

From rice cultivator to agroforester within a decade: The impact of *Doi moi* on agricultural diversification in a mountainous commune of *Cho Moi* District, *Bac Kan* Province, Viet Nam

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Abstract

Bac Kan agriculture is in transition from almost exclusively rice-based production systems to a complex and diversified agroforestry system. Less than ten years after agricultural decollectivization, farmers have shifted from irrigated rice in the lowlands combined with a limited area of upland rice under slash-and-burn cultivation in remote upland areas to highly diversified farming systems combining perennial and annual crops with various kinds of livestock systems. Major government policies and programs, including the *doi moi* package of economic reforms, have contributed to these changes. Beginning in 1982, land-use rights for previously-collectivized paddy fields were distributed to individual families, creating an incentive for individual households to intensify lowland cultivation. Beginning around 1990, forestland distribution and large-scale timber tree plantation programs were implemented to buffer the major deforestation trend of the 1980s. Farmers had to develop new production systems to sustain and/or increase the income they could generate from shrinking agricultural land. They diversified their farming activities with multiple innovations and relocated their families to new farms next to their forest plots on the hills, planting fruit trees and digging fishponds. The relocations reduced lowland congestion in the village centers and allowed the development of new livestock systems (primarily goats and pigs and to a lesser extent cows). Livelihood strategies evolved along different trajectories according to the relative land endowment of each household. This comprehensive

analysis of land use changes and household differentiation patterns makes it possible to prioritize development issues and to propose concrete solutions in order to assist local communities along their development pathways.

Keywords: mountain agriculture, rural development, livelihood systems, differentiation, farming-systems typology, *Bac Kan*, *Viet Nam*

1. Introduction

This monograph results from the joint efforts of CIDSE, an international NGO working in close partnership with provincial agricultural extension services; and SAM, an international research program aiming to understand and document the driving forces of land use changes from local to regional scales. This diagnostic study was designed to meet the needs of diverse stakeholders. First, the study describes diverse farming systems and analyzes their strengths and weaknesses, enabling the prioritization of rural development needs in a mountainous commune of *Bac Kan* Province (Fatoux, 2000). Second, it contributes to a comparative analysis of land use changes over the past fifty years at a network of six research sites within *Bac Kan* Province, designed by SAM Program (Castella et al., 1999). The comparative analysis allows us (i) to identify the mechanisms underlying local land use changes, (ii) to explain the observed diversity of land use and its development over time, and (iii) to identify the mega-trends in land use changes and natural resources management from their specific local manifestations. This network eventually will support the diffusion to large geographic areas of technical and organizational innovations designed to overcome location-specific issues related to agricultural development and natural resources management.

2. Methods

We applied a holistic analysis of land use changes at district, commune, village, and household levels. We focused on the agricultural components of household livelihood systems and their interactions with natural ecosystems in shaping landscapes.

2.1. Site selection and sampling methods

The SAM Program has research sites in each of the six districts of the *Bac Kan* Province; this monograph focuses on *Cho Moi* District. We divided *Cho Moi* into five homogeneous agro-ecological zones according to the following criteria:

- Ecosystem features: geology; relief (aspect of slopes, abundance of flat land); climate; and water availability.
- Distribution of the main ethnic groups (*Tày*, *Dao* and *Kinh*).

- Distribution of the main land uses in the lowlands and uplands.
- Accessibility and general state of roads and communication infrastructure.

Within *Cho Moi* District, we then selected *Thanh Mai* Commune for study because it appeared to contain areas that represented most of the district's biophysical and socioeconomic diversity. To most effectively describe the diversity of farming systems encountered within the commune, we first conducted a rapid survey of all households in the commune (n=459) with the help of the village heads. A preliminary farming system typology was derived from this rapid appraisal and was used to select representative households for more intensive sampling (n=70). Interviews with local stakeholders and authorities complemented the data.

2.2. Data collection and analysis

The field survey took place between March and July 2000. We first interviewed locals (elderly farmers, government officers, etc.) about the history of the commune and district in order to identify the main stages in the transformations of the agricultural systems and landscape. To this knowledge we added information from farmer-participatory mapping and from aerial photographs of *Thanh Mai* Commune taken in 1954, 1977 and 1998, generating land-use maps and land-use-change maps.

We surveyed a total of 70 households with a semi-structured questionnaire on the following themes:

- *The historical background* of each household farm and the spatial distribution of the resources they rely on (lowlands, uplands, forests, etc.).
- *Household assets and farm management rules*: Quantitative data included family structure, land endowment, main crops and animals, equipment, etc. Qualitative data included tactical (short term, seasonal) decisions on allocating land, labor, and capital to specific agricultural or non-agricultural production activities. Qualitative data also included cropping calendar, input use, main economic indicators, use of family labor or mutual help, off-farm income, access to credit, etc.
- *Family consumption patterns*: rice or maize consumption, duration of food shortage periods, schooling fees, medical expenses, etc.

