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RURAL POVERTY AND DIVERSIFICATION OF FARMING SYSTEMS IN UPPER NORTHEAST THAILAND.

C. BARNAUD¹, G. TREBUIL², M. DUFUMIER³, N. SUPHANCHAIMART⁴

ABSTRACT

In northeast Thailand, 85% of the farmers are smallholders who are unable to meet their basic needs from agricultural production only. These tiny farms survive thanks to non-farm income which face increased difficulties as other economic sectors ran out of steam during the recent economic crisis of the late 1990s. In this context, farmers have to rely more on their agricultural production activity and income. But how can this be made possible in a region well-known for its very constraining soil and climatic conditions? To answer this question, and to examine the whole complexity of agricultural development issues, this article proposes an analysis of recent agrarian transformations and an understanding of farmers' current practices and strategies. A diagnostic analysis of a village agrarian system located in Khon Kaen Province in upper northeast Thailand was carried out in 2002 by using a combination of field observations, interviews with key witnesses of the local history, and a farm survey of 26 diverse households. The recent history illustrates that farmers have shown a high adaptability to rapid changes in their economic environment, such as changing market demand for agricultural products and labour. The differentiation among farming households has led to different types of farmers with different resources, practices, and strategies. Families belonging to the most frequent type have a very tiny holding and their members are permanently or seasonally involved in unskilled off-farm activities. Their low and unstable total cash income is often insufficient to meet the family's basic needs and they become deeply indebted. As efforts to improve water availability are being made, many *Isarn* families could improve their living conditions by diversifying their agricultural production systems with more small-scale fruit, vegetable, fish, or livestock production to improve household food security and cash income, eventually combined with non-agricultural activities. But currently, such a strategy is still out of reach for numerous very poor farmers facing elimination across the region and government support to help them catch-up is still needed.

INTRODUCTION

Unacceptable levels of poverty in the world and fast-growing disparities, sometimes resulting in terrorism, set off an alarm bell regarding the seriousness of the situation. But a fundamental question remains: How can we reduce poverty, particularly in the context of globalisation? Does family-based agriculture still have a significant role to play? Could it still help reduce poverty, like in the late sixties and seventies during the "Green Revolution", which led to higher agricultural productivity, lower food prices, and an increase in food intake in irrigated areas across Asia. According to C.P. Timmer (2003), the answer is yes, but nowadays the linkages between improved household-based farming systems and poverty alleviation are less direct.

The proposed case study from upper northeast Thailand is particularly appropriate for analysing such linkages and for deepening the reflections because the model of economic

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growth the country adopted since the eighties is very much in line with the current neo-liberal development orthodoxy promoted by international agencies. Moreover, this region has a lot in common with other developing countries compared with other more developed areas in Southeast Asia (Dixon 1995). Thailand is also a “model” of social inequality as in the past fast economic growth was limited to urban areas and the industrial and service sectors. The average income of the middle class resulting from the years of rapid industrialisation after 1986 is around ten times higher than that of the average farming household in the country (Trébuil 1995).

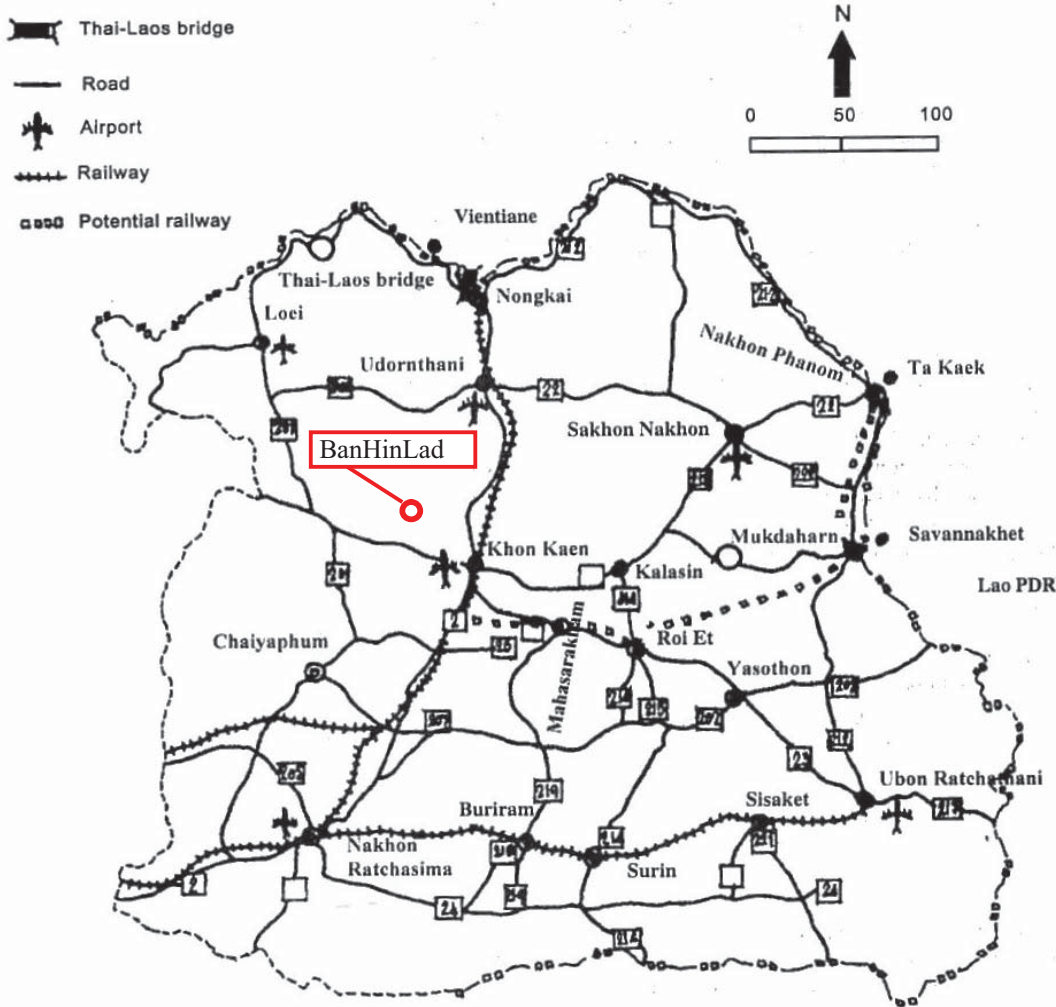
Northeast Thailand has always been synonymous with poverty and a somewhat backward rural setting in the kingdom (Grandstaff 1988). In the mid- nineties, 94% of the 21 million inhabitants of the “*Isarn*” region (one-third of the country population) lived in rural areas, and 80% of the regional workforce was involved in agriculture. Most farmers are smallholders, with the average farm size being 4.3 ha. But more telling is the fact that 85% of these farmers are unable to meet their basic needs from agricultural production alone, and more than half of the farming households’ income originates from non-farm sources (Farming System Research Group 1996). Having reached the limits of the agricultural land frontier after millions of pioneers migrated across the region during the previous decades, clearing 80% of the forest area for farming, northeast farmers migrated massively out of their villages in search of complementary employment (Phélinas 1995, Trébuil 1995). In the seventies, they went to the Central Plain and abroad, as far as the Middle East, then to Bangkok and its fast-growing industrial belts during the eighties and early nineties. More recently, thanks to economic incentives and decentralisation policies, non-agricultural employment increased in the countryside as well. As a result, more than ever, non-agricultural income allows most smallholders to survive and to continue to farm. But, since the major economic crisis started in mid-1997, the industrial sector has been running out of steam and cannot absorb the numerous rural labourers anymore (Ruaysoongnern and Suphanchaimart 2001). This crisis has generated a recent increase in poverty levels (the share of poor families in the northeast region jumped from 15% in 1994 to more than 30% in 1999), and has deeply affected the *Isarn* families surviving thanks to non-agricultural income through remittances and the multiple activities of some household members.

In this context, how could northeast farmers escape from poverty? It seems that in the future they will have to rely more on their agricultural production and income. But agricultural income in the northeast has never been either high or stable. This is mostly due to unfavourable natural conditions for agricultural production. The major constraints are the widespread occurrence of very coarse-textured soils (they are regarded as the most infertile of Southeast Asia) combined with an erratic distribution of rainfall (KKU Ford Cropping Systems Project 1982; Rigg 1991). Traditionally, the major agricultural system has been based on the production of rainfed lowland rice (RLR) in bounded paddy fields, associated with livestock (cattle and water buffalo) rearing (Craig and Baker 1986). In the sixties, the government invested in several irrigation projects (Formoso 1997) but their impact at the regional level remains very limited as more than 90% of the farmed area is still under rainfed conditions (Office of Agricultural Economics 2001). As a consequence, rice productivity did not increase during the three decades of the “Green Revolution” and is still lagging at a low 1.8 tons per hectare of paddy rice. Having no access to input-intensive rice farming to improve their economic conditions, *Isarn* farmers diversified their combination of economic activities with a series of industrial crops for export such as long-fibre crops (roselle and kenaf), then cassava and sugarcane, but also through more non-agricultural wage-earning employment (Thomas 1988).

This article focuses on analysing this process of agricultural diversification adopted during the recent decades by highly adaptive *Isarn* farmers in response to changes in their

economic and ecological environments. An in-depth understanding of the way farmers diversified their agricultural production, in spite of a very constraining environment, and combined them with non-agricultural activities is presented. We want to show how much different types of farmers —especially the majority of very poor households— could further improve their future livelihoods by diversifying their economic activities. This paper is based on an agronomic and socio-economic diagnostic analysis carried out in 2002 in a village agricultural system of Khon Kaen Province in upper northeast Thailand.

PRESENTATION OF THE STUDY AREA



(Source : Northeast Agriculture Extension Office 1995 ; Limpinuntana V. 2001)
 Map 1. Location of Ban Hin Lad village in upper northeast Thailand

The village of Ban Hin Lad in Khon Kaen Province was chosen for this research (Map 1). In 1998, the village had 1,937 inhabitants in 383 households farming 1,250 ha of land. Ban Hin Lad has not been affected by the several irrigation projects in which the government invested in the 1960s and its farmed area has always been under rainfed conditions. As this village is located some 40 km northwest of Khon Kaen City, the major economic, industrial, and urban centre of this sub-region, its economy was affected by changes in the non-agricultural sectors of the regional economy.

