Overview of Rainfed Agriculture in Northeast Thailand

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Appendix 5

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Introduction

The purpose of this paper is to provide background information concerning rainfed agriculture in Northeast Thailand. This review cannot hope to be complete and therefore attempts to focus on the agricultural characteristics of the region that have important implications for the objectives of this workshop and presents information that will not be directly dealt with in other papers.

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The Northeast Region

The Northeast region covers 170,000 km^2 and is bounded to the north and east by the Mekong River which forms the common border with Loas, to the west by the Phetchabun mountain range and to the south by the Damrek mountain range where it borders with Kampuchea. The Phu Phan mountains run in a southeast direction dividing the region into the Sakon Nakorn and Korat basins. The former drains by the Sri Songkram River directly into the Mekong while the Korat basin or triangle is drained by 2 major rivers, the Chi and the Mun which flow into the Mekong in Ubon (Figure 1). Both basins are at an elevation of approximately 200 M. and are characterized by a gently rolling topography sloping towards the southeast. A schematic cross-section of the region is shown in Figure 2.

Rainfall patterns are dominated by both the southwest monsoon and tropical cyclones originating over the Indian Ocean. There is a distinct rainy season from May to October exhibiting a bimodal pattern with peaks in June and September Average annual rainfall varies from less than 1000 mm in the rain shadow in the west to over 2,300 along the Mekong in the northeast giving 3 distinct rainfall regimes (Figure 3). The critical factor affecting agriculture, however, is the extreme variability both within and between years rather than the total amount of rainfall received.

There are 35 different soil types in the Northeast but the majority fall into one of 4 great groups (Table 1).

With the exception of some limestone areas in the hills, virtually all soils in the Northeast are derived from sandstone, shale or siltstone and therefore are inherently low in potassium, calcium, magnesium and phosphorous (Ragland et al., 1984). Being highly weathered, they are extremely sandy and have low organic matter and clay (predominantly kaolinitic) contents. Low clay contents combined with the low activity of it's kaolinitic minerals give rise to soils of extremely low cation exchange and buffering capacities which are often extremely acidic especially when dry. In addition, parts of the region are underlain by salt bearing rock, often quite close to the surface giving rise to geologically induced salinity problems in some areas (Mitsuchi, 1984).

The region contains approximately 17 million people or about one third of the total population of Thailand and has an annual population growth rate of 2.37% The majority are "Thai Issan" who migrated across the northeast from Laos and the left bank of the Mekong over the past several hundred years (KKU, 1982). There are also many ethnic sub groups including: Laos-Wieng; Thai Korat; Khmer in the southern provinces; recently-migrated Vietnamese and long established ethnic Chinese mainly in the towns and larger villages.

Farming is the major occupation of 80 per cent of the population and, on average, 75 per cent of household-income comes directly from farming (USAID, 1981). Average agricultural household-income for the region is 15 000 Baht or approximately $540 per year which represents only 65% of the national average

(OAE, 1983). The Northeasterners are extremely mobile and will often migrate to the provincial centers. Bangkok or other regions to find work in the off-season to supplement their incomes. A significant number also migrate to Singapore or the Middle East to find work mainly as labourers for periods of 1 to 3 years.

The region is well served with air, rail and road systems linking the major market towns and the region as a whole with Bangkok. Laterite roads link most of the villages directly with market centers or at least provide access to the highway system. Small-scale industry and construction in the changwat centers provides some off-farm employment in the region.

Administratively the Northeast is organised according to Table 2. Agriculture receives high priority in the Nation's economic policy and greater attention is now being given to rainfed and poverty areas than in the past with obvious positive implications for the Northeast. The region includes 60 per cent of the nation's government-designated poverty areas with over 75% of the region's Districts falling into the category. Such Districts receive additional aid through various development programs. A major policy shift in recent years is towards greater reliance on local initiative and participation in development programs which should, as a consequence, solve locally important problems and thus better serve the real needs of the farmers. This should greatly benefit the Northeast which in the past has suffered from inappropriate programs run from Bangkok. Specific agricultural policies which will help the

Northeast include the promotion of export crop commodities, reforestation, small-scale water resource development and improvement of problem-soil areas (saline, acid and eroded soils).

Production Patterns

Total cropped area in the Northeast is increasing as population pressure causes the farmers to cut the forest and bring it under cultivation. Deforestation is occurring at an alarming rate and currently stands at 7% per year (Table 3). Most of the forest clearance is not for permanent agriculture. Farmers are exploiting the initially high organic matter and nutrient levels for 2 to 3 years cropping after which the land is abandoned as fertility levels and yields decline. This is adding significantly to the regions problems through increased flooding in the rainy season and reduced river flow in the dry season.

Permanent agriculture in the region is essentially small, predominantly crop-based, mixed-farming with 80 per cent of agricultural income coming from cropping activities, the remainder accrues from the sale of livestock and fish, production of silk and charcoal, sale of forest products, etc.