We then created a farming-systems typology according to farmers' assets, objectives, and strategies, identifying five main types of farming systems that reflect the general tendencies found in *Thanh Mai* Commune.

3. Agro-ecological zoning

Before 1997, both *Bach Thong* and *Phu Luong* districts belonged to *Bac Thai* Province. In 1997, *Bac Thai* Province was split to form *Bac Kan* and *Thai Nguyen* provinces. Specifically, six southern communes of *Bach Thong* District were merged with ten communes of northern *Phu Luong* District to form the district of *Cho Moi* within the newly-created province of *Bac Kan*. This new administrative division of the former *Bac Thai* Province was aimed at better distinguishing between two major agro-ecological zones of the Red River Basin, with *Thai Nguyen* Province belonging to the hilly areas characteristic of the midland zone whereas *Bac Kan* Province was included in the mountainous zone. *Cho Moi* District marks the transition between these two natural environments. We identified five agro-ecological zones in *Cho Moi* District according to their geography and the distribution of ethnic groups (Figure 1; Fatoux, 2000).

3.1. Agro-ecological zoning of Cho Moi District

Zones 1, 2, and 3: Lowland rice-based systems with differences in accessibility

All communes or parts of communes classified in this zone share the same landscape characteristics (Figure 2). Alluvial valleys, enlarged along the main streams or rivers, surround the low rounded hills. Villages are generally grouped

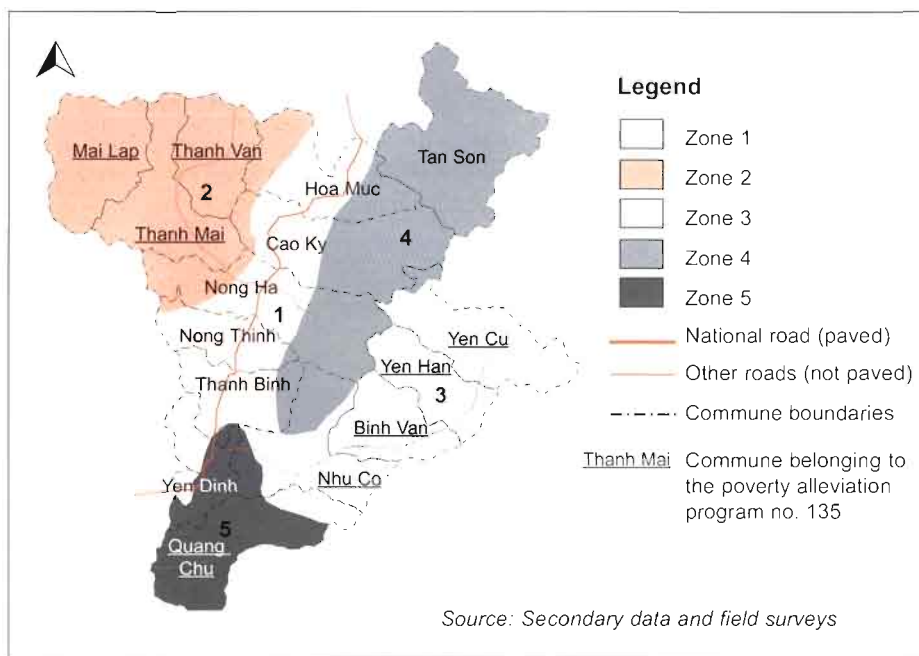


Figure 1: Agro-ecological zoning of Cho Moi District, Bac Kan Province

around flat valleys that have been transformed into paddy-fields. Zone 1 covers the wide valley of the Song Cau River. The valley floor is wider than in the other zones and irrigated by dams built along the river. In Zone 2, the paddy areas are linked by narrow valleys with minimal cultivation. The zone is further distinguished by the presence of young forest. The landscape of Zone 3 is similar to that of Zone 2 but is isolated by a mountain range, making it unique in its poor accessibility, which may explain its better forest quantity and quality (older forests). Some villages in Zone 3 are up to 15 km away from the *Cho Moi* administrative center, and can be reached only by foot. Dwellings are more dispersed in this third zone than in the two others.

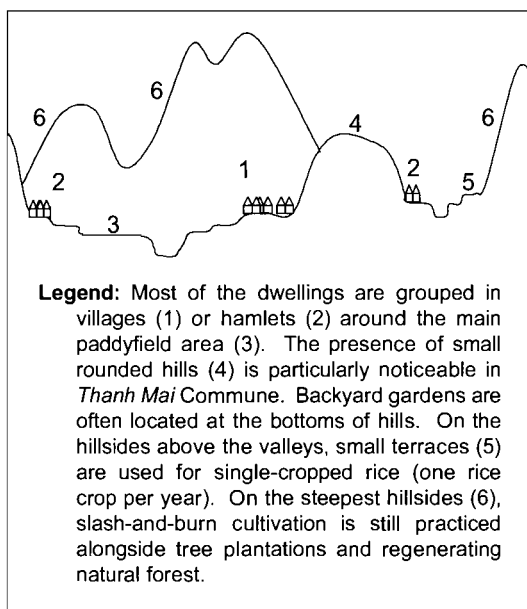


Figure 2: Schematic representation of the landscape in Zones 1, 2 and 3

Most of the households in Zones 1 to 3 are in the *Tày* ethnic group. Families in these zones traditionally rely on irrigated rice complemented by some slash-and-burn cultivation on sloping land close to their paddyfields. Small-scale fruit tree production further supplements local incomes. In recent years the area has benefited from government forestry programs (Projects 327 and 661, and the World Food Program). Goats and cows are the major livestock species in the region. The landscape lends itself well to fishponds, and aquaculture has been developing rapidly since the beginning of the 1990s.