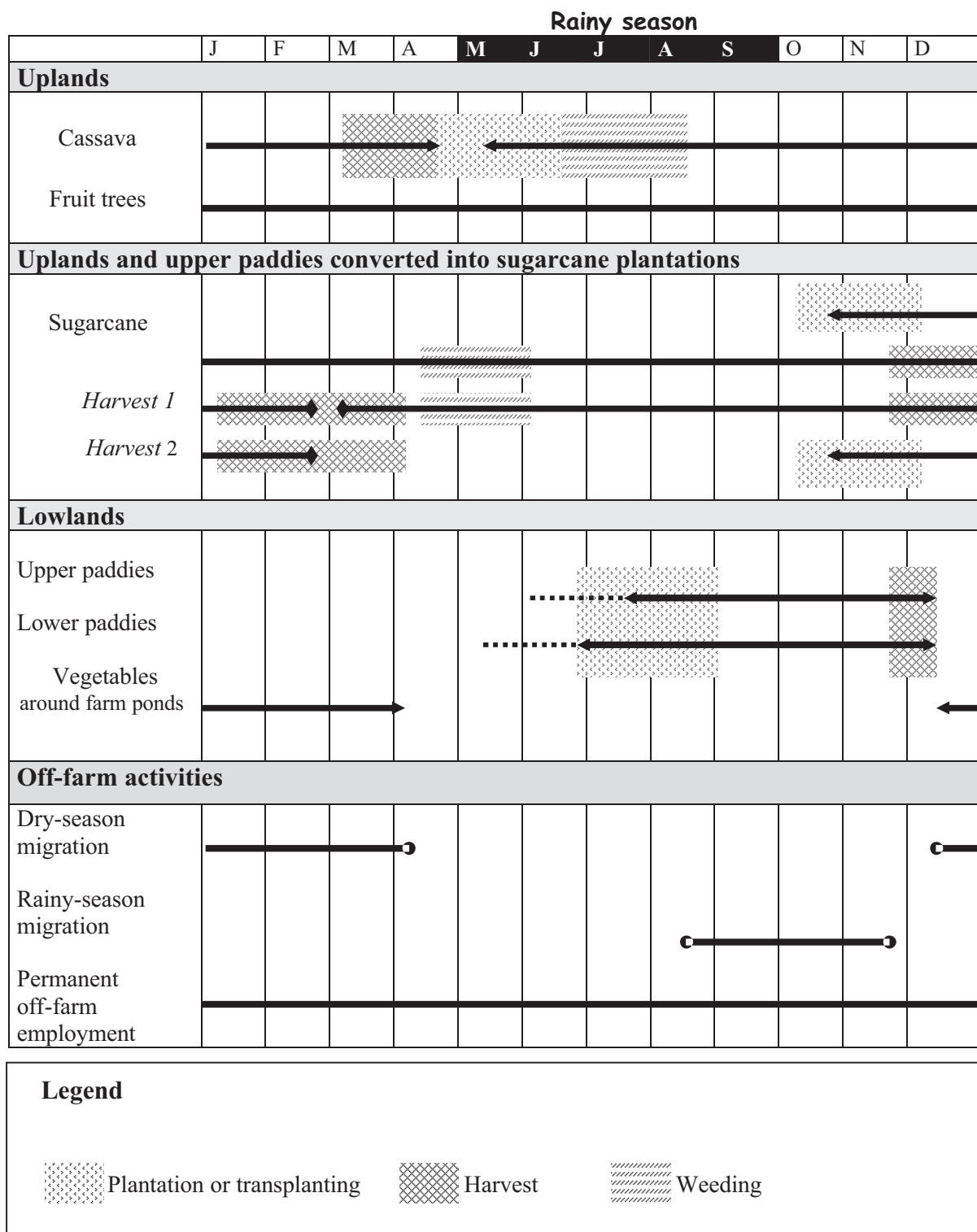


Figure 1. Location and patterns of the main cropping systems in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, 2002 crop year.

The village territory is made up of the common combination of uplands and lowlands separated by a transition zone, a landscape characteristic of the middle terrace across the northeast region. From a geological point of view, the region consists of a massive sandstone plateau bounded to the west and the south by ranges of mountains, and by the Mekong River to the north and the east. The bedrock is overlaid with tertiary and quaternary alluvial deposits

eroded to form a succession of terraces (Donner 1978). The middle terrace is the most important one as it occupies more than 70% of the total area. It has a typical, slightly undulating topography that forms an unending series of “mini watersheds” (KKU Ford Cropping Systems Project 1982; Grandstaff 1988). Shallow depressions, with relatively more clayey soils where wet rice is cultivated, are called “lower paddies”, while above them the “upper paddies” are more drought-prone because of their lower water retention capacity. Above these paddies, the more hilly “uplands”, characterised by very sandy soils, are planted to drought-tolerant crops such as sugarcane or cassava. Figure 1 presents the main cropping patterns found in each of these key agro-ecological units. This figure also displays the seasonal distribution of the labour demand in each main agro-ecological zone and for off-farm employment.

This village was also chosen because a team of researchers from the Faculty of Agriculture at Khon Kaen University conducted a first survey on its agrarian systems in 1983. The results of this previous survey were used to quantify several key changes that took place during the last two decades.

NATURE AND ORIGIN OF DATA

Different kinds of complementary data were used to produce this analysis: secondary data about the international, national, and regional contexts, direct field observations, and, mainly, results of interviews and a farm survey across 26 different farming households. The central objective of the field survey was to understand what farmers do, and why, in relation to their ecological environment and the social and economic context in which they operate.

Initial field observations allowed us to define hypotheses about the diversity of the modes of exploitation of the main landscape units. These hypotheses were the starting point for a series of informal interviews among selected key witnesses of recent agrarian changes, such as old farmers or village headmen. These interviews were conducted to identify the main ecological, social, and economic elements and cause-effect relationships that influenced the course of local agricultural development. Based on this understanding, the main phases of the recent transformations in the village life were characterised, each phase being associated with a given dominating type of agrarian system, and the modalities for the transition from one phase to the next were also analysed. This theoretical framework is based on Mazoyer’s theory of evolution and differentiation of agrarian systemsⁱ (Mazoyer and Roudart 1997).

Through these interviews on the local agrarian history, we were able to assess the timing, origin, extent, and consequences of the differentiation among the local farming households. Finally, we identified and characterised the different main types of farming households in the current agrarian system according to their biophysical and socio-economic constraints and opportunities, and their various management strategies.

Based on the previous findings, a detailed farm survey was conducted on a sample of 26 households covering the whole diversity of farmers’ circumstances in Ban Hin Lad to assess the technical and economic performanceⁱⁱ of the main types of farming households.

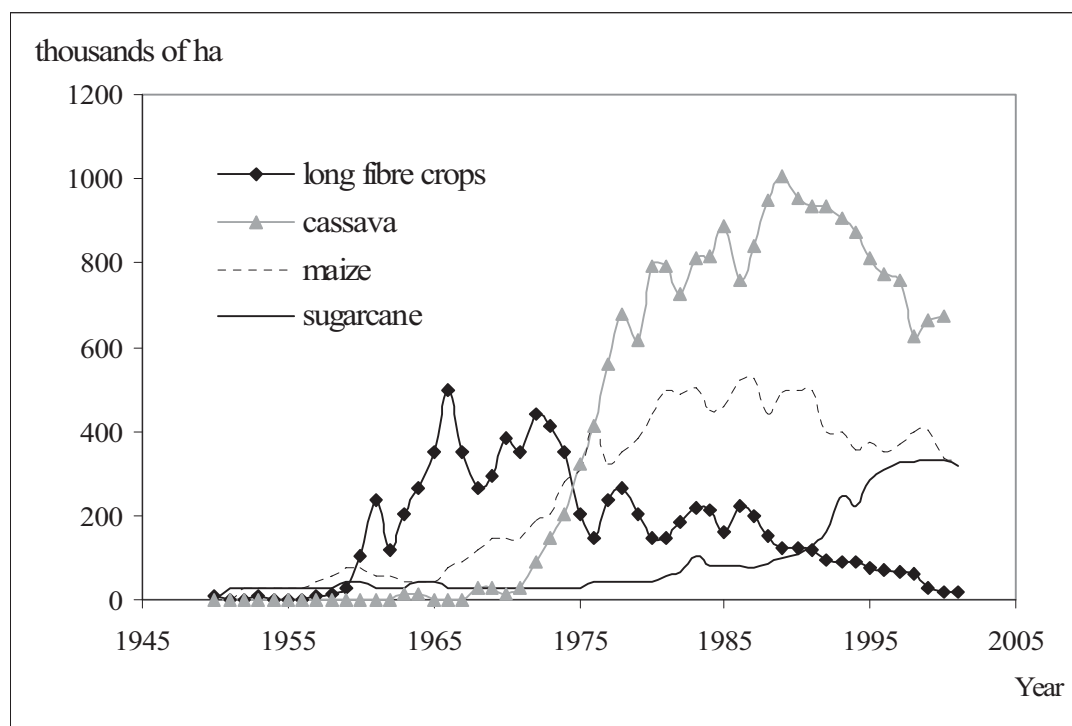
UP TO THE SIXTIES, A MAINLY SELF-SUBSISTENT AGRARIAN SYSTEM

The first settlers arrived in the Ban Hin Lad area in the mid-19th century and gradually cleared the sparse dipterocarp forest in the lowlands to grow glutinous rice in bounded paddy fields for family consumption. Rice production was closely associated with buffalo rearing, with these large animals filling a triple function by providing draft power, manure, and a kind of living capital. Products of hunting and gathering in the forest and fishing in the rivers were of major importance as they provided essential proteins and other key nutrients to the local people. Even in these early days, a kind of diversification of activities occurred to manage the

climatic risk and to prevent starvation: besides rainfed lowland rice, farmers were growing fruits and vegetables in small home gardens, and exploited non-timber forest products as well as by-products from paddy fields. To cope with erratic rainfall, each farmer combined the cultivation of 3 or 4 photosensitive varieties of glutinous rice with different duration to adapt his practices to diverse topographical situations and soil and unpredictable climatic conditions.

In this largely self-sustaining system, exchanges with the outside world were mostly limited to the village or regional level, and the cash economy was not yet predominant. The extensive Sino-Thai commercial network had yet to penetrate into this village, in spite of the proximity of the railway connecting the region to the Central Plain since the beginning of the 20th century. But, in those days, Chinese tradesmen travelled mainly by rivers and canals, and the northeast was the only region of the kingdom without a river transport connection to the Central Plain (Donner 1978).

OPENING TO THE MARKET ECONOMY AND DIVERSIFICATION THROUGH CASH CROPPING DURING THE SIXTIES



Source: OAE, Agricultural Statistics of Thailand 2000/2001 crop year.

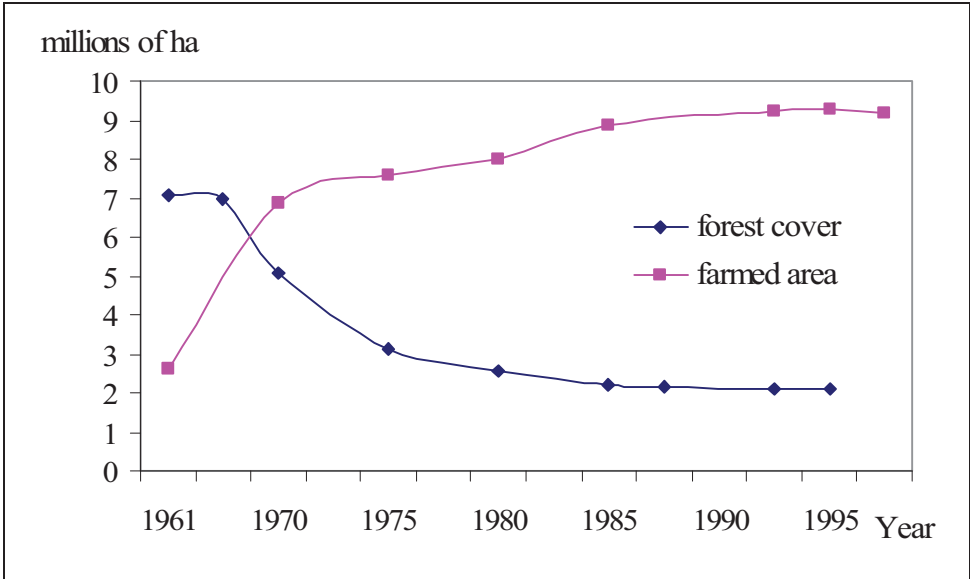
Figure 2. Changes in planted area for the main upland cash crops in northeast Thailand, 1950-98.