A variety of cropping systems have been evolved by farmers in response to their local agro-ecological conditions and family requirements. Ninety-five percent of the region has no irrigation and the crop production environment is characterized by rainfall with extremely high annual variability. Staggered planting dates, cultural practices and the crops grown are the most common farmer strategies for dealing with this variability.

Cropping patterns in the region can best be summarized according to five generalized land types. lower paddy, middle paddy, upper paddy, upland and hill land. Most farms are composed of a mixture of 2, 3 or more of these land-types in varying proportions depending on their location.

The lower paddy land is bunded and planted to long duration rice every year in the wet season. Rice seedling nurseries are also generally established on this land type as soon as sufficient water is available. Other crops grown in part of this area include kenaf before rice and a variety of vegetables for home consumption with sale of the surplus in local markets. The major problems on the lower paddy land are occasional flooding of the rice in wet years and difficulty in establishing pre-rice upland crops due to temporary waterlogging of the soil.

The middle paddy is probably the most productive land in the region as it combines reasonable water control with a reduced risk of flooding. A medium duration rice crop is produced in the rainy season most years sometimes with vegetable, legume or tobacco crops before and/or after the rice.

The upper paddy is also bunded but may be planted to short duration rice in only three or four years out of ten with a successful harvest being taken even less frequently. This land has the potential for producing one or two upland crops during the rainy season. Farmers will plant rice whenever possible, however, and by the time the decision is made that there will be insufficient rainfall for rice it is generally too late to plant an upland crop. Weed problems are severe on this land since it

often lies fallow for 2 - 3 consecutive years allowing weed populations to build up.

The uplands account for 20-30 percent of the cultivated land in the Northeast and consist of unbunded fields, often on land reopened from a short bush fallow. The major crops grown on this land in order of importance are: cassava, kenaf, sugar cane, upland rice and legumes such as peanut or mungbean, which are usually grown as monocrops during the rainy season. The major problems here are rapid reduction in soil nutrient levels, selective soil erosion of clay and organic matter (Mitsuchi, 1984) and disease build-up in the continuously cropped areas.

The hill-lands are found in the more mountainous areas in the south, the west and in the Phu Phan range. The hill soils are usually of higher inherent fertility than those found in the river basins and generally produce good yields of maize, upland rice, cotton and a variety of other crops in the rainy season. The major problems include sheet and gulley soil- erosion, poor water retention due to the shallow nature of the soils in some areas, isolation from markets and market price fluctuations. Farmers in these areas are especially at risk from price fluctuations as they often grow no rice and are therefore totally dependent on selling cash crops to buy their subsistence rice supply.

Production Levels

The crop production data presented in Table 4 illustrates a number of important properties of the agricultural situation in the Northeast.

First, the Northeast is a vital contributor to the successful Thai economy through it's contribution to agricultural production, which for Thailand as a whole accounts for 65% of total export earnings. The region supplies 36 and 59 per cent, respectively of the country's rice and cassava, Thailand's 2 largest export earners. It also produces 22 per cent of the maize, 11 per cent of the sugar cane and 100 per cent of the kenaf which are also important export commodities.

Secondly, despite the generally poor soils and erratic rainfall in the region, yield levels are generally comparable with and in some cases exceed national averages. Rice yields are low because of soil and water-control problems but also because, unlike many larger rice farmers in the Central Plain and elsewhere, rice is produced as a low input, subsistence crop in the Northeast and produces little or no cash for the purchase of fertilizer and other inputs. Considering the production constraints facing the Northeastern farmers, the yields obtained should dispel any ideas that, the farmers are backward or lazy. They are undoubtedly among the most skilled in southeast Asia and are behaving rationally in the face of the constraints facing them.

Thirdly, changes in the planted area of the major crops illustrate that agriculture in the Northeast is extremely dynamic The rice area varies considerably from year to year in response to rainfall Changes in planted area of the other crops, however, are more in response to market opportunities and prices received. Cassava is the best example of this. Within

the last 10 years as demand grew in Europe, cassava from being a virtually unknown crop has become the second most important crop after rice and the largest cash earner for the region. These shifts in production patterns illustrate how farmers will respond to new opportunities and should help to dispel the myth that they are resistant to change.

With the exception of rice and cassava where planted area has fluctuated annually and kenaf production which has declined, the area of all the other major crops has increased significantly in recent years. Production levels have also increased but due mainly to the expansion of the area planted rather than higher yields which have fluctuated from year to year but have not significantly increased. In the future, if production is to continue to expand and the natural resource base of the region is to be maintained then yields per unit area must be improved.

Agro-ecosystems of the Northeast

Various attempts have been made to classify the Northeast into zones or domains for agricultural purposes (Pisone, 1984; OAE, 1980; DOA, 1979). These efforts have been based mainly on rainfall, soil type and economic conditions but have generally not been found to be very helpful and have not been widely used. This is probably for 2 major reason. Firstly, local diversity within the various zones or even within villages and individual farms is considerable and probably accounts for larger differences in agricultural practices within the zones than between them. Secondly, the zoning systems have failed to take sufficient account of the topography of the region which is the

main determinant of both soil hydrology and nutrient status, the two critical factors for crop production.

