phimai series

These soils are situated in the valley of the Nam Phong and are found exclusively in the eastern part of the surveyed area. Pm soils of this area are clayey throughout with a black surface soil and a dark gray subsoil. Mottling, an indication for periodic high groundwater starts in the surface layer and continued throughout the profile. These soils are thus poorly drained. pH values in these profiles are over 5, usually around 6 or 6.5. Base saturation is medium.

The Pm soils in the surveyed area are exclusively in use for rice; they produce one good rice crop a year, but damage may occur during exceptional floods of the Nam Phong river. Most of the rice of the villages on the border of the Nam Phong plain is grown on the adjacent Pm soils.

#### St : Si Thon series

The St soils are found in narrow strips in the valleys of the Huai Yang and the Huai Hin Lat. Their total surface is small. Valleys of other creeks and drainage ways usually contain also some St soils in the lowest parts, but these spots were too small to be represented on this soil map.

The St soils have a variable texture, usually loamy materials compose most of the profiles. More sandy and more clayey layers are found also. The pH of these soils is somewhat higher than 5 ; neutral to slightly alkaline St soils were found in the valley of the Huai Hin Lat.

The St soils are all used for rice and give a medium to good crop.

Kn : Kalasin series

These soils are found in the lowest part of the Nam Phong valley. Not all Kn soils, present in the surveyed area are represented on the map; some were grouped with the AC unit. The Kn soils are marshy and covered with water for most of the year. The unit probably includes some spots which are inundated throughout the year (permanent lakes)

These soils are clayey and have a black, humiferous surface soil which may be even peaty. Only along the transition to higher soils, rice is grown on the Kalasin soils; for the most part they are not cultivated. Because of drainage difficulties, these soils do not have much agricultural potential. Some water vegetables can be grown here.

AC : Alluvial complex

Along the Nam Phong river and the lower part of Huai Hin Lat, the terrain shows a complicated soil pattern. Higher and lower parts and strips alternate quickly and soils of the Chiang Mai, Phimai and Kalasin series are found side by side. The different soil series cannot be represented separately on the soil map.

The AC areas are, for all large part, composed of good soils but, apart from a few rice fields, they are not put to agricultural use because the rough microrelief and often the periodic flooding prevents their permanent use. On this soil complex, a rich forest with dense undergrowth prevails, but the lowest parts are marshy. It is our opinion that much of the AC area could be reclaimed for permanent pasture of high productivity.

LOW UPLAND SOILS (Soils of the low and middle terrace, inundated because of rice cultivation)

Re : Roi Et series

These soils occur in a number of depressions, especially along the border of the Nam Phong but also in some narrow valleys in the western part of the surveyed area. While most of the surveyed Re soils are in the deepest parts of the depressions, some are found climbing up the gentle slopes.



The latter kind of Re soils was recognized as a separate soil phase which, however could not be indicated separately on the soil map because of the small scale of this map.

Most Re soils, surveyed in this area, are medium textured (fine sandy loam) with a somewhat lighter surface soil and a somewhat more clayey subsoil. The high Re soils, however, are distinctly more clayey in the subsoil. The Re soils show gley (mottling) throughout the profile. They are inundated by impounded rainwater, during part of the year, but in the dry season the ground water table sinks deeply below the surface. The pH is slightly acid to acid, with minimum values around 4.5

These soils are in use for rice cultivation. Since they are not flooded by the rivers and creeks, virtually the whole water supply is provided by rains which are impounded in the rice fields. Yields vary strongly with the amount of rainfall and can be low in a dry year. The natural fertility of most Roi Et soils is only mediocre and the rice yields in this area are usually situated between 12 and 22 tangs per rai. Yields could be improved by better water control and fertilizer application, but in several cases such measures may not be economical for the farmer.

Ub : Ubon series

The Ubon series is found both in narrow depressions and on the smoothly sloping lower parts of the terrace formations. Some of the Ubon spots, surveyed in the very narrow valleys include some other soils (Phen, Roi Et and Si Thon series) which could not be indicated separately on the map.

The soils of this series are sandy (loamy sand or sand) for at least 50 cm. Below this limit, heavier textured material may occur but more often than not the soil is sandy till at a depth (125 cm). They are slightly acid to acid and have little humus in the topsoil (less than 0.8 % organic matter). Whereas these soils are mottled in the surface layers, they nevertheless are dry for an important part of the year. Only in the middle of the rainy season do they fill up with water so that rice can be planted.