Zone 4: a steep and dry landscape managed by *Dao* families.

Stretching across the eastern part of *Cho Moi*, Zone 4 rests on limestone bedrock with deep and narrow stream-carved valleys. There is almost no place for paddyfields and forest remains only on the highest part of the hillsides. The bulk of the zone is accessible only by mountain footpaths. Almost exclusively inhabited by *Dao* households, the area's production systems consist primarily of shifting cultivation on the hillsides, as very few lowland areas exist, and even fewer can be irrigated. Hillside fields tend to be cropped for at least three years, followed by a fallow period of 7 to 9 years. Cattle raising has been practiced since 1993 but the limited pasture area prevents further increases in herd size.

Zone 5: a complex geologic combination; agricultural specialization in tea and sugarcane.

Bordered by large limestone mountains, Zone 5 consists of flagstone hills isolated in a large alluvial plain. Water availability is low and the forest is heavily degraded. The area was not accessible by road until the year 2000. This primarily Tày-populated area has highly diversified agricultural systems, including various annual crops in association with rice as well as plantations of sugarcane and tea.

3.2. Overview of Thanh Mai Commune

Zones 1, 2 and 3 are very similar and encompass most of the district's population. *Thanh Mai* Commune was selected for our study because it contains many characteristics of these three zones:

- (i) Both single-cropped and double-cropped ricefields,
- (ii) Crop diversification trends in the lowlands and competition between fruit tree development and livestock grazing on the hillsides,
- (iii) Variable accessibility to marketplaces,
- (iv) Rapidly developing aquaculture and other income-generation activities, and
- (v) A large number of households that remain barely self-sufficient. Figure 3 shows *Thanh Mai* Commune; a red broken line circles the area that we studied more intensively for this chapter.

The paddyfields are concentrated in the center of the commune, and cover less than 10% of the whole area (110 ha out of 1300 ha). Their quality varies with location:

- Along the river, the soil is sandy and paddyfields do not retain irrigation water adequately. Two harvests are usually possible every year, but total annual yield is low (< 4 t/ha/year). The best paddyfields are usually located farther from the river, between the sandy strip and the hills. If well irrigated and fertilized, they can produce up to 7 t/ha/year.
- Secondary valleys radiate from the main paddyfield area, narrowing as they penetrate farther into the forest. The quality of paddyfields is highest at the downstream end of each secondary valley and lowest at the upstream end, for several reasons. First, soil quality is usually lower at the upstream ends (less alluvium, higher acidity from eroded hillsides). Second, irrigation is more difficult. Finally, the presence of forest and the sharp relief cause cool weather and a shortage of sunlight. All these factors result in reduced paddy yields, from 6t/ha downstream with 2 harvests a year to 2-3t/ha upstream with only 1 harvest.

Foothills are left as low-quality pastureland; are planted with bamboo; or are used for dwellings, terraces or gardens. Small rounded hills are generally planted with *Livingstonia* sp. (a palm tree traditionally used for thatching roofs of stilt houses) or used for upland agriculture. The rest of the area is made up of steep slopes that

used to be covered by forest. The steep slopes are the only areas where slash-and-burn cultivation is still practiced, and some families have begun to develop perennial plantations there. *Thanh Mai*'s numerous streams and small valleys also provide many potential sites for fishponds.