During the sixties, two main external factors led to the emergence of a new agrarian system. The construction of the “friendship highway” across the region allowed the penetration of the market economy (Bruneau et al. 1982) while the government policy of industrialisation through import substitution powered the expansion of agricultural production (Trébuil 1995; Dixon 1995). At the same time, a drop in Pakistan’s exports of jute provided access to the international market for long fibre-crops (Kono et al. 1994). Long-fibre crop production of roselle (*Hibiscus sabdariffa*) and kenaf (*H. cannabinus*) found suitable ecological conditions and was promoted in the uplands above the paddy fields for the former and in more submergence-prone areas for the latter (Craig and Baker 1986). The rapid expansion of this

textile Hibiscus production was facilitated by labour and land requirements that did not compete much with rice (Figure 2). As a consequence, this first phase of diversification through cash cropping in the uplands did not affect the production of glutinous rainfed lowland rice for home consumption.

The integration into the market economy and the availability of electric power led to the increasing use of cash for exchanges and the creation of new basic needs regarding household equipment and consumer goods (bicycles, radio sets, refrigerators, etc.). Their purchase provoked indebtedness and the impoverishment of some families. Cash incomes were not yet invested in farming to maintain production costs at a low level and to better manage risk, except for the payment of wages of more frequent hired labourers replacing the traditional system of mutual help among the village households.

From the mid-sixties, we observe a very high rate of deforestation that led to the destruction of 75% of the forest cover of the northeast region over the following quarter of a century (Figure 3). This process was driven by the expansion of cash cropping in the uplands, but was also due to a high rate of population growth. From 1960 to 1980, the local population density rose from 55 to 100 inhabitants per km² thanks to rapid demographic growth and migration to forest margin areas. Feeding this increased population was not achieved as the result of an increase in land productivity, but by doubling the local farmed area. Consequently, the more marginal upper zones of the lowlands were also progressively planted to rice in more drought-prone upper paddies. Farmers call them *na don* while *na loom* designates the more submergence-prone lower paddies. These upper paddies are defined as “bounded fields that are planted to rice wherever possible but which receive sufficient water for transplanting in not more than one year out of three” (Craig 1987).



Source : Forest cover 1961-73: Royal Forestry Department of Thailand; 1979-86:Landsat III (Rathakette, 1995); forest cover 1990-2000 and farmed area: Office of Agricultural Economics.

Figure 3. Evolution of forest cover and farmed area in northeast Thailand, 1961-98.

While the lowlands were already totally deforested, in the uplands forest clearing for long-fibre crop production was still partial because only manual tools were available and the tedious and very demanding labour requirements of post-harvest operations for roselle and kenaf processing limited labour productivity and the land per labour ratio. But, during the sixties, families managed to appropriate these uplands. Indeed, up to this time, land had never been privately owned as it was not a limiting factor, so families continued to clear and to

cultivate areas adjusted to their needs and workforce. Three main reasons explain this sudden wave of land appropriation: (i) the government decision to change the land tenure system, from implicit user rights to the promise of explicit land property titling, (ii) the possibility of cultivating a cash crop thus increasing the market value of these uplands, and (iii) the rising population density and the fear that, in the future, farmers' children might not have enough land to meet their needs.

The result of this unplanned appropriation of the uplands was an uneven distribution of access to farmland among households. Any family could reserve a piece of land, even without clearing it but just by making crosses on the trees along the borders of their desired area. This uneven distribution of land did not reflect wealth disparities under the previous agrarian system (those were still very limited), but mainly access to information and social influence because all conflicts were settled by the village headman. Moreover, the new migrants arriving after this period of land grabbing had no access to the uplands. This uneven distribution of the uplands will profoundly determine the future differentiation among local farmers.

In the late seventies, one could distinguish between (i) large family holdings with more than 0.5 hectare of uplands per family that needed to hire labour for post-harvest operations and (ii) small family holdings with 0 to 0.5 hectare of uplands per family whose members used to work seasonally as wage-earners on the larger holdings. This process is at the origin of an unequal accumulation of capital among farmers that will later increase significantly with the commercial value of cash crops produced in these more and more economically important uplands.

CASSAVA PRODUCTION EXPANDS UP TO THE LIMIT OF THE AGRICULTURAL FRONTIER IN THE EIGHTIES

The third important phase of the local agrarian history is characterised by the acceleration of deforestation for the cultivation of cassava in the uplands up to the limits of the agricultural frontier.

Why cassava? The main reason is the strong demand for cassava products to be used in the animal feed industry of the European Union. Because of the Common Agricultural Policy, internal grain prices in Europe were supported and animal feed industries started to import products of substitution for cereals. Cassava was one of them. This increasing demand was combined with the fact that, at that time, the Thai government policy provided much basic infrastructure to support the development of the private sector. Investments were made to set up a strong cassava industry for exports and to expand the road network (Besson and Douchet 1988). As a consequence, freight costs declined and competition increased among cassava processing plants having to purchase their roots at higher farm prices. Moreover, cassava is a drought-tolerant plant, and is well adapted to the poor soil conditions of the *Isarn* uplands. But it is also adapted to the local socio-economic conditions because it requires less labour than roselle and kenaf, and has more flexible labour requirements, thus allowing farmers to take off-farm jobs at a time when more and more of them needed to migrate in search of wage-earning employment to complement their meagre agricultural income. Farm prices were very low and unstable and the average farm size kept decreasing as there was no more idle land to clear.

Northeast farmers extended cassava planting from 10,000 ha in 1969 to almost one million hectares in the mid-eighties (Figure 2). The acceleration of deforestation was driven by two main factors: (i) the higher land per labour ratio in cassava production vis-à-vis long fibre-crops and (ii) the heavy mechanisation of tillage and land clearing that increased labour productivity. The disappearance of the forest ecosystem had serious consequences. As forest products (hunting, gathering, firewood, etc.) decreased, families needed to buy more food

instead, and, for the poorest of them, this meant a less diverse diet. Besides, as cattle used to graze in the forest area of the uplands during the rainy season, sources of forage became scarcer during this period of the year. The economic return from cassava production was such that farmers were not interested in retaining their upland plots just for livestock grazing. So, during the rainy season, only the upper paddies were left to be grazed if no rice could be grown on them in that year. The complementarity between livestock rearing and rice cropping was a way to mitigate the effects of erratic rainfall: if the upper paddies could not be transplanted (two years out of three on average), at least they could be grazed by cattle and buffaloes. But these upper paddies were not enough, and most farmers sold a large share of their herds during this period. The average number of head per family decreased from 10-20 to 3-4 only (2-3 buffaloes and 1 head of cattle, buffaloes still being needed for tilling the paddies). Herd management also changed as the end of the free access to common grazing areas during the rainy season pushed smallholders to sell more animals than others. On contrast, some large farmers started to fence some of their grazing fields. Nevertheless, during the dry season, common grazing in paddies was still used and fences were opened, but the animals had to be tied up to protect the cassava fields that, unlike kenaf and roselle, still occupied the land at this time of the year. In general, deforestation led to a loss of diversity in farmers' resources and activities, making them more vulnerable to an unstable economic context.

Moreover, problems of soil erosion and droughts increased. In the young cassava plantations, the strong rains at the beginning of the rainy season washed a part of the topsoil down to the paddy fields, which gradually silted up. Farmers had to plough furrows along the slope to avoid seeing young cassava seedlings being carried away with the run-off. This practice aggravated soil losses. The problems of erosion and drought were the official reason for an environmental concern leading to the much-debated "Green Isaan" policy. Very much influenced by the military, this reforestation project proposed to move 1.2 million farmers out of coveted "forest reserves" to establish commercial eucalyptus plantations for the booming pulp and paper industry. But, in Ban Hin Lad, like in many other parts of the region, farmers firmly resisted and remained on their land.

The loss of biodiversity, particularly in rice, is another emerging environmental concern. Indeed, after 1977, the agricultural extension service introduced RD6 (Rice Department 6, a point mutant of the very famous non-glutinous "jasmine rice" Khao Dok Mali 105 _ KDML 105), a photo-sensitive glutinous rice variety with wide adaptability and excellent grain quality (aroma, softness, fineness) that fetched a higher market price. In several years, a large majority of the villagers replaced their traditional varieties of glutinous rice with RD6, except for a few farmers with only upper paddies who still grew shorter duration varieties combined with RD6 to manage the risk of drought. Besides, many farmers also planted the non-glutinous KDML 105 on small areas of upper paddies for sale, as glutinous rice for home consumption and household food security occupied the less risky lower paddies. From a total of 28 varieties of glutinous rice reported in the village in 1983, only 2 were found in 2002. Such an extremely limited gene pool in rice increased the risk of a disaster if tolerance for a major disease (such as blast) in a major cultivar would be lost. Another consequence is the fact that the rice harvest is now concentrated over a short period of 2 to 3 weeks only, in late November and the beginning of December, instead of 2 to 3 months before. It is now necessary to hire labourers if the farm has more than 0.75 ha of paddy per family worker, and this leads to an increase in rice production costs (all the more since wages increase because of migration and a shortage of labour in the village). This also contributed to an increase in the economic vulnerability of many families who were already indebted.

For a better understanding of this growing vulnerability or poverty, it is important to focus on the mechanisms of unequal accumulation of capital after the uneven distribution of

upland areas in the sixties. Families with more uplands than others, and who employed daily workers for almost each farming operation, belong to a type called “large family farms”. They accumulated capital faster than others as cash and cattle, until they could buy more land for their children. These children, like their parents, inherited enough land to accumulate capital as well. Some of the wealthiest among them chose to invest in a truck for transporting farm products (mainly cassava roots to the processing plants) from Ban Hin Lad villagers. We called this type “small entrepreneurs”.

The smaller farms did not have enough uplands to accumulate capital and gradually sold their cattle, and sometimes part or the totality of their upland fields as well. They were very affected by the increase in the cost of living related to the growing scarcity of forest products. Moreover, the increase in off-farm employment opportunities encouraged young villagers to migrate. These families faced a crucial dilemma when it was time to share their land among children. Two main strategies were observed: (i) either part of the children migrated to Bangkok for several years (often more, but they still hoped to come back to the village one day) and sent money back to their relatives in the village who managed to survive with their agricultural incomes -we call this type “small family farms”- or (ii) every child settled on very tiny landholdings and migrated seasonally in search of off-farm employment, most of the time in the central region during the dry season to harvest sugarcane on large plantations. These latest farms are called the “very small farms with off-farm workers” and display the most precarious and insecure situations at this time.