The value of these soils for agriculture is low. Rice yields average from 7 to 10 tangs per rai and in a dry year total or partial crop failure is not exceptional. The marginal character of these soils can be observed by the fact that several of them are abandoned after having served for rice fields for a short time.

Whereas both fertility and water economy are poor in these soils, improvement can only be obtained by combined fertilizing and irrigation. These measures, however may prove in most cases to be too costly in regard to yield increase obtained.

Pn : Phen series

Soils of this series were found in a few depressions only; their total surface is small.

The surface layers are sandy or loamy; deeper down more clayey material prevails. All Phen soils show lateritic concretions at a depth of less than 50 cm. They are mottled throughout and, hence, poorly drained but the groundwater descends deeply in the dry season.

These soils are used for rice with results, comparable to those obtained on the Roi Et soils.

UPLAND SOILS (Soils of the terraces, not in undated)

Kt : Korat series

Soils of this series are encountered both in the eastern and the western part of the area where they occupy an intermediate topographical position between the higher Nam Phong series and the Low Upland or Lowland soils. Some Kt soils form narrow strips along the sides of the narrow valleys, passing through the high middle part of the surveyed area. Two phases of this series can be distinguished which, however are not indicated separately on the map. The Korat soils, surveyed in the Western and middle parts of the area are composed of pure sand in their upper layers, which passes to loamy sand or sometimes sandy loam at a depth of less than 60 cm. Quite frequently, lateritic concretions are found in the deeper subsoil.

The Korat soils bordering the Nam Phong plain are usually composed of loamy sand, sometimes of sandy loam which becomes somewhat finer with depth. The villages on this maps are all situated on such Korat soils in which lateritic concretions, if present, are mostly encountered at more than 100 cm. depth.

The Korat soils are somewhat acid to acid, with pH values which usually are between 4.5 and 5.5 in the subsoil. Mottling (gley) may occur in the subsoil or may altogether be absent in the profile.

The Korat soils with a sandy surface soil are mostly not used for agriculture. The somewhat finer Korat soils have for an important part been used for shifting cultivation but have by now been mostly abandoned. Permanent agriculture is mainly limited to the areas in and around the villages, where gardens with diverse vegetables and fruits are found. These village soils, are somewhat richer because they have been fertilized with village refuse, bones and the like. Also, they have more humus in the topsoil.

Korat soils are poor soils, the sandy Kt soils even being very poor. When cultivated they are highly susceptible to deterioration, both in respect to physical conditions and to plant nutrient status. After a few years of dry land crops, fertility goes down so much that the farmers abandon the land. Erosion, especially micro erosion due to destruction of the surface structure is rampant when these soils are exposed to heavy rains. Establishment of permanent agriculture is mainly dependent on finding a good crop rotation which protects the soils surface and maintains the little fertility there is.

Ng : Nam Phong series

This series occupies the higher parts and is the predominant series of the surveyed area. The site, chosen for the agricultural station is for more than 70 % composed of Nam Phong soils.



Profiles of the Ng soils are composed for at least 60 cm. of pure sand which is loose when freshly dug and which contains very little clay and minerals other than quartz. Below 60 cm. loamy sand and lateritic gravels are quite often found. The humus content is low, the pH of these soils is around 5 with higher values in the topsoil. Ng profiles do not show mottling at less than 60 cm and are never water saturated, even in the rainy season. For most of the year they are very dry.

Only a few spots of Ng soils have ever been cultivated in this area. Results are poor and the soil is abandoned after one or two years. Mostly, the Ng soils are covered with an open dipterocarp forest of little economic value. The undergrowth is poorly developed and more than half the soil is bare of any vegetation.

The soils of the Nam Phong series, under present-day economic conditions, have no or little agricultural value and even their value for forest is strictly limited. Reclamation of such soils is bound to become a failure because very little can grow. Even when fertilizing and irrigation would be applied, agricultural production would be so low as to make the investment of capital a very poor proposition. The poor growth of natural grass indicates that establishing pastures on these soils is bound to become a failure too.

Pp : Phon Phi Say series.