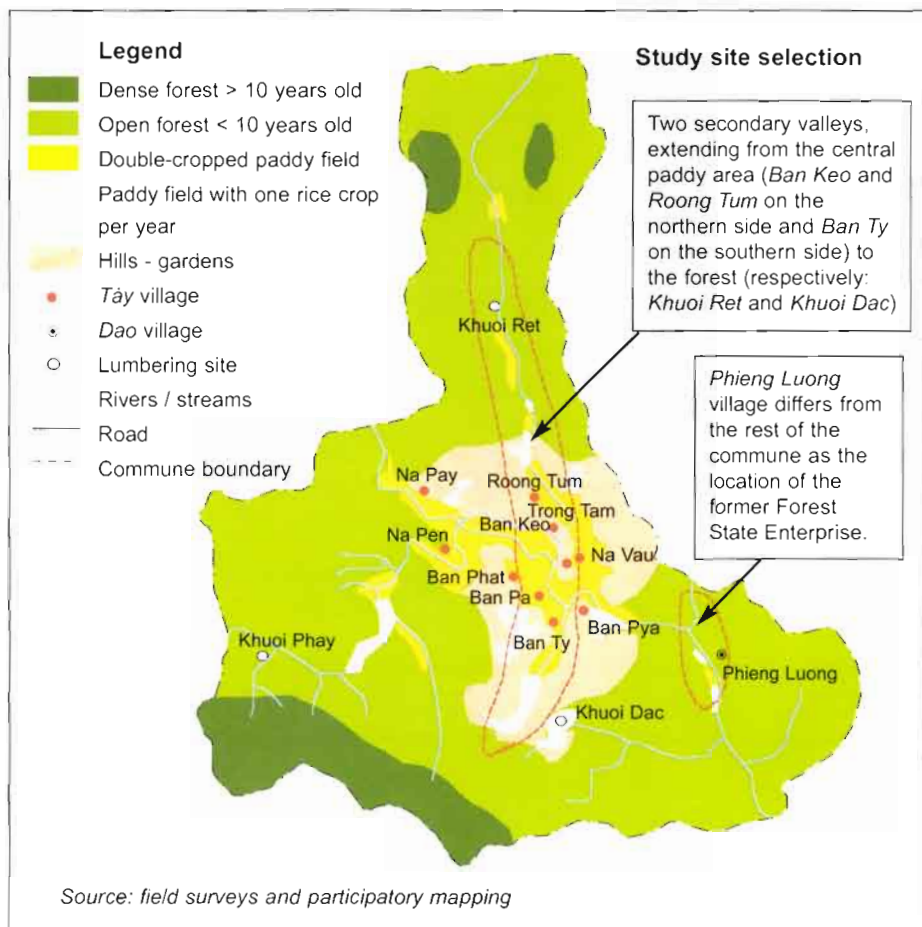


Figure 3: Land use map of Thanh Mai Commune as of 2000.

N.B.: The broken red line surrounds the two areas selected for intensive study.

4. Agricultural dynamics and land use changes in *Thanh Mai* Commune

4.1. Agricultural dynamics during the 20th century

Thanh Mai Commune is predominantly populated by the *Tày* ethnic group, but also contains a number of *Dao* villages. These two ethnic groups have traditionally been separated by their reliance on different production systems (the *Tày* in the lowlands and the *Dao* in the uplands), though in recent years they have become more similar in terms of production and land access strategies (Castella et al., 2002a). In this chapter, for the purpose of brevity, we will focus on the *Tày* groups in our studied area. *Phieng Luong* village in *Thanh Mai* Commune is a special case within the commune, by virtue of the State lumbering site that was developed there. For a more detailed examination of the lumbering site and the *Dao* groups in the area, see Fatoux (2000).

Pre-collectivization agricultural systems (to 1960)

The oldest settlements in *Thanh Mai* were located in the west-central part of the commune. In the early 1900's, residents began to spread from there and settle new villages. By 1950, the total population of *Thanh Mai* Commune was close to 100 families, approximately 30% of the present-day population.

The dwellings in the past seem to have been more dispersed than they are today, with families living far upstream to be close to their rice plots. In the 1950s, only half of the current paddy area had been cleared and was cultivated with a single crop of rice per year, without fertilization. Depending on the soil, yields ranged from 2.5 to 3.5 tons/ha. On hillside swidden fields, farmers grew maize, cassava, glutinous rice varieties, and mungbean. Fallow periods on swidden fields were often seven years or more, rotated with three years of cultivation.

There was no mutual help; only members of the family carried out agricultural tasks. The number of workers (*w*) in each family relative to its total size (number of mouths to feed, or *mtf*) became an important factor in household differentiation. In particular, a small *mtf/w* ratio meant that families had free time to develop new paddyfields or cultivate larger hillside fields.

Bamboo and palm trees (*Livingstonia* sp.) grew naturally in the forest and fallow areas, but also were planted on the riverbanks and hill bottoms. They were important sources of income, especially for the families who did not have enough rice to cover their needs. People also collected wild vegetables and roots in the forest.

The per capita number of buffaloes (up to 10 heads per household) was far higher than it is today. Buffaloes were left roaming freely from October to April. During the rice-growing period, buffaloes were tended during the day and stabled at the house at night. Manure was not collected, but because the houses were located

above the ricefields, we can assume that some manure flowed into the plots. Most households also raised 2 to 3 pigs each year.

The first arrivals in an area were able to claim the largest and best-irrigated tracts of land, making time of settlement another key criterion for differentiation (in addition to mtf/w ratio). During the first 60 years of the 20th century, there were three main household types:

- Households with paddy areas greater than 7000 m². These were the wealthiest families.
- Households with between 500 m² and 7000 m² of paddyfields. These families faced rice shortages, varying in intensity depending on mouth-to-feed/worker ratio.
- Landless families, who had to work in the fields of the wealthier families.