INCREASED DEPENDENCE ON THE MARKET ECONOMY IN THE NINETIES

During the nineties, *Isarn* farmers had easier access to the sugarcane market as the sugar industry partly relocated from the central region to the northeast. Unlike for cassava, domestic prices of sugarcane are tightly controlled as the government supports prices and sets up quotas among sugar mills. The stability and political importance of this state intervention gave confidence to the farmers, who, for a while, endured strong fluctuations in cassava prices. However, cassava production contracted but did not disappear from the uplands (Figure 2).

A distinctive feature of sugarcane production is its adaptation to the ecology of upper paddies as it tolerates temporary waterlogged conditions better than cassava. Consequently, a gradual conversion of many (but not all) upper paddies into sugarcane fields was observed (Figure 4). In Ban Hin Lad, 55% of the upper paddies were converted to sugarcane plantations from 1983 to 1998. This land-use change implies quite an irreversible destruction of the bunds that is not always in farmers’ interest as sugarcane production competes with livestock rearing and rice cropping for the use of upper paddies. Only farms with enough paddies and producing a significant surplus of rice can afford to convert their upper paddies into sugarcane plantations. As another climatic risk management strategy, local villagers like to store an amount of paddy equivalent to at least one year of the family consumption. This land-use change means an increase in the added value of agricultural production in this landscape unit as only poor rice crops were obtained before. But what could happen if sugarcane prices collapsed?

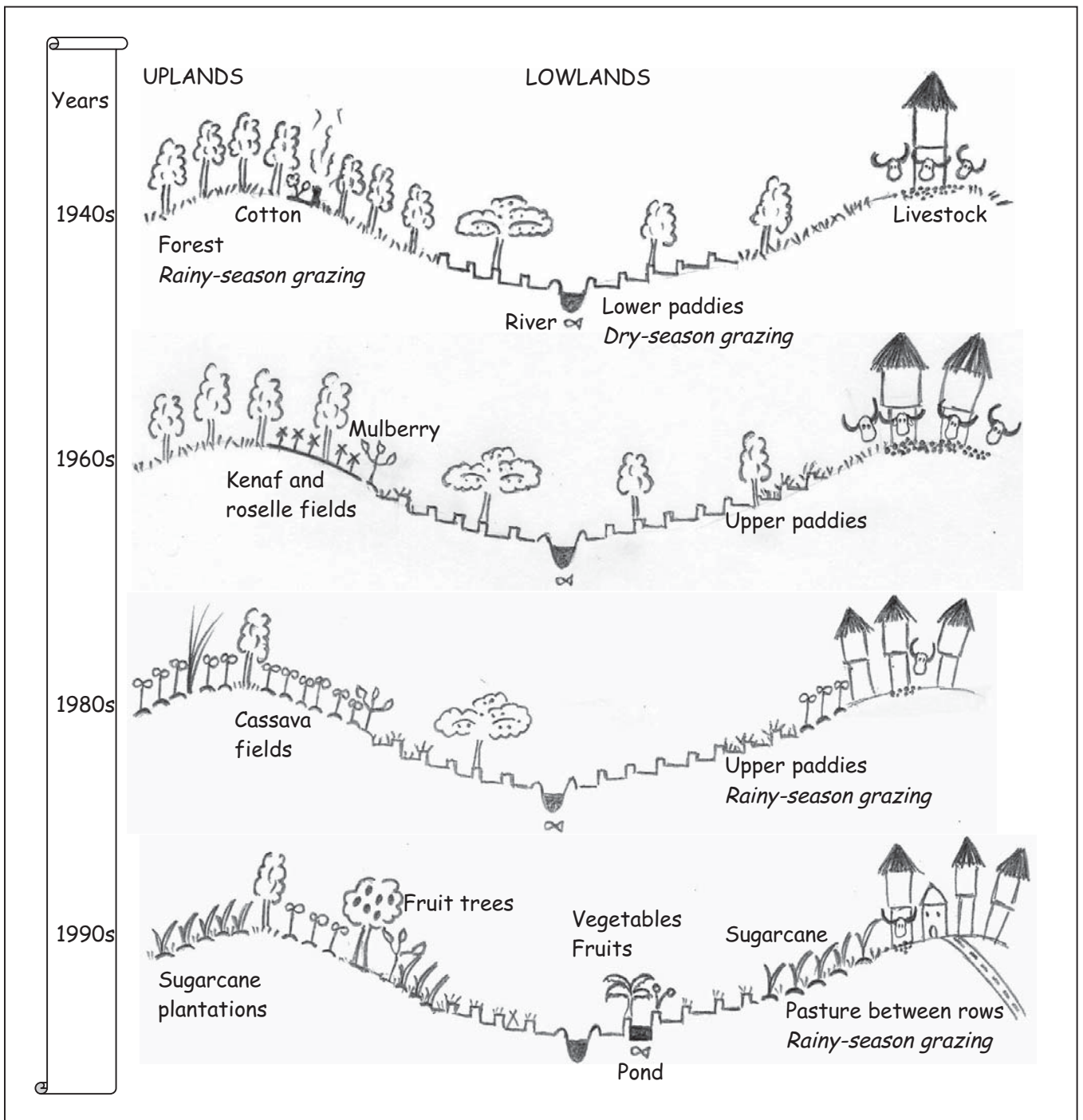
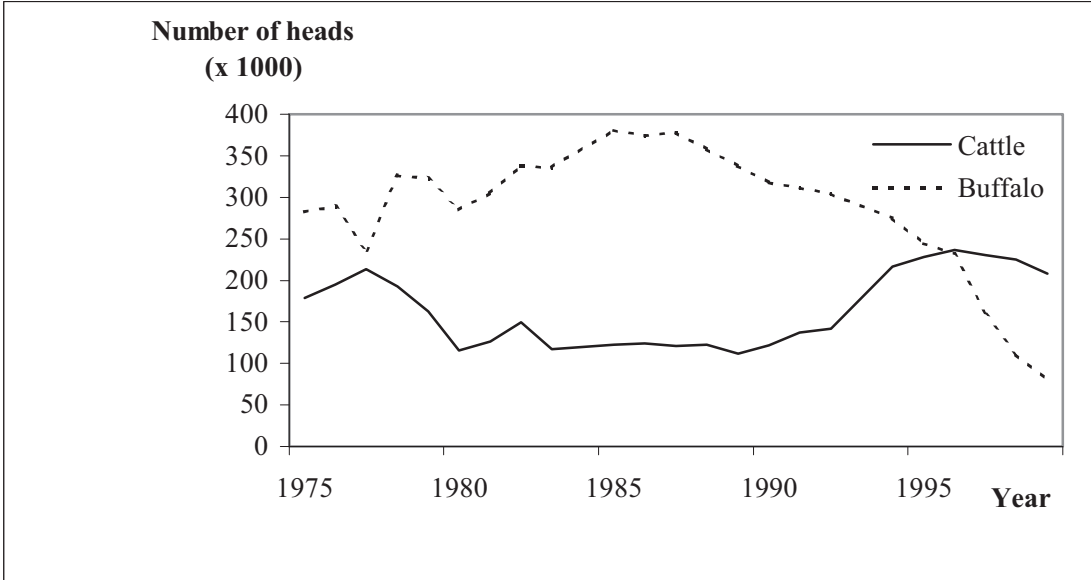


Figure 4. Chronological series of transects displaying the land-use pattern under each main type of agrarian system, Ban Hin Lad village, Khon Kaen Province, upper northeast Thailand.

It is also during the last decade that villagers invested massively in the adoption of the multi-purpose two-wheel hand-tractor (the locally called “iron buffalo”). In 1983, there were only 2 hand tractors for 234 households in the village, in 1998, there were 255 of them among 383 households. The main reason for their adoption was the need to decrease the peak of labour demand at rice transplanting through faster ploughing and puddling of the paddies. This is particularly significant in a region where rainfall is so erratic that, depending on the

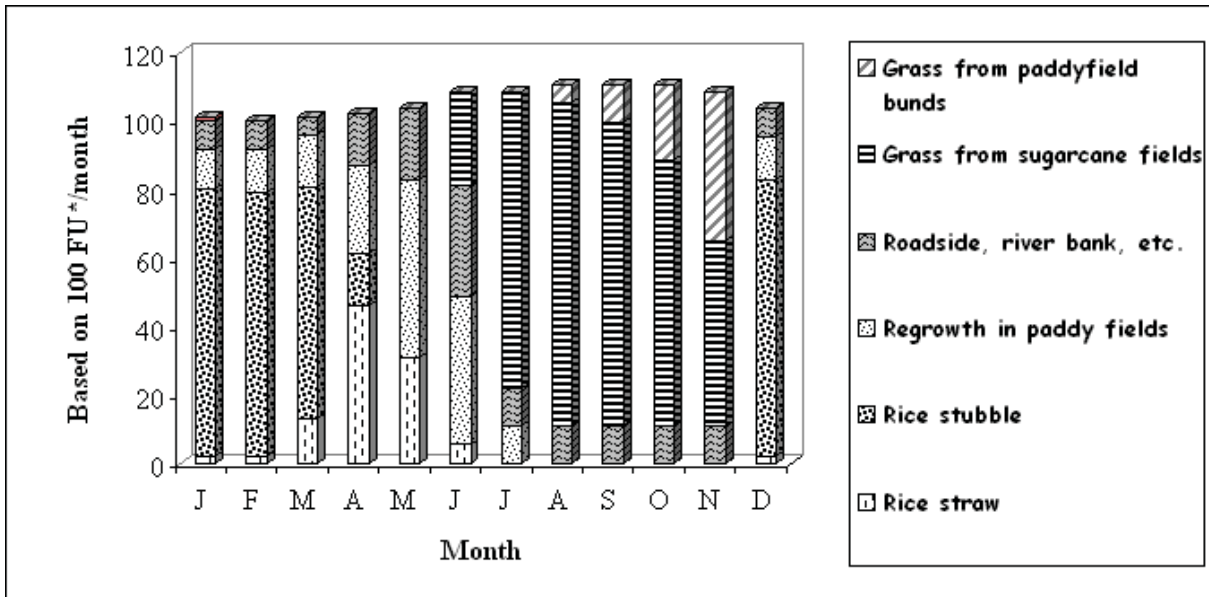
year, farmers have only 5 to as many as 45 days available to complete rice transplanting. As a consequence, at the provincial level, more than two-thirds of the water buffalo population was sold to pay for the purchase of these hand-tractors (Figure 5). This was also to free one family worker, who used to look after the livestock, to seize the more readily available opportunities for off-farm employment.



Source: Office of Agricultural Economics, Ministry of Agriculture and Co-operatives, Bangkok.

Figure 5. Changes in the buffalo and cattle populations in Khon Kaen Province, upper northeast Thailand, 1976-2000.