These soils are mainly found on the slopes, bordering the Nam Phong valley in the Eastern part of the surveyed area. They have their largest extension South of Ban Nam Payom. Elsewhere, Pp soils are found on the flanks of the valleys crossing through the higher terrain. Mostly, these soils have an accentuated relief with medium to strong slopes, often crossed by gullies and drainage ways.



The profiles are usually composed of a sandy or loamy surface soil, passing to heavier material such as clay loam or even clay at shallow depth. Lateritic gravel is found at less than 50 cm depth, usually in great quantities. More often than not, the laterite starts in the surface layers and the soil may be partly covered by these lateritic gravels. The pH of these soils is low, values of 4.5 in the clayey subsoil are common.

Although the presence of the lateritic gravel may interfere more or less severely with soil management, the Pp soils are not nearly as poor as the Nam Phong soils. The clayey subsoil contains at least some mineral reserves and preserved water so that these soils are less susceptible to drought than the soils of the Korat and Nam Phong series. Nevertheless, the Phon Phi Say soils in this area are only sporadically cultivated, which is due to their unfavourable topography and to the fact that farmers have no experience in working these finer and gravelly soils. In future, a more intensive agricultural use could be made of these soils, provided that measures are taken to avoid accelerated erosion, for which the Pp soils of this area are extremely susceptible. Establishing permanent grassland may be the most economic solution.

Bb-c : Borabu complex

In this complex are comprized the rocky outcrops and surrounding soils, which are found in a strip along the Khon Kaen-Udon highway in the North of the surveyed area. The rock outcrops are prominent just South of the Huai Yang. These rocks are composed of sandstones and conglomerates. In-between and on the side of the rock outcrops, some soils are found which were formed on residuum from the sandstone and which belong to the Borabu series. Further, some soils of the Nam Phong series, discribed above, form part of the complex.

Agriculturally speaking, the area surveyed in this unit is useless and can be considered as wasteland.

#### IV CONCLUSIONS AND RECOMMENDATIONS

##### 1. General aspects of agriculture

Considering the situation of the farms and villages, it is clear that only a small part of the area is in agricultural use. The villages are all situated on the lands, bordering the alluvial plain of the Nam Pho. Their main agricultural produce, rice, is derived from the soils of the Nam Pho plain and, to a lesser extent from the valley bottoms of the creeks and drainageways. As far as the upland soils are concerned, only the village areas proper are in permanent use for gardens, producing mainly fruits and vegetables.

Rice cultivation is pushed about to its maximum extension; nearly all soils on which rice could possibly be grown under the present management and economic conditions are indeed converted to paddy lands. There are even indications of over-extension because in several cases soils which were converted to rice land are so poor that they had to be abandoned afterwards.

Within the framework of existing agricultural techniques and economic conditions, the situation is much the same for the upland soils and crops. Most of the soils of the Korat series in the Eastern part of the area are or have been used for shifting cultivation. After a few years (maximum three) of cultivation these soils are abandoned for an indetermined period because they have become unproductive. Most if not all of the potential shifting cultivation land of the surveyed area has thus been "used up". In a few spots it was observed that the farmers even start to cultivate the much less productive Nam Phong soils; usually with bad results right from the start.



The conclusion of these observations is thuswise that, although apparently much land is free in this area, the soils are already being "overused" and no increase of production can be expected with the existing landuse and management practices.

## 2. Productivity of the surveyed area.

The quality of the lands and their suitability for agriculture is represented on the land classification map (map nr 3). It is very clear that the majority of the lands is very poor and not economically suited for agriculture, even if modern techniques, management and irrigation would be applied. The area which was provisionally chosen as the site for the agricultural station consists for at least 80 % of low-grade land, not even suited for experimental agriculture.

## 3. Soils of the area in relation to general soil conditions in North-Eastern Thailand

Comparing the soils series found in the surveyed area with the new legend of the soils of North-Eastern Thailand (1) it can be seen that many of the main soil series of the North-East are represented here. However, the ratio in which these series appear is not typical for the North-East as a whole. More in particular, the predominance of the Nam Phong series is characteristic for this area but (luckily) not for the whole North-East, especially not for the main agricultural regions of the North-East. The Phon Phi Say soils, found here, are different from the Pp soils, found in large areas more to the North inasmuch as they have a much more pronounced relief. The most important rice-growing soils of the North-East (Ubon and Roi Et series) are only scarcely represented in the surveyed area and even less if only the project-area is considered. Another soil series, the Yasothon series, which has a fair agricultural potential, is not represented in the surveyed area.