The main transformations brought by collectivization (1960-1982)

Beginning in 1959, the State established a cooperative in *Thanh Mai* Commune and implemented collective management of land, equipment, and labor force. In the first years of the cooperative, rice production doubled. The main reason for increased production was construction of irrigation ditches and canals, which made it possible to grow a second annual crop of rice on a lowland area nearly as large as today's. In addition, new rice varieties were introduced, as well as chemical fertilizers (urea) and the use of animal manure. This slightly increased paddy yields, which in the initial years of collectivization ranged from 3 to 3.5 tons/ha/crop. Harvested rice straw served as fodder for the buffaloes during the winter.

The material situation of the families improved during the first few years, and the relations of production were completely redrawn. Irrigation had previously played a major role in social differentiation, as it was the early arrivals who were able to claim the best-irrigated paddyfields, thus assuring higher yields for themselves and their families. Collectivization brought this benefit to all the ricefields in the cooperative. Rice production was distributed to each family according to a labor point system, so that families with a large number of laborers received more than families of equal sizes but with fewer laborers. The decisive element in social differentiation thus became the ratio of number of mouths-to-feed to number of workers (mtf/w). Families with low mtf/w ratios could diversify their sources of food and income even while earning full work-points from participation in collective tasks, as they could afford to send workers to private fields early in the morning to be back by 08:00 h to work in the collective paddyfields. Families with high mtf/w ratios often faced 3 to 6 months of food shortage. Land had been almost fully collectivized: just three years after the cooperative began, only 5% of land continued to be used for private production, this having been divided among all households in proportion to the number of members in each family.

The intensification of the paddyfields led to a slow decline in upland cultivation, resulting in some regeneration of forest cover on the hillsides. However, the growing population soon became too large for the lowland rice production, and people again turned to upland cultivation to overcome shortage periods. Poorer families started to substitute cassava and maize for rice in their diets. Upland rice, cassava, and maize were cultivated on the hills, and with the passage of time, cultivation periods lengthened and fallow periods shortened. Over the entire cooperative period, upland cultivation increased, and families that had previously not resorted to the uplands began to clear forest areas to survive.

Bamboo plantations were managed by the cooperative. The exploitation of bamboo and other forest products increased, particularly by families with high mtf/w ratios who did not have time to cultivate the hillsides. *Livingstonia* palm remained a major cash crop though it was just as often cleared for planting cassava. A few families experimented with planting traditional fruit trees such as oranges, mandarins, and grapefruits, but because their hillside plots were far from their houses, fruits were stolen and free-grazing animals damaged trees, so orchards did not expand much.

Every family had to give one buffalo or its cash equivalent to the cooperative for each of its laborers, and could keep the remaining livestock for itself. Buffaloes were stabled together and tended throughout the year, and manure began to be used as fertilizer in the ricefields. Pig raising remained private during this period, but mostly for family or village consumption, as there was no available market. In the middle of the 1970's, encouraged by the government, low mtf/w families started to raise goats. In the last few years of the cooperative period, goat raising spread through the commune like wildfire, as it offered quick and regular profits and was a good way to earn extra cash with minimal investment. However, because most goats were allowed to roam freely, their damage to crops created tensions among families. The cooperative period also saw the first development of fishponds, although they were mostly controlled by the cooperative and thus not very productive.

Between 1967 and 1972, a road was built in *Thanh Mai* Commune, probably in conjunction with the creation of the lumbering site in *Phieng Luong*. Nine hundred hectares of old forest, which had previously been almost untouched, were allocated to the State farm and heavily exploited during this period. People began to immigrate to *Thanh Mai* from several regions, beginning with the neighboring communes. Two forest production teams were formed: one in charge of harvesting (cutting every possible tree), and the other in charge of replanting (starting in 1975) and caring for the replanted forest. The first team was more active than the second, and the natural forest rapidly deteriorated to a mixture of bamboo and young plantation trees.

With time, the cooperative management structure grew more bureaucratic and less flexible. This led to a progressive loss of confidence in the system, and farmers focused their efforts on private activities as much as possible within the cooperative framework. Little time was given to lowland intensification, and rice yields stagnated and even declined, dropping to pre-cooperative levels (below 2.5 tons/ha/cycle).

Decree 100 (1982-1989)

In 1982-83, the collective paddyfields were distributed to individual families in proportion to the number of mouths to feed in each household. Families had to deliver to the cooperative a rice quota equivalent to what they had produced on these plots during cooperative times, but could keep any surpluses. Collective tasks for rice cultivation were reduced and families could manage their time more flexibly. Yields in the lowlands continued to be limited by input supply, which was poorly managed by the cooperatives. The new policy triggered an unexpected and uncontrolled growth in slash-and-burn cultivation in the uplands for at least the next 7 years, peaking around 1988-89. Fallow periods were shortened drastically. Once all favorable uplands had been put into production, yields began to decrease and problems of erosion put the system into an ecological crisis.

Some families tried to start fruit tree plantations but most failed for the same reasons as before (theft and free-grazing). To be productive, fruit trees had to be planted near the house, which limited potential plantation area. Bamboo and forest timber exploitation also reached the limits of available land during this period.