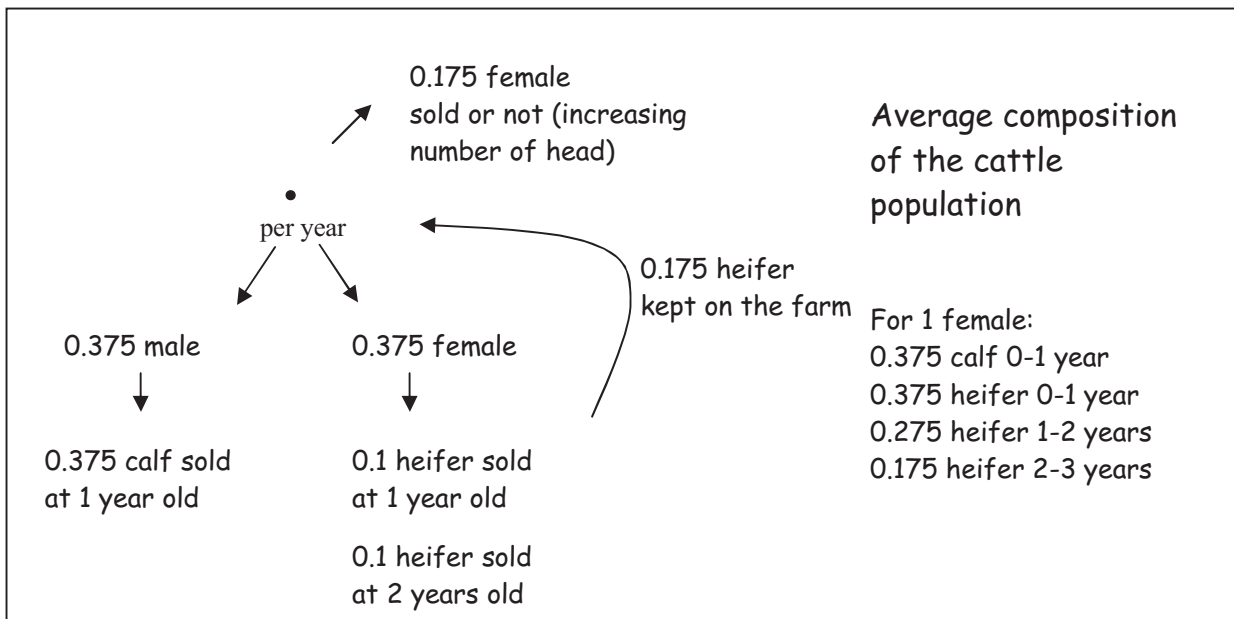
While buffalo rearing was winding down, cattle rearing increased rapidly after the early nineties. During the decade of rapid economic growth (1986-96), a larger urban middle class emerged and adopted more Westernised diets, boosting the demand for meat and dairy products in particular. Increased farm prices made cattle rearing a more attractive option for the farmers who could afford it. Government agencies introduced the Brahman breed, which, compared with the native ones, is heavier (it is almost twice as large as the native ones) and gains weight faster. Mainly larger farms were able to adopt this new breed. Beyond the traditional function of living asset, cattle rearing now contributes significantly to the increase in annual cash income on such large farms. These new livestock rearing systems led to an intensification of labour use. Indeed, as sugarcane is cultivated in many upper paddies (the only grazing land left during the rainy season under the previous agrarian system), cattle feeding is heavily modified, and, from now on, farmers have to cut grass every day during the rainy season. Because quite high rates of chemical fertilizers are applied on sugarcane plantations (50 to 100 kg ha⁻¹ of N and P, 25 to 50 kg ha⁻¹ of K, compared to half these amounts in cassava fields), it is in between the sugarcane rows that most of the grass is found if no herbicide is used. Figure 6 displays a quantitative assessment of the changes and origin of cattle feed over the year. Our assessment of the availability of forage resources in relation to cattle requirements in Ban Hin Lad village concludes that the maximum carrying capacity for livestock in the current system, estimated at up to 1 head per 2 ha of farmed land, is five times higher than the present number of large animals. So, the limiting factor to an increase in cattle rearing is more socio-economic in nature.



⁽¹⁾ FU= feed unit, energy content equivalent to 1 kg of barley.

Figure 6. Seasonal changes in the sources of feed for livestock rearing in Ban Hin Lad village, Khon Kaen Province, upper northeast Thailand, during 2002 crop year.

Herd size ranges from 1 to 2 head on very small holdings to a dozen head on the largest farms. Herd management is not precisely planned in advance, the main rule being to avoid selling young females as long as possible. Figure 7 displays the resulting common type of management and composition of the cattle population in the village.



(Source: author's survey and verification through livestock census of Khon Kaen Veterinary Office)

Figure 7. Average management and composition of the cattle population in Ban Hin Lad, upper northeast Thailand, 2002.

More cattle rearing is leading to a diversification of local farming systems, as recommended by government agencies to reduce rural poverty in the northeast. The attempt to slow down labour migration to industrial centres that are running out of steam following the 1997 economic crisis is led by the King's "New Theory" promoting a diversified, more self-reliant, and integrated type of agricultural production in this region. The main concrete impact

of this policy is the financial support provided to dig small multi-purpose farm ponds. In Ban Hin Lad, this state intervention has been a real success and farming households used more than 130 ponds in 2002. These farm ponds cover areas ranging from 0.04 to 0.16 ha and are 2-4 meters deep. At the beginning of the rainy season, they provide supplementary irrigation to rice nurseries and allow a better control and sometimes an earlier transplanting of rice in some fields. Farmers equipped with a hand-tractor can connect its engine to a water-pump and this new water management for rainfed lowland rice help to stabilise yields. But the limited volume of water available cannot suppress the still strong dependence on rainfall. Water is also needed for fish-farming: farmers catch fish all year long for family consumption with fishing lines, and often organise a large catch with fishing nets at the beginning of the dry season. At that time of the year, after rice harvesting and at the onset of the cool season, water is also used for irrigating fruits and vegetables grown on the pond levees. In the context of widespread indebtedness among small farmers and unstable food and farm prices, these on-farm reservoirs ensure the production of family food needs, limit family dependence on cash purchases, and provide a more balanced diet. These “integrated farming” and animal rearing systems produce mainly small quantities of diverse products for family consumption; few farmers produce larger quantities of fruits, vegetables, or fish for sale in neighbouring towns. The limited volume of water available is usually managed so that each sub-system can have access to it, but sometimes priority is given to one or another purpose. For example, during the latter part of the rainy season, farmers limit the amount of water pumped into rice fields so that enough is left for irrigating fruits and vegetables during the dry season. Farmers rearing cattle always make sure that water is in their ponds for their animals to drink. This limiting water volume explains why, gradually, farmers having enough paddy fields are digging new ponds, so that today it is not rare to meet a farmer managing two or three on-farm reservoirs.

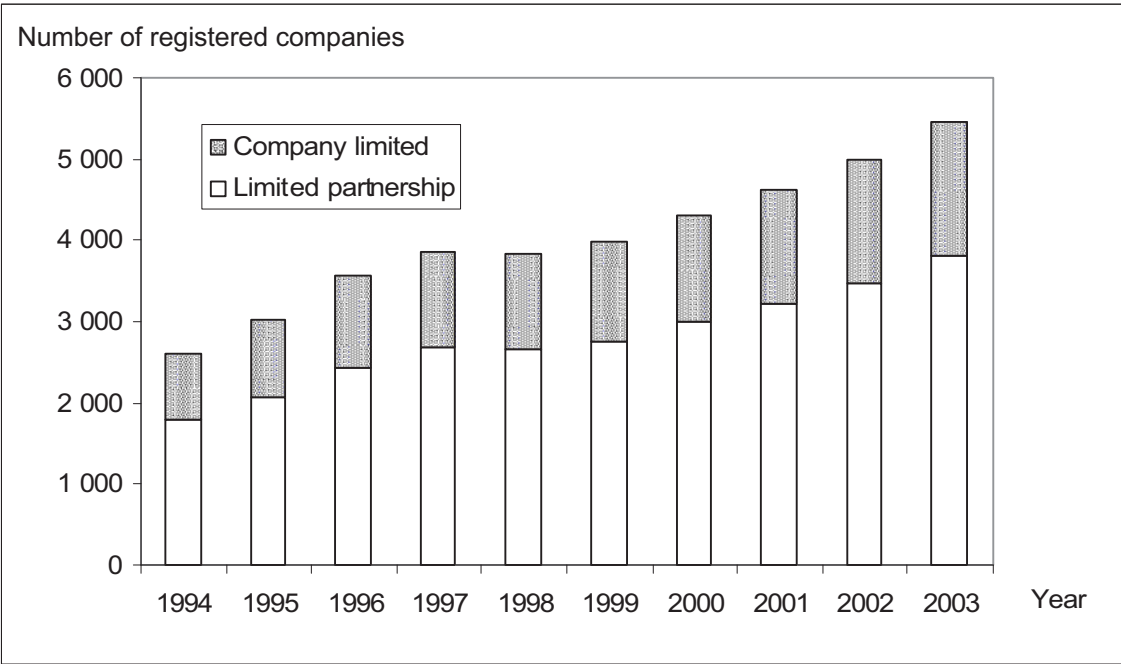
With these ponds, there is a return to more farm autonomy, in a general context of increased economic dependence on the outside world. Sugarcane cropping is more input- and labour- intensive than cassava production (Table 1) and its production costs are higher, in particular at harvest, because hired labour is required, also to transport the cane to the mill. If small farmers do not have the investment capacity required for harvesting the cane, or if their production is not large enough to get a quota from the sugar mill (where the smallest quota is 100 tons of cane), they sell their sugarcane as “green” to other quota-leaders that will be in charge of the harvest. But even the early phases of sugarcane production require enough cash to rent a tractor for land preparation, to buy planting material and chemical fertilizers, etc.

Table 1. Technical characteristics of the main cropping systems in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, 2001 crop year 2001 farm prices.