Based on topography and water regimes, 5 major agro-ecosystems can be identified for Northeast Thailand. These are: hill, mini-watershed, non-flood plain, flood plain and irrigation systems (Rimpinuntana, 1984). This is not offered as an alternative form of agro-economic zoning but rather classifying the region in this way facilitates the description of the major agricultural production patterns and allows conclusions to be drawn regarding the important problems and constraints facing farmers. Figure 4 shows the location of these systems and their major characteristics are summarised in Figure 5.

Stability

Agriculture in the Northeast is subjected to 2 major types of instability first, production instability, caused mainly by climatic variability and second, price instability for both marketed products and purchased inputs.

The greatest production variability occurs in the wet season rice crop and is reflected in both the area planted and yield per planted area. Regional production data do not give a true picture of this variability. It is not until the lower levels in the hierarchy are reached that the real variability facing farmers becomes apparent (Figure 6). This is due to internal buffering within the region -droughts in one place are compensated for by high rain elsewhere; high rainfall reduces yields in the flood plain through flooding but increases yields

through better water control in the non-flood plain or mini-watershed systems, etc. Individual farmers still have to cope with the variability, however, and they have developed various strategies for coping with risk. In rice for instance, they use photo-sensitive rice varieties so that planting date can be adjusted depending on if and when this is sufficient water; they keep a number of years rice supply in their barns to carry them over years of low production and they use minimal purchased inputs to reduce risk in drought or flood years when they may lose the entire crop.

In cash crops, a further factor of market risk is also introduced. The farmers respond similarly with minimal inputs in these crops; they choose export crops which have more stable prices and plant crops with flexible marketing schedules such as cassava or kenaf which can be left in the ground until prices improve or choose storable crops such as rice and maize which can be sold when prices are higher.

The inherent instability has a number of important implications for technology design and transfer. First, rice is the key to agricultural development in the region, if rice yields can be stabilized and improved this will remove many of the constraints currently facing farmers in the northeast. Secondly over-emphasis on productivity and insufficient attention to the stability properties of new technologies has led to low adoption rates in the past. Finally, many of the current cropping systems are exploitive in nature and are degrading the production resource base. In the future if agricultural production is to continue to expand and the natural resource base of the region is

to be maintained or improved then yields per hectare must be increased. This will not be achieved in the initial phases, however, by dramatic increases in purchased inputs. Rather, attention must focus on low-cost improvements in water control such as small weirs, shallow wells, better levelled paddies, etc and low input systems of soil improvement such as green manuring, liming, more efficient use of animal manure and compost, etc that the poor, subsistence farmers can afford.

Conclusion

The problems facing northeastern farmers are severe but not unsolveable. However, solutions will only come through a joint effort between research, extension and the farmer. The latter should be considered on active partner in the development process in order that his real needs, the constraints facing him and the wealth of local knowledge that he has to offer are incorporated into the design of new technology. In conclusion, the prolems that need to be addressed, some of which will be tackled by this worksnop, are as follows.

1. Rapid deforestation
2. Limited opportunity for irrigation: 5% at present; 20% maximum
3. Problem soils: Low O.M. and nutrients, acidity, salinity, low water-holding capacity.
4. Irregular rainfall: drought/flooding
5. Farmers' lack of cash for purchased inputs
6. Farmers' unstable subsistence rice production