Resolution 10 (from 1989 on)

From 1989 to 1993, families regained control of their ancestral land and farmed it privately. This was the true end of the cooperatives. Across the commune, *Tây* farmers reclaimed the ricefields of their ancestors; their situation rapidly improved and the pressure on hillsides was reduced within a few years. Meanwhile, most *Kinh* and *Dao* families had received only small lowland plots if anything at all, and continued to cultivate large upland areas, up to three hectares in area. With capital accumulated from this upland cultivation, from goat raising, or from labor advantages during the Decree 100 period, these *Kinh* and *Dao* households began to buy ricefields after 1993.

Farmers began to grow rice more intensively, and added fertilizers and pesticides to the system beginning around 1996. They continued to rely on labor exchanges for rice transplanting and harvest. In 1998, the agricultural extension office of the district introduced hybrid maize as well as winter maize and potato. However, these crops have developed slowly because of damage from free-grazing livestock during the winter.

The distribution of protected forestland to individual families together with reforestation programs (initially the World Food Program, followed by

government projects 327 and 661) put a brake on upland cultivation. Reforestation programs were conducted in the *Tây* villages in 1993, 1995, and 1997. In addition to the mandatory timber species, families planted fruit trees.

By 1992, the growing number of free-grazing livestock in the area close to the village were competing directly with farmers' upland cropping practices. The resulting damage and conflicts led some families to begin to build farms on their forest plots farther from the village. New bans on slash-and-burn cultivation limited these upland farms to terraces, livestock, and fishponds. However, the new farms also created the opportunity for farmers to monitor forestland more closely, paving the way for perennial plantations. By 2000, about 100 of the 460 *Thanh Mai* households had moved to their forest plots, and another 100 were living with one foot in their village house and the other in the new farm. The first to move were the wealthier families, particularly those families who had received large paddyfield endowments and had enough workers to start raising animals on a second farm.

Many poorer families also seized the opportunity to improve their livelihoods. Initially they invested only in a fishpond and planted large areas of timber trees and orchards, and then later used the income to invest in cattle. Aquaculture developed quickly during the 1990s, as it was an immediate and legal source of income for families while their plantations were young. Most of the families tried to dig ponds by building earth dams on the property they had received. However, those who did not have houses near the ponds lost much of their production to nighttime thefts.

Capital accumulation from goats had begun to dwindle around 1993, as goat grazing was causing too many conflicts with upland cultivators. Nonetheless, the relocations slowly permitted goat and cattle raising to increase again. Because the new upland farms were so widely spread out, free-ranging animals were no longer a concern to anyone except the animal owners. Through all the policy changes and to the present, pig raising has remained a key element in all classes of farming systems. During the Resolution 10 period, new pig breeds were adopted and hybrid pigs are now fattened in less than 8 months using commercial feed.

The trend of relocating farm activities to the uplands was given a push by fruit tree planting and credit programs, which offered families with less paddy area the opportunity to catch up with the better-off families. On the other hand, since 1999, the district extension service has been introducing rainfed winter crops (e.g. maize, peanuts, cabbages, and potato), permitting lowland fields to reach three crops per year. Presumably, intensifying the lowlands by adding a third crop per year will slow the trend to relocate in the uplands.

4.2. Impact of land use changes on the natural resource base

Figure 4 summarizes the main impacts on land use of the agricultural changes that were described above. Over the last fifty years, dense forest cover has decreased

by 68% while shrub areas have tripled. However, these daunting figures do not reflect the underlying mechanisms of the deforestation, nor the relative regeneration of forest that has occurred in recent years (i.e., increased area of young open forest). The two land-use-change maps of Figure 5 offer some explanation. Between 1952 and 1977, the forest surrounding the main paddyfields in the center of the commune underwent substantial deforestation, while in peripheral areas the forest was regenerating. The expansion of paddyfields during the cooperative period is clearly visible as well as the expansion of upland crops around the collective fields. Private upland fields were cleared as close as possible to the paddyfields to lower the daily travel time between private and collective fields. Not surprisingly, the forest around the *Phieng Luong* lumbering site was cleared.

Between 1977 and 1998, land uses displayed an opposite trend. Forest cover regenerated in the center and disappeared at the periphery, illustrating the rapid expansion of slash-and-burn practices during the 1980s. Close to the commune center, there was not much forest left to cut. Farmers rapidly expanded their upland fields far from the commune center, out of sight of the authorities. The land allocation associated with Resolution 10 returned the focus of many farmers to lowland rice, but those farmers left without land, particularly the *Dao*, were forced to turn to the uplands.

The most recent land cover changes, related to forest protection and plantation policies, are not yet visible on the 1998 land use map because the relevant policies were just being implemented at that time. On the 1998 aerial photographs, the young plantations still resemble either upland crops (as in most cases maize is intercropped during the three first years of plantations) or shrub.