Crop	Rice	Cassava	Sugarcane/ sold as green	Sugarcane/ own harvest
Average yield (t ha ⁻¹)	2	18		1st harvest: 65 2nd harvest: 45
Labour per land unit (days ha ⁻¹)	64	69	82	169 (for 2 harvests)
Max. land/labour ratio (ha labour ⁻¹)	0.68	1.9	0.85	0.85
Physical labour productivity (kg labour ⁻¹ day ⁻¹)	30	260	-	650
Labour productivity (US\$ labour ⁻¹ day ⁻¹)	3.6	7.8	9.2	10.4

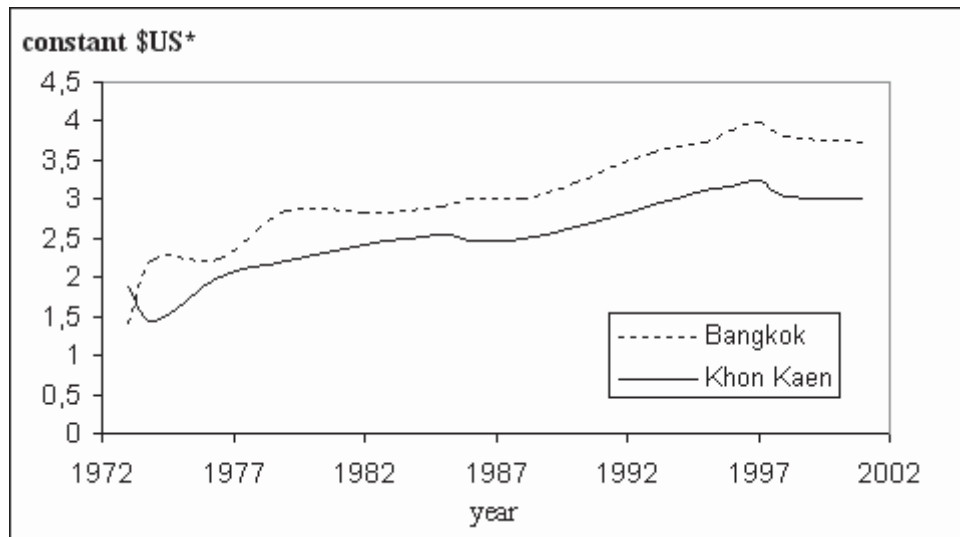
Moreover, hand-tractors and pumps also require gasoline, spare parts, and maintenance. So, *Isarn* farmers who used to manage risk by limiting their production costs are more and more dependent on external markets. On top of climatic risk, they are now exposed to fluctuating prices of inputs and outputs, and this is what happened just after the 1997 economic crisis.

The recent increase in farm investments and production costs is accompanied by an easier access to credit. The Bank for Agriculture and Co-operative (BAAC) offers flexible terms so that access to credit is no more only for some few happy people. If short-term credit enables farmers to face higher production costs and deferred income from sugarcane production, longer-term debts are more worrisome for many farmers who cannot repay a loan contracted to buy a hand-tractor or a new major consumer good (refrigerator, motorbike, TV set, etc.). The smallest farms in the village are also the most indebted ones. In these families, indebtedness is one more reason for seeking off-farm activities because cash income is often needed urgently. There are more and more families in this precarious situation as the average farmed area per household in the village decreased from 5.5 ha in 1983 to 3.2 ha in 1998. Consequently off-farm income represents an increasing share of total family income for these very small farms with off-farm workers. However, there is relatively less migration than during the eighties because more off-farm opportunities are available locally, thanks to the government’s decentralisation policy and the incentives provided to promote the economic development of the region (Figure 8). Increasing wages encourage young villagers to migrate or to work off-farm (Figure 9).



Source: The office of commerce, Khon Kaen province.

Figure 8. Evolution of the number of registered companies in Khon Kaen Province, 1994-2003.

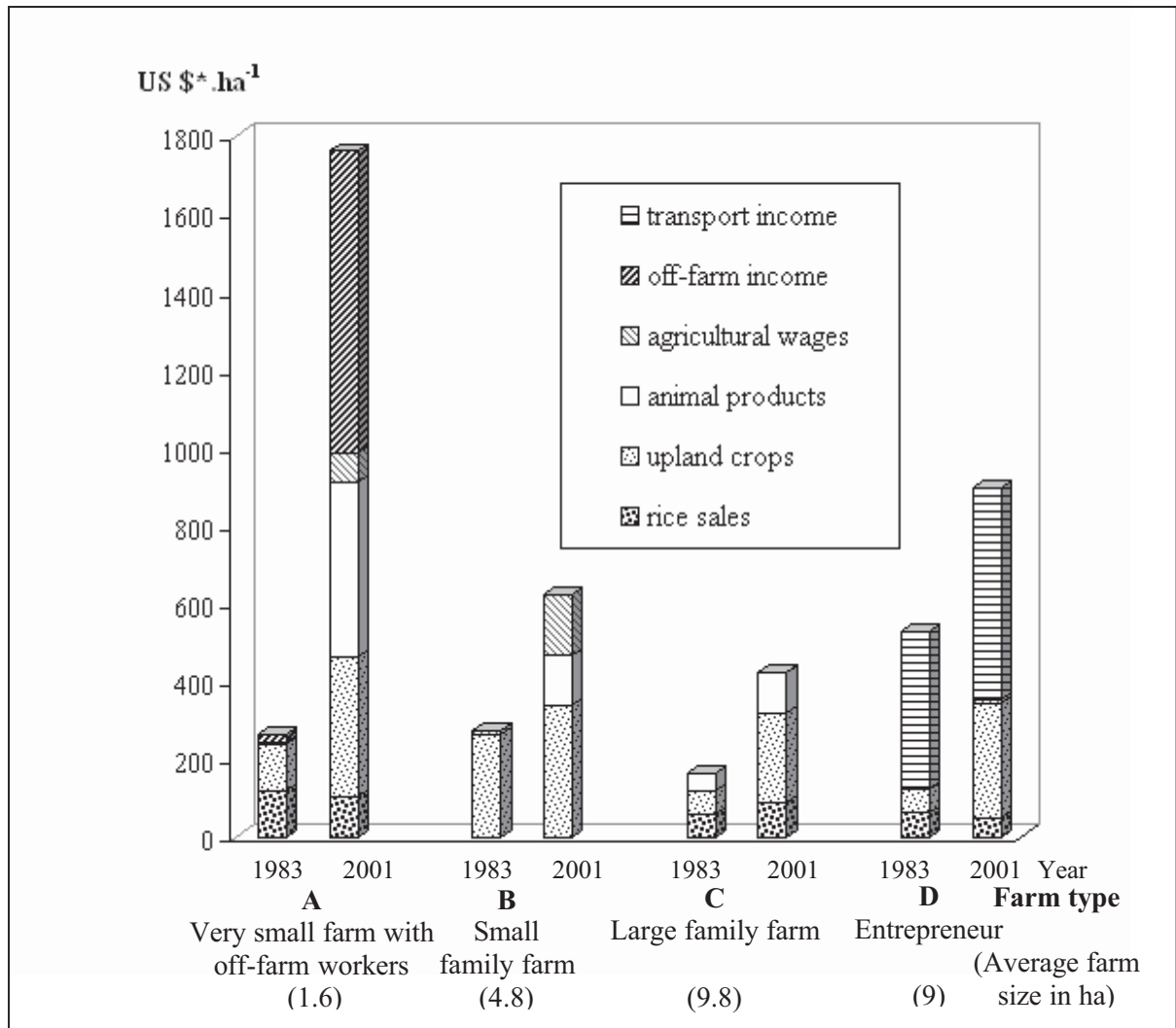


Inflation-adjusted baht for year 2000, converted into US\$ (1 baht = US\$0.023).

(Sources: Economic Research Service, United States Department of Agriculture. Ministry of Labour and Social Affairs. 1996. Report on minimum wage rate, Bangkok).

Figure 9. Evolution of official daily wages evolution in Khon Kaen and Bangkok, 1973-2001.

On some very small farms, young family workers work in Khon Kaen factories every day, and their salaries help to meet the increasing production costs on the farm. We call this type of farming household the “very small farms with permanent off-farm workers”. Compared with their brothers and sisters who migrate to Bangkok, those who can stay in the village and be wage earners locally enjoy relatively better living conditions. In this way, this more decentralised pattern of economic growth also helped to reduce rural poverty. But these people were particularly affected by the wave of dismissals at local companies following the 1997 crisis. The relocation of the sugarcane’s growing area also played an important role by providing off-farm employment to wage earners in the mills but also in the fields, as weeding and cane harvesting operations require a lot of hired labour in the wet and dry season, respectively. The transport of sugarcane to the mills also generates important income to truck owners, the “entrepreneurs”. Figure 10 shows the growing dependence on off-farm income of four farming households, belonging to different types of farming systems, in this village from 1983 to 2001.



* Constant US\$ for year 2001.

Figure 10. Changes in the composition of gross income per land unit of four households belonging to the main types of households in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, from 1983 to 2001.

Different types of farming households have been clearly identified in the current agrarian system. They have different amounts of productive resources, as well as different constraint, and strategies to cope with the challenges of their ecological and socio-economic environments. Table 2 presents the key characteristics of the five main types of farming households identified in Ban Hin Lad in 2002. This table illustrates the present extensive diversity of livelihood systems exploiting the same environment in a single village of the northeast region.

Table 2. Characteristics of the main types of farming households in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, 2002.

Type	A. Very small farms with off-farm workers 0.3-2 ha		B. Small farms 2-3 ha	C. Large farms 3-4.4 ha	D. Entrepreneurs 1.7-5.5 ha
Farmed area family labour					
Employment opportunities for family workers	- Not enough uplands to meet cash needs - Not enough land for full family employment - Off-farm work needed		- Enough land so that on-farm work pays more than off-farm employment	- Land area allows family to meet cash needs, provide full employment, and to accumulate capital	- Invest their capital in service activities using heavy equipment (truck, tractor), which allows family to meet cash needs; accumulate more capital, and provide full employment
	A1. Permanent off-farm workers > 3 family workers: some workers have permanent off-farm jobs, their salary pays for hired labour	A2. Seasonal off-farm workers 2 family workers: seasonal migration, daily search for work on larger farms at peak of labour demand	- Sell labour only if there is no work on the farm - Hire daily workers as little as possible	- Never or rarely sell labour - Extensive use of hired labour	- Extensive use of hired labour
Capital accumulation	Sales of capital assets (cattle, buffaloes, upland fields) + indebtedness		No accumulation, few debts	Accumulation through livestock rearing	Further accumulation mainly through heavy equipment
Cash flow facilities	No investment capacity, insufficient cashflow to meet regular expenses and costs		Very limited	High	Very high
Share of agricultural products/total income (%)	25	55	77	98	22
Type of farm equipment available	Own or rent hand- tractor	Own hand-tractor or rent hand-tractor or draft animals	Own hand-tractor, sometimes rent a tractor	Own hand-tractor, rent a tractor	Own hand-tractor, own tractor and/or truck(s) rent out to villagers
Net total household income (US\$ labour ⁻¹ year ⁻¹)	1100	800	1150	1600	2800
Frequency in village community (%)	35	40	20	3	2

FARMERS' CURRENT STRATEGIES TO COPE WITH POVERTY: STILL MORE DIVERSIFICATION

WHICH PRODUCTION, UNDER WHICH CONDITIONS, FOR EACH TYPE OF FARM?

"We all do the same thing". This is what the farmers say and, in a way, it is true. Facing unstable natural and socio-economic environments, they all need to diversify their sources of income as much as possible. However, not all of them can afford or have access to an extensive combination of cropping and livestock rearing systems. Under the current agricultural system, the presence or not of livestock rearing and the kind of management of the industrial cash crops are the main aspects of differentiation among the local farming households. The following three parameters seem to determine the type of farming system: its investment capacity, off-farm employment, and the land-labour⁻¹ ratio. Based on these characteristics, the following main farming systems managed by the five main types of households identified in Ban Hin Lad village can be distinguished.