7. Low and unstable market prices

8. Lack of area specific farming system recommendations

9. Poor links between farmer
   research ---- extension

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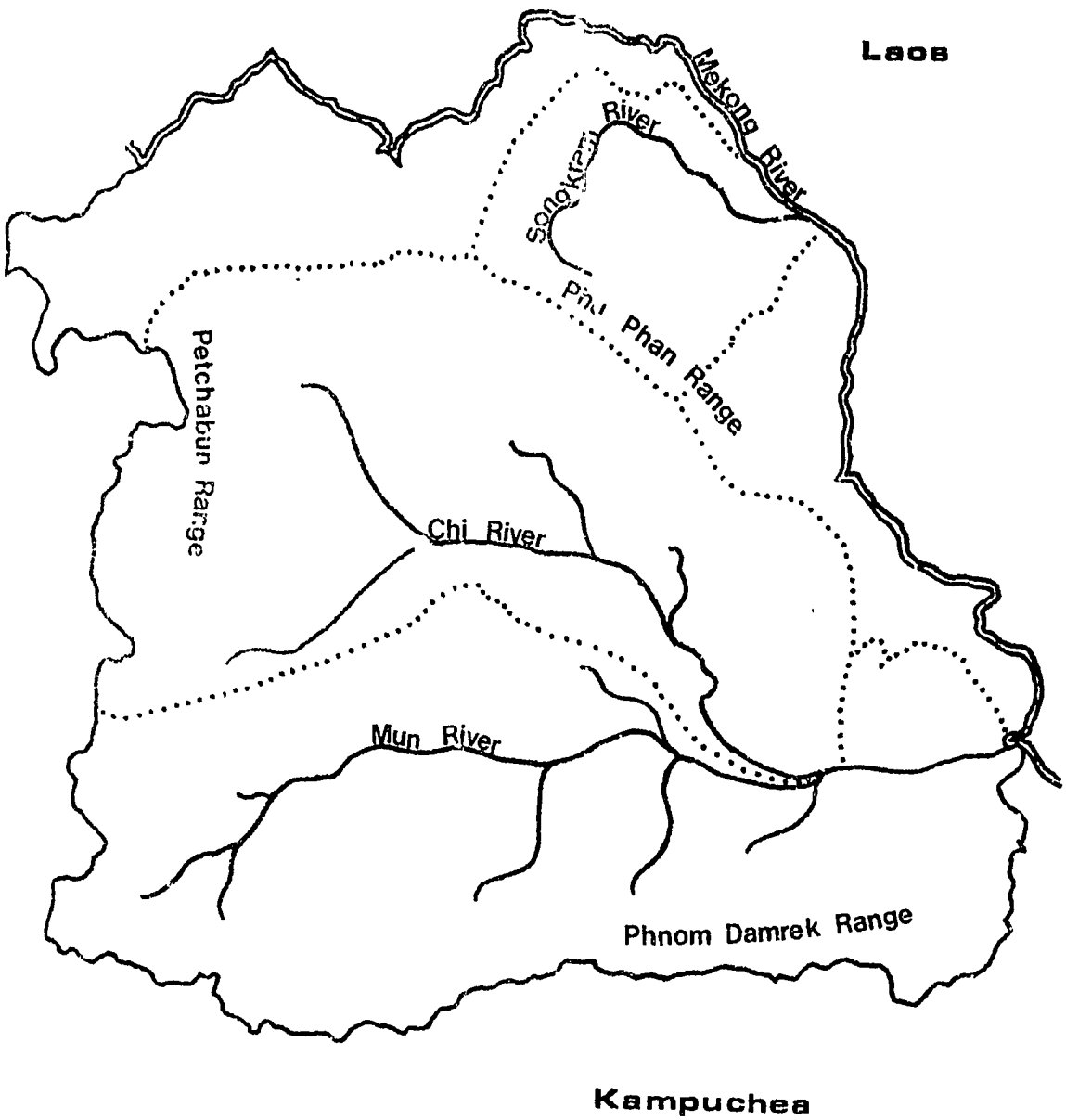
Figure 1. Topography of Northeast Thailand