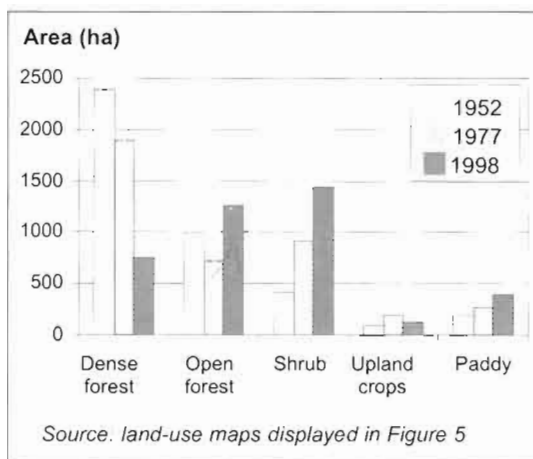


Figure 4: Areas of the main land-use classes within Thanh Mai Commune in 1952, 1977, and 1998

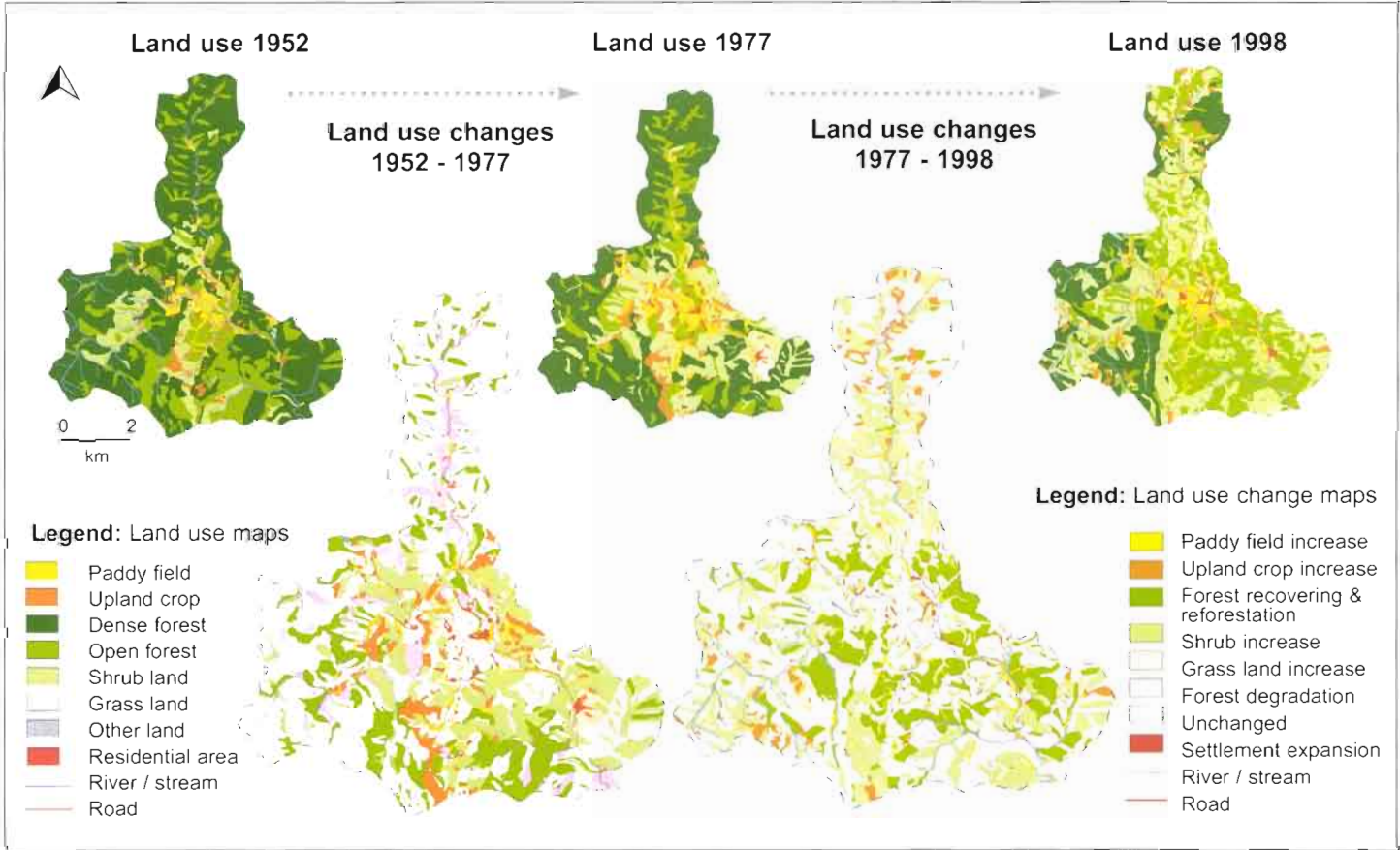


Figure 5: Land use maps and land use change maps of Thanh Mai Commune as interpreted from aerial pictures.