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(1) See Miscellaneous Soil Report nr 9, "a key to the soil survey of North-Eastern Thailand."



#### 4. Irrigation possibilities

The high ridge which traverses the area from North to South and in which bedrock is found at a shallow depth is well suited for the construction of water storage dams. The valleys, where they cross the ridge are V shaped and narrow so that the length of the dams needs not be very great. Westward of the ridge, the valleys widen out, so that great quantities of water could be stored behind a relatively low earthen dam. Whereas, thuswise the engineering aspects of dam construction in the area are favourable, this is not the case with the agricultural aspects. Consider, for instance, the valleys of the Huai Yang and the Huai Hin Lat, which are more in particular suited for dam construction. Building a dam in these valleys would result in the inundation of quite a large surface of the valley bottom, upstreams of the dam. The soils of these valley bottoms, (mostly Si Thon and Roi Et soils) are the only productive soils in this upstreams area and the villages (Ban Sa Kut, Ban Nuang Wat, Ban Non Sawm Na Kham Hai) which are situated here would thuswise be deprived of the larger part of their riceland and, consequently, would become unviable. If the gain in newly irrigated land would be more than the loss in flooded land, this measure could be justified, but this does not appear the case. Projecting the level of the water in the prospective reservoir down streams, it can be observed that only a relatively narrow strip along the valleys of the two mentioned creeks could possibly receive water, the rest being situated too high. Of this potential irrigable land, a good part is composed of Nam Phong soils, which, even under irrigation, would retain their low productivity. Another part (especially the Phon Phi Say soils) has an outspoken poor topography for irrigation, and only a small part, the flatter soils of the Korat series would really benefit from the irrigation. The conclusion is thuswise clear that building the dams in the two valleys would mean a definite loss in productivity and the upsetting of the

precarious landuse balance of several villages in the area. Such a measure would be justified only from a point of view of agricultural experimentation but definitely not from the point of view of improving the agriculture of the region. A more favourable alternative to the building of dams in the larger creek-valleys may well be the construction of small ponds in some of the narrow drainage-valleys, found in the higher parts of the surveyed area. Such ponds could feed the valley-bottom down-streams, without too much land being inundated. Several ponds in one valley might be possible. Here, a probable difficulty may arise from the fact that such ponds would often have to be constructed in sandy, permeable material and thuswise might lose much of their water through seepage.

##### 5. Forestry

The majority of the area is covered by forest or secondary forest growth on lands which have been used for shifting cultivation. According to informations, obtained from the FAO Specialists, working on the forest-inventory of North-East Thailand, several types of forest can be distinguished.

By far the best is the low forest, found on the AC unit in the valley of the Nam Phong. This forest certainly has a potential productivity and merits to be exploited and improved. On the contrary, the open dipterocarps forest which is found on the Nam Phong soils, apparently shows a very poor stand and is, from a forest exploitation point of view, hardly productive. The stand on the somewhat moister soils, especially on soils of the Korat and Phon Phi Say series is, though poor, markedly better than on the Nam Phong soils.

It is the opinion of the above mentioned forest specialists that, under the prevailing conditions it is hardly worthwhile to spend effort and money on the amelioration of the very poor open dipterocarps forest.



## List of Miscellaneous Soil Reports

- 1 : Report on the preliminary soil survey of the Mae Klong Irrigation Project Area
- 2 : Report on the preliminary soil survey of the Lam Takong Irrigation Area (in print)
- 3 : Report on the preliminary soil survey of the Tung Sarit Irrigation Area (in print)
- 4 : Report on the preliminary soil survey of the Lam Nam Phong Irrigation Area (in print)
- 5 : Report on the soil survey of the Huai Si Thon Irrigation Project
- 6 : Report on the preliminary soil survey of the Greater Chao Phya Irrigation Area (in preparation)
- 7 : Report on the soil survey of 10 villages in Changwat Ubon
- 8 : Major soils of South-East Asia
- 9 : A key to the soil survey of North-Eastern Thailand
- 10 : Report on the soil survey of the site of the proposed agricultural centre near Satani Nam Phong (Khon Kaen Province).

Limited number of copies of these reports are available upon request.