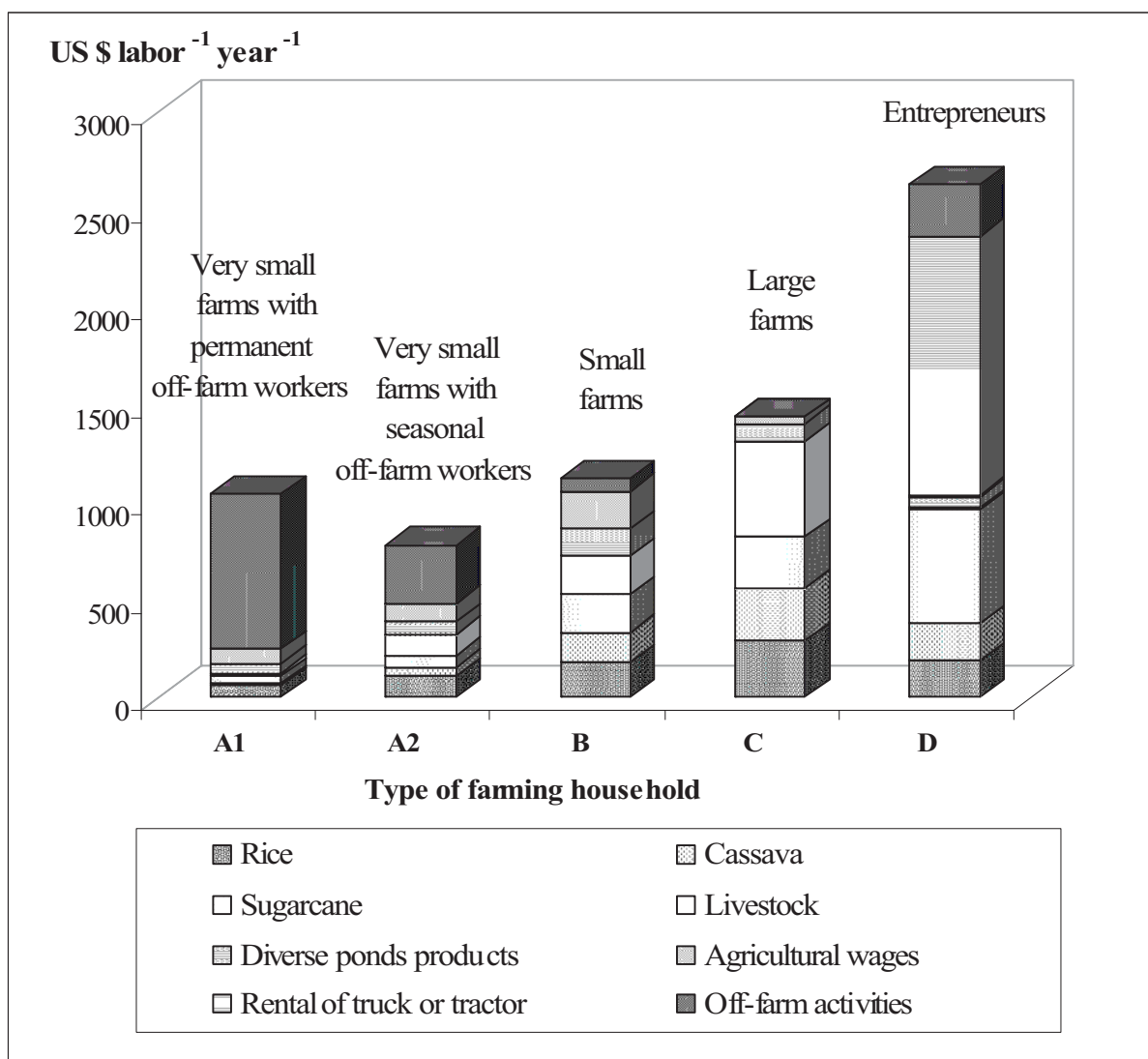


Figure 11. Composition of the net total household income per labour unit for each main type of farming household in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, 2001. (Average figures for sampled households belonging to the same type).

Very small farms with permanent off-farm workers: sugarcane sold as green or cassava productions

Their main constraints follow: (i) their paddies are hardly large enough to meet family needs in rice, (ii) their uplands are far too tiny to meet family needs in cash income, (iii) they have a very low investment capacity and are heavily indebted, and (iv) because part of the family labour force is permanently working in off-farm activities, they lack labour when demand peaks.

Their objective is to achieve self-sufficiency in rice and to increase their cash income through off-farm employment. Wages pay for the costs of rice production. Some of these farmers do not own a hand-tractor and have to rent one when it is available. Frequently, land preparation is not performed at the optimum time and rice yields are very unstable. Figure 11 displays the composition of the net income per labour unit for these tiny holdings. Non-agricultural wages represent 76% of their total income. Because they are not self-sufficient in rice, these smallholders are not interested in converting their upper paddies into sugarcane fields. On their small upland areas, they grow cassava or sugarcane sold as green to limit labour requirements and production costs. Past financial difficulties led these farmers to sell their livestock and they do not have enough cash to buy several head again. Anyway, this option does not interest them in the short term as looking after livestock would require a permanent farm worker and make the family lose the benefit of a whole year of off-farm salary.

These small farms face high production costs and debts that keep them from saving and investing. They need to hire labour because of the limited availability of family workers on the farm, a hand-tractor to till the paddies, and buffaloes to till their sugarcane fields. They also buy on chemical fertilisers as no manure is produced on the farm. Finally, they were strongly affected by the recent economic crisis and the dismissal of many workers in the industrial sector.

Very small farms with seasonal off-farm workers: livestock, sugarcane sold as green, or cassava production

These households also have paddies and upland areas that are insufficient to meet their needs in rice and cash. On their small upland areas, they can grow only sugarcane, to be sold as green, or cassava. But compared to the previous type of household, every family worker is on the farm during the peaks of labour demand to limit the use of hired labour. Their strategy is to maximise agricultural income per land unit. Diversification into livestock production helps when that is feasible. Thanks to the availability of farm ponds, the diverse production of fish, fruits, and vegetables (mainly for home consumption) is of major importance for household food security, even if the household sometimes lacks labour to produce more during the dry season. But agricultural income is still far from enough, and outside the main periods of farm work, the family need to seek day-to-day off-farm employment. During the dry season, members easily get hired to harvest sugarcane, but there is competition for family labour between off-farm employment and livestock rearing. At least two native female head of cattle are needed to offset the loss of income from an off-farm worker during the dry season. Mutual help among relatives plays an important role, with old people taking care of the cattle. During the rainy season, very few off-farm job opportunities exist and these families are particularly vulnerable as they consume the totality of their limited rice stock. On this period of the year, livestock are important for facing difficult economic situations, but they are also the reason why these families are not able to accumulate more than one or two head.

Small farms with livestock, cassava, and/or sugarcane sold as green

These families have enough land so that their agricultural income can meet more than 75% of the family needs. Their objective is to optimise the employment of family labour on the farm. They grow both cassava and sugarcane to spread the requirements for family labour and cash expenses over the year, and to better manage price fluctuations. Their production of sugarcane is rarely large enough to get a quota of cane from the mill. Depending on their investment capacity and off-farm job opportunities, it may be more important for them to sell sugarcane as green to a quota leader and to work for other farmers as daily wage-earners during the sugarcane harvest (Figure 11 shows that agricultural wages represent 17% of their net total family income), or to harvest their cane by themselves and sell it to a quota leader. In some cases, they can benefit from a part of the bonus linked to the quota; the social network plays an important role in this kind of decision.

The main constraint faced by these families is the uneven distribution of labour requirements along the year, as they can afford to pay only for a limited use of daily wage-earners. Most of them try to hire labourers only at rice harvesting because of the risk of lodging at maturity, and at cassava harvesting because they have to fill up a truck within a day. Because they are frequently overworked, they rear native cattle and buffaloes instead of the more demanding Brahman breed. The early part of the wet season is the busiest time of the year when, apart from preparing the rice nurseries and ploughing paddy fields, they must also weed the cassava fields and start cutting grass on sugarcane plantations to feed the cattle. These families can manage to increase their herds up to four or five female head. During the dry season, as family labour stays on the farm, they have enough time to produce fruits and vegetables around their ponds in larger quantities than the previous types of smaller farming households. These diverse horticultural products for family consumption and for sale represent 12% of their net family income. Their situation is less precarious, but this is often a situation of reprieve when sharing the land among children has been postponed for years and when brothers and sisters who are migrant face hard times working as wage-earners in Bangkok.

Small farms with livestock, sugarcane, and a small quota

Some small farms focus on sugarcane production on their uplands. This crop uses their whole investment capacity (usually provided by a BAAC loan). These farmers get a return on their investment thanks to a small quota of sugarcane (usually equivalent to the 100-ton minimum) and by harvesting sugarcane three times in as many years if cropping conditions permit. They rear buffaloes because these are needed to rebuild the furrows in the sugarcane fields. This is the reason buffaloes are still being used in the current agrarian system despite the widespread use of the hand-tractor. The key constraint facing these households is risk, especially from sugarcane diseases, because production costs are high compared to the value of capital goods available on these small farms.

Large farms with livestock, cassava, sugarcane, and a quota

Compared with smaller farms, these holdings have a relatively large investment capacity and large upland fields (all the more since their upper paddies have usually already been converted into sugarcane plantations). They rear Brahman cattle (5 female head on average) and livestock products represent 34% of their average net income per labour unit (Figure 11). They grow both cassava and sugarcane and secure a 200-300-ton quota of sugarcane from the mill (they buy some extra sugarcane as green to fill their quota if necessary). Although they have more livestock, and consequently more manure than other holdings, chemical input use is more intensive and they buy fertilizer in larger quantities than other farmers. They rent a tractor every year for deep ploughing of their upland fields and they are able to hire labourers

as soon as they run short of family workers. If they grow both cassava and sugarcane, this is both to manage price fluctuations and to avoid the negative effects of a monoculture on soil conditions. In this agrarian system, they are the only households that can afford to care about such a long-term preoccupation. But, together with the entrepreneurs, they are also the only ones who will be able to keep their children on the farm.

Entrepreneurs with heavy farm equipment and sugarcane with large quotas and purchased as green

This is the most capital-intensive and specialized kind of farming system. The main purpose of these farmers is to maximise the return on their investment into heavy farm equipment (trucks and tractors). It is profitable to rent it and to secure a large sugarcane quota (more than 600 tons) from the mill to lower transportation costs. It is different with cassava as the output of 1 ha is three times lighter to carry than the harvest of 1 ha of sugarcane. This is also the reason the number of trucks (and the number of entrepreneurs) increased after sugarcane expanded in this area. The transport of farm products amounts to 50% of their total net income per labour unit (Figure 11). These farmers plant sugarcane intensively in their upland fields and their former upper paddies, and each year they buy as much sugarcane as green as they can. If sugarcane harvesting could be mechanised, they would be the main beneficiaries as meeting the cost of hired labourers is their main worry. But then, poorer farm types such as the small farms with daily labourers and the very small farms with off-farm workers would lose an important source of their cash income in the dry season.