5. Farming systems typology

5.1. The driving forces of farming system differentiation

Farmers now face three major constraints when it comes to developing production systems:

- *Forest protection policy.* State policy now forbids slash-and-burn cultivation, and restricts production and gathering activities to clearly defined locations, limiting farmers' choices.
- *A deteriorating resource base.* Reduced fallow periods associated with shifting cultivation have drastically reduced soil quality in many regions to the point that it is impossible to grow any crops, including timber trees.
- *Human constraints.* The main constraint is population concentration in residential areas, exacerbated by an influx of people during the cooperative period. Living far from their paddy and upland fields, farmers often incur heavy losses to theft and animal free grazing. Responses to this constraint include households relocating to live next to their plots, and the creation of small farmers' groups who manage adjoining ricefields and build collective fences for winter production of cabbages or potatoes.

In previous periods, land was abundant and labor was scarce, so farmers based their strategies on the labor productivity of various activities. With seemingly limitless amounts of forest to clear, slash-and-burn cultivation provided an excellent return on labor investment. Today, the commune population is considerably higher, and the commune land area is becoming the limiting factor. Labor is now relatively abundant, while land has become scarce, making land productivity the driving factor behind farmers decisions. The new trend is in the direction of land intensification: for example, fruit tree plantations on hillsides, triple-cropping ricefields with winter maize, and growing vegetables (e.g. cabbage, potato).

Table 1 presents a comparison of various cropping and livestock systems in terms of land and labor productivity in the year 2000. In the lowlands, cabbage and potato have the highest land productivities, but are often difficult to market. Fruit trees offer the greatest productivity in the uplands, but do not produce for the first four years after planting. In terms of livestock systems, goats offer a high productivity, but as mentioned earlier, can be a major source of conflict.

5.2. The main types of farming systems identified in Thanh Mai

Table 2 presents the main differences among current farming systems. We did not include ethnicity as a criterion to build the typology because we believe that ethnicity has only an indirect effect on farmers' strategies. Farmers' strategies depend to a large extent on the farm assets on which they can rely, one of the key assets being land. Following decollectivization, the *Tày* ethnic groups tended to

Table 1: Comparison of various cropping and livestock systems (VND of year 2000).

| | Agricultural products | Reference unit (RU) | Initial investment (VND or PD) | Yield or production | Total Person-Days (PD) | Value-Added/RU (VND) | Value-Added/PD |
|--|-----------------------|----------------------------------|----------------------------------|---------------------|------------------------|----------------------|----------------|
| Ricefields or river banks | Paddy rice (per crop) | 1000 m ² | 30 PD/year (fences) | 500 kg | 34 | 1 000 000 | 29 000 |
| | Maize | | | 250 kg | 54 | 460 000 | 8 500 |
| | Peanuts | | | 150 kg | 56 | 790 000 | 14 000 |
| | Cabbages | | | 2,5 t | 120 | 2 100 000 | 18 000 |
| | Potato | | | 1,5 t | 120 | 1 180 000 | 10 000 |
| Sloping lands | Upland rice | 1000 m ² | - | 285 kg | 43 | 340 000 | 8 000 |
| | Maize | | | 100 kg | 20 | 200 000 | 10 000 |
| | Green beans | | | 67 kg | 33 | 385 000 | 11 500 |
| | Cassava | 1000 points | 150 000 (4 y without production) | 1t (f)-0,5t (d) | 20 | 600 000 | 30 000 |
| | Apricots | 60 trees / 1000 m ² | | 50 kg/tree | 60 | 5 800 000 | 100 000 |
| | Oranges | | | 20 kg/tree | 30 | 8 260 000 | 235 000 |
| | Longan | | | 30 kg/tree | 40 | 5 260 000 | 120 000 |
| | Manglieta plantation | 200 trees (1000 m ²) | 50 000 (7 y without production) | 30 trees/y | 3 | 250 000 | 83 000 |
| Animal husbandry | Goat | 5 m | 400 000 | 4 babies/y/m | 105 | 2 050 000 | 19 500 |
| | Cow | 5 m | 4 000 000 | 1 calf/y/m | | 6 900 000 | 65 700 |
| | Buffalo | 1 m | 3 000 000 | 1 calf/1,5y/m | | 1 500 000 | 14 300 |
| | Pig | 1 pig | 200 000 | 60 kg/ 6 mths | 45 | 160 000 | 3 400 |
| | Fishpond | 1000 m ² | 1 000 000 | 200 kg | 63 | 1 200 000 | 20 000 |
| Average income of 1 day spent in the forest gathering roots, bamboo shoots, or stems | | | | | | | 15 000 |

N.B.: *d* = dry, *f* = fresh, *m* = mother, *mth* = months, RU = Reference Unit,

PD = Person-Days, *y* = year.

receive more land than others, but this was not universally the case. Land sales and purchases since then have also made it more difficult to associate any particular ethnic group with any kind of land holdings. *Dao*, *Kinh*, and *Tày* households can be found in any of the following types of farming systems, not because of ethnicity per se but because of how much land and labor force (mtf/w ratio) they have or had in the past:

Type 1 comprises families who inherited (*Tày*