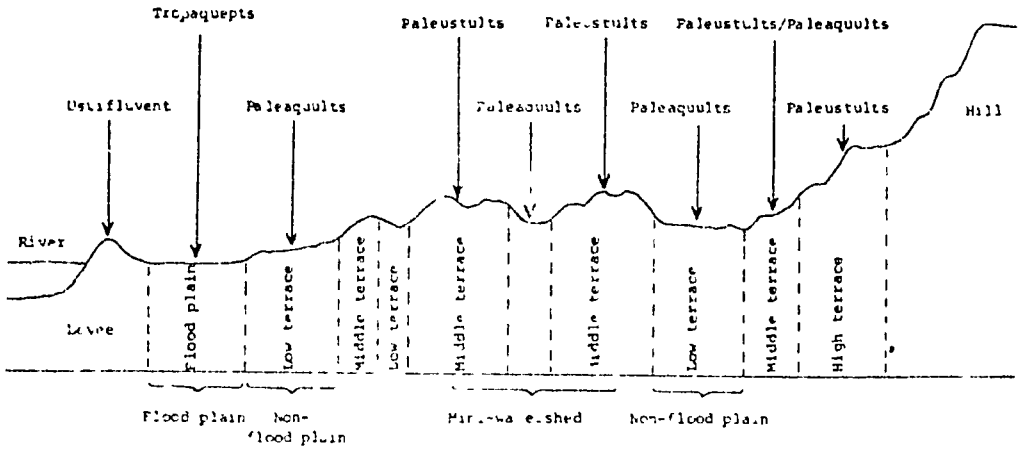
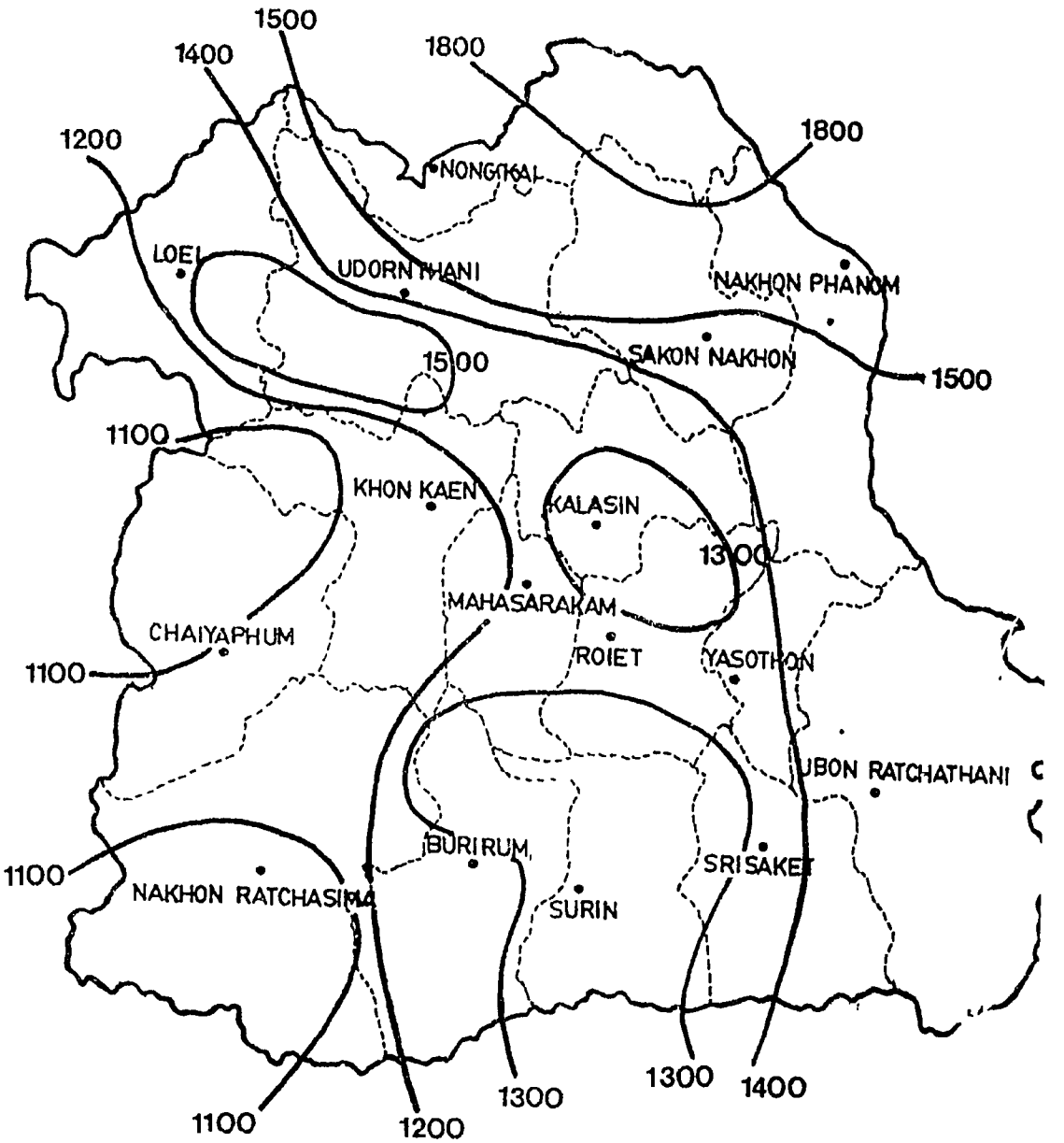


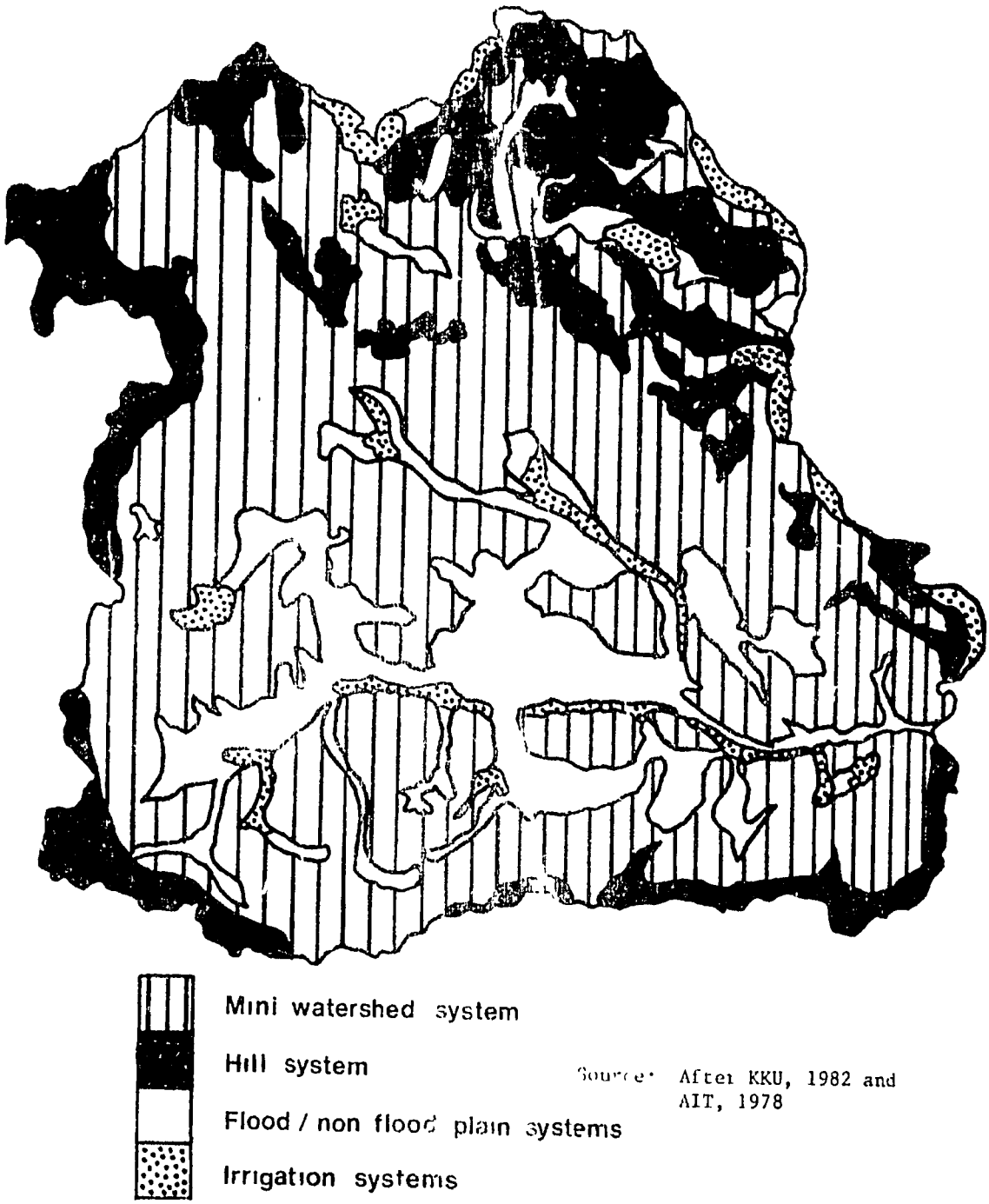
Figure 2. Schematic cross section of topography and soils in the Northeast.

Figure 3. Rainfall isohytes and major rainfall regimes



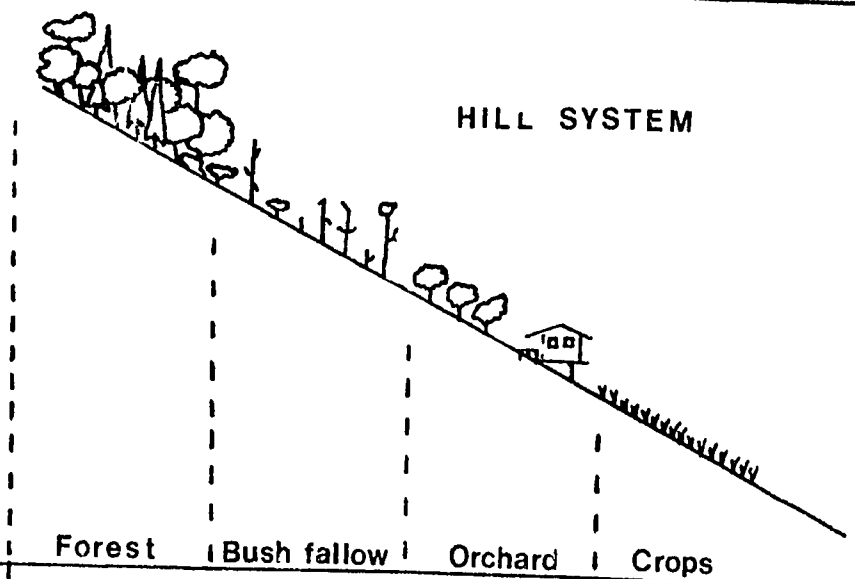
Source: KKU, 1982

Figure 4. Major agro-ecosystems of Northeast Thailand



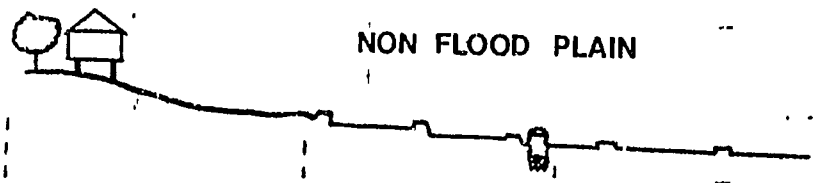
Source: After KKU, 1982 and AIT, 1978

Figure 5. Characteristics of the major agro-ecosystems of Northeast Thailand



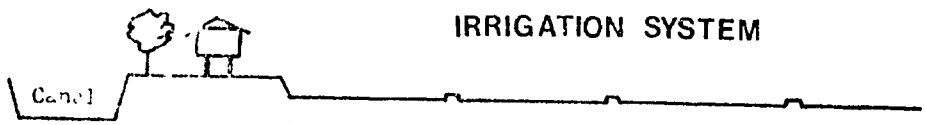
SOILS	Paleustults (loamy, fine-clayey), Haplustalfs			
CROPS	Gathering, firewood, hunting	Upland rice, cassava, maize	Mango, jack-fruit, custard apple	Maize, cassava mungbean, sorghum
PROBLEMS	Diminishing area	Shorter fallows, weeds erosion	Marketing, prices	Drought, weeds, soil erosion, prices
LOCATION	Western and southern hills and the Phu Phan mountains.			

Figure 5. Characteristics of the major agro-ecosystems of Northeast Thailand



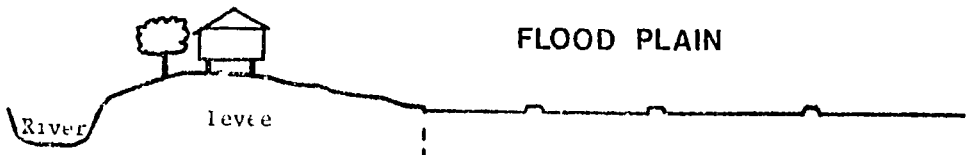
	Upland	Upper Paddy	Lower Paddy
SOILS	Paleustult	Paleaquult or Dystropept	Paleaquult or Dystropept
CROPS	Cassava, kenaf, sugar cane, peanut	Rice followed by peanut/tobacco, sesame-rice	Long-duration rice, kenaf-rice-water melon
PROBLEMS	Low soil fertility, marketing	Drought, low soil-fertility	Salinity, water-logging of upland crops, marketing
LOCATIONS	Throughout the Korat Triangle but predominate in the southern parts of Mahasarakam, Roi Et and Yasothorn and the northern parts of Sri Saket, Surin and Buriram.		

Figure 5.
Characteristics of the major Agro-ecosystems of N.E. Thailand



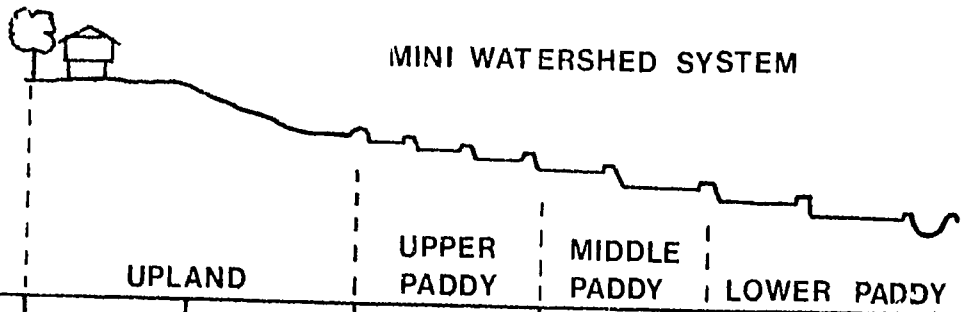
	Paddy
SOILS	Paleaquult
CROPS	Rice, rice-rice, rice-peanut/corn/vegetables
PROBLEMS	Irregular water supplies, salinity, marketing
LOCATIONS	Throughout the region in limited areas

Figure.5. Characteristics of the major agro-ecosystems of Northeast Thailand



	Upland	Paddy
SOILS	Ustifluvents	Paleaquults, Dystropepts or Tropaquepts
CROPS	Vegetables, fruit trees, mulberry	Long duration rice, rice-vegetables
PROBLEMS	Marketing, limited area	Flooding
LOCATIONS	Areas along the Chi, Mun and Songkram rivers	

Figure 5. Characteristics of the major agro-ecosystems of Northeast Thailand



	UPLAND		UPPER PADDY	MIDDLE PADDY	LOWER PADDY
SOILS		Paleustult	Paleustult/ Paleaquult	Paleaquult	Paleaquult
CROPS	Vegetable gardens, mulberry	Cassava, kenaf, sugar cane, water melon	Rice (short-duration)	Rice (long-duration)	Rice (long-duration)
PROBLEMS		Low O.M. content, selective-erosion, marketing	Insufficient water, weeds, drought	low soil-fertility	Low soil-fertility, occasional flooding
LOCATION	Throughout the Northeast in areas between the hills and the flood and and non-flood plains				

Figure 6. Percentage deviation of rice yields from an 8 year mean.

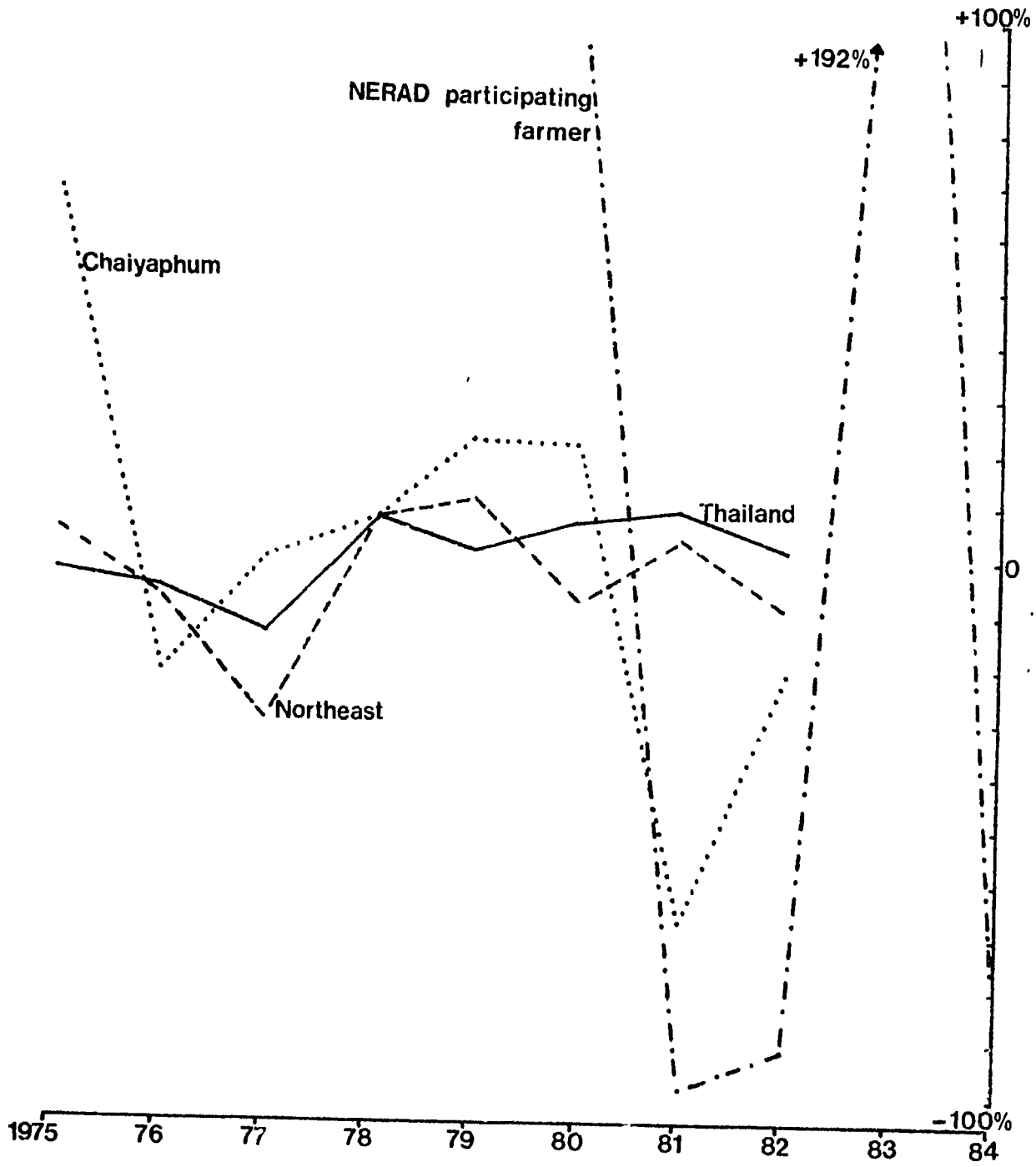


Table 1. Major soils of Northeast Thailand

USDA Classification	National Systems	Major Series
Ustifluvents	Semi-recent alluvial	Tamuang, Sanphaya
Tropaquepts	Recent alluvial	Ratchaburi, Pimai
Paleagults	Low Humic Gley	Roi Et, Tatum
Paleustult	Red-yellow/Gray Podzolic	Korat, Warin, Satuk Yasothorn

Source: KKU, 1982 and Mitsuchi, 1984

Table 2. Administrative Organisation of the Northeast

Total area	17 million Ha.
Provinces	17
Districts	193
(Poverty Districts)	(147)
Tambons	1981
Villages	20,828
Farms	1,840.184
Average farm size	4.5 Ha.
Average household members	6.6 people
Population	17 million
Pop growth rate	2.37 per cent

Table 3. Land Use in Northeast Thailand

Land use	Area (million Ha.)	Percent of total area	Percentage change in last 5 yrs
Total area	17	100 %	Unchanged
Forest land	2.7	16 %	- 3[illegible]%
Farm holding	8.3	49 %	+ 6%
Unclassified	5.9	35 %	+ 20%
Farming holding	8.3	100 %	+ 6%
Irrigated area	0.4	4.8 %	+ 44%
Paddy land	5.8	70 %	+ 5%
Field crops	1.7	20 %	+ 31%
Others	0.8	10 %	Unchanged
Head of cattle	6 million	-	+ 7%
No. of pigs	1.1 million	-	± 24%

Source: OAE, 1983

Table 4 Crop Production in Northeast Thailand

	Land Use		Production			
	Planted Area (Ha. x 10^3)	Change in Planted Area 1978-1983 (%)	N.E. as Percentage of National Production	N.E. Mean Yield 1978-83 (kg/Ha)	National Mean Yield 1978-83 (kg/Ha)	N.E. Yield as Percentage of National Average
Rice	4,257	± 9	36	1,200	1,660	73
Cassva	726	± 15	59	13,400	13,900	96
Maize	501	+ 53	22	1,780	1,990	90
Kenaf	217	- 31	100	1,040	1,040	100
Sugar cane	104	+ 124	11	39,800	40,600	98
Peanut	28	+ 25	19	1,020	1,190	86
Cotton	25	+ 13	25	1,270	1,150	110
Mungbean	18	+ 55	4	664	594	112

Source OAE, 1983