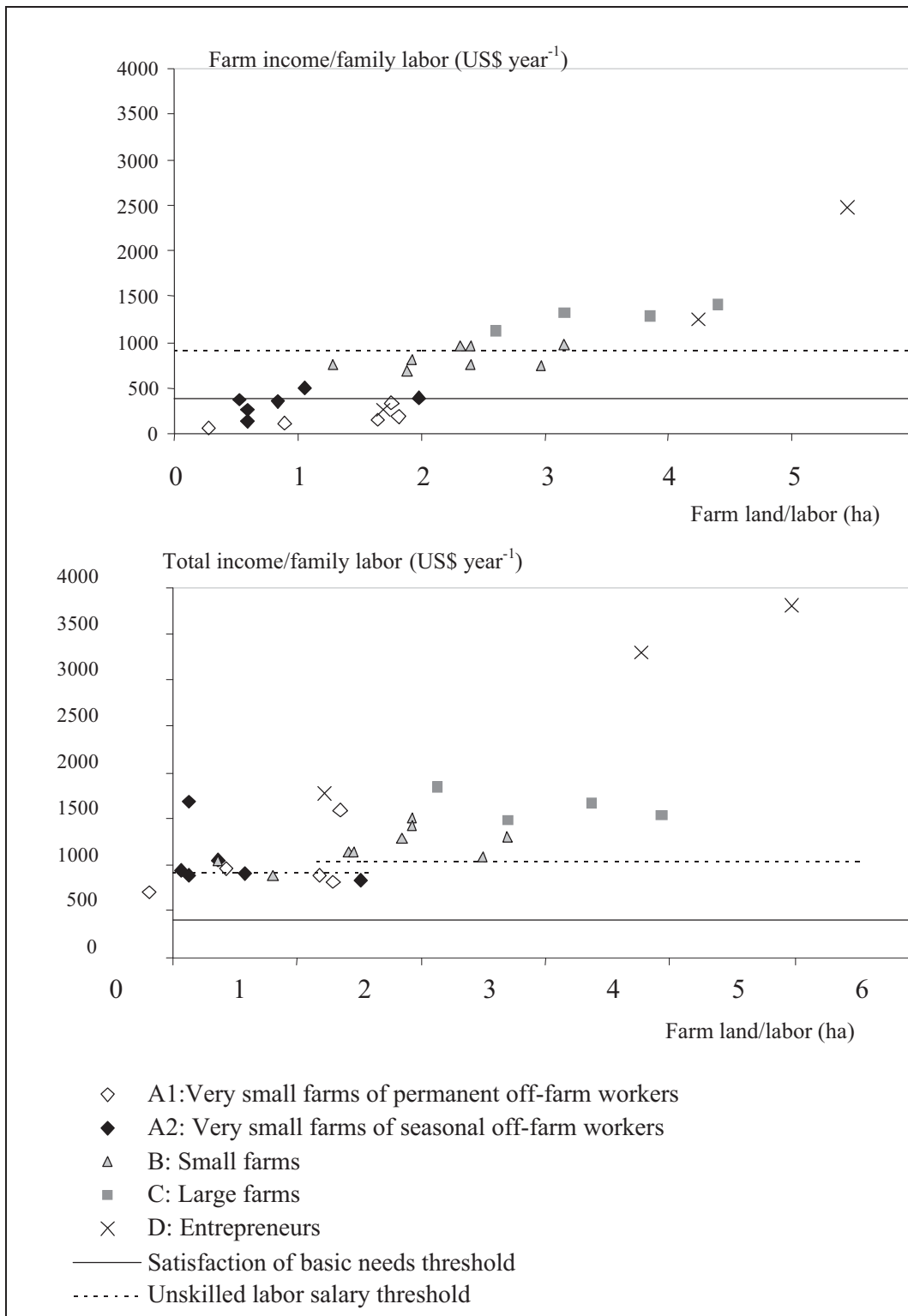


Figure 12. Distribution of agricultural and total net income among the main types of farming households in Ban Hin Lad, Khon Kaen Province, upper northeast Thailand, in 2002.

A MAJORITY OF FARMERS STILL LIVING IN POVERTY

Multiple employment as an answer to an unequal development process

Figure 12 displays the economic performance of these different main types of local farming systems. Because of their very tiny size, the very small farms with off-farm workers cannot meet their basic needs solely from agricultural income and they survive thanks to their non-agricultural income (permanent jobs in Khon Kaen factories, agricultural wages, jobs in the construction sector, as cleaners, bus, taxi, motorbike, or tricycle drivers, charcoal dealers, etc.). By providing enough employment opportunities, general economic growth helps them to escape rural poverty. Non-agricultural employment has been gradually integrated into their diverse portfolio of activities. Farmers have shown a high adaptive capacity by optimising management of the family workforce while facing a crucial lack of land. They manage to survive on these tiny holdings (that is to say, to achieve an economic performance higher than the satisfaction of the basic needs threshold) and to postpone the sale of their land as much as possible. But for how long? Their total income is still below the level for unskilled labour that they could earn in the Bangkok region. Even if they are aware that employment in the capital city is very insecure, they select this option when cash needs become crucial. And this trend is likely to continue in the foreseeable future. In the best cases, their children will find jobs in local factories and will manage to continue to live in the village, some becoming very small farms with off-farm workers. Only contractors-entrepreneurs and larger farms with wage earners still have some time ahead to adjust in this uneven development process. Some of their children will have the opportunity to study and to secure skilled non-agricultural employment in urban areas. Others will settle on the family farmland that their parents have purchased from the very small farms with off-farm workers when these finally decided to stop farming.

Diversification through farm ponds and cattle rearing to reduce rural poverty

The comparison of the economic performance among the main different farming systems shows that, to make up for the lack of land and to reduce the effects of an unequal agricultural development process, two complementary options are currently available for small farmers to increase their agricultural income and be able to continue to farm in the future: cattle rearing and more diversification through the use of farm ponds.

Diversification into cattle rearing brings both a surplus of agricultural income and some economic security to face hard times and to prevent small farmers from entering the vicious circle of indebtedness and sale of farm assets. The problem with cattle rearing is that not all farmers have access to this activity. As meat prices increase, everybody in the village would like to raise cattle, but many farmers are already deeply indebted and cannot accumulate enough capital to buy cattle, or to sell their few head to meet large repayments. The other problem is the lack of labour on the farm as young workers obtain off-farm jobs. If someone decides to raise cattle, we estimate that a smallholder needs 5 and 2 native female cattle to compensate for the loss of income from a permanent wage-earner or a dry-season daily labourer, respectively. The problem of keeping cattle through the dry season could be partly solved if a village shepherd were paid to take care of the farmers' animals or through mutual help within the family (elders and children who are on school holidays in the dry season). Forage resources are not a limiting factor now. Nevertheless, if cattle were to increase in the village, small farmers cutting grass in sugarcane fields of larger farms might get into trouble, as there could be no more free access to this source of feed in the rainy season. It could then become necessary to establish pastures. Water resources are of major too importance and this is why diversification into cattle rearing is closely related to the adoption of farm ponds.

Diversification into small-scale fruit and vegetable production and fish rearing thanks to these ponds is the second option available to small farmers to increase their agricultural income. Contrary to cattle rearing, digging a pond is possible for indebted farmers thanks to government subsidies. The only limiting factor is that tiny farms with very small paddy areas are not able to dig more than two small ponds. The diversification of food production has a direct effect on the quality of the diet consumed by family members, especially on smaller farms, but also by all rural households as the diversity of food products available in local markets increases. If farmers could store more water (which means digging more ponds), they could market larger quantities of food products to meet the local urban demand and increase significantly their cash income. Some innovative farmers in the village have already made this choice and are exploring market niches for their mangoes and fish production.

CONCLUSIONS

Northeast Thailand has long been considered as an important region from the point of view of development policies (Donner 1978). But, since the mid 20th century, it has been subjected to varied and sometimes contradictory initiatives that did not particularly focus on the interests of the poorest rural households. But following the 1997 economic crisis and the deceleration of economic activity and growth in the country, the government has been taking more measures to create employment in villages and to limit the rural exodus. Even before, in the eighties, the relocation of several sugar mills in this region allowed farmers to stabilise and diversify their agricultural income, and also offered thousands of off-farm jobs to agricultural labourers. Farmers in the irrigated Central Plain enjoy better soil and water conditions and can grow more demanding and higher-value crops than sugarcane. In these conditions, it seems justified to continue to protect the local sugar market (domestic market prices for sugar are at least twice as high as international prices), but this is often debated since Thailand is also a major sugar exporter. If an increase in the domestic price is accepted during negotiations with the World Trade Organisation, there should be assurances that it will benefit small growers and not only sugar mills and large quota leaders.

During the nineties, the government promoted private investment into decentralized industrial zones. This policy played an important role in reducing rural poverty by providing off-farm employment opportunities to the increasing number of small farms without enough land to meet their basic needs. Once more, small farmers showed a high adaptive capacity to cope with economic hardship and diversification into non-agricultural activities was an answer to the inevitable gradual decrease in their average farm size. But these very small farms with off-farm workers were deeply affected by the 1997 economic crisis, and since the industrial or services sector cannot absorb this workforce anymore, they need to rely more on their very limited agricultural income. One can say that many of them will have to choose between poverty in town and poverty in the village. That is the reason there is now a concern about how such villagers could increase their agricultural income and standard of living. In this context, at the King's behest, the government is now promoting his "New Theory", a form of "integrated agriculture" (actually more diverse than integrated) focussing on the use of small multi-purpose farm ponds. Through diversification into cattle and fish rearing, and fruit and vegetable production, these ponds play a role in increasing agricultural income per land unit, but they also have positive and direct effects on the food and financial security of village households. For cattle, the government promoted the Brahman race, but this breed is not accessible to small farms. Indeed, the main limiting factor in cattle rearing is that it represents too big a step in capital accumulation for smallholders. An easier access to farm credit has already been tried, but most borrowers could not pay back their loans. In this context of paralysing indebtedness, the new autonomy permitted by the ponds is helpful for coping. Farm ponds and the related diversification of economic activities have the potential

for further reducing rural poverty and improving the villagers' living conditions. As the government is now promoting the King's "New Theory", many more northeast farmers will benefit from it. Moreover, it seems that, in the current context of globalisation, it is wiser for farmers to search for local and diverse markets such as for beef, fish, fruits, and vegetables than to specialize in one industrial crop such as sugarcane, especially at a time when the protection of this crop could be reconsidered at any moment in the arena of international trade negotiations.

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NOTES

ⁱ An agrarian system has been defined as « an historically constituted mode of exploitation of the environment, durably adapted to the bio-climatic conditions of a given area, and corresponding to the social conditions and needs at the moment » (see Mazoyer and Roudart 1997).

ⁱⁱ Net agricultural and total incomes were assessed to characterise the economic performance of farming households. The first one includes all the net income from the agricultural products that are for sale or for home consumption. To obtain the net total income, we added all the non-agricultural income (salaries and wages of family labour, remittances, truck, tractor, or cultivator rental, sale of silk products, etc.) to the agricultural income (Dufumier 2001). These data can be compared to two thresholds that were also assessed in the farm survey: the satisfaction of basic needs threshold, under which households need to sell part of their assets to survive, and the unskilled labour salary threshold for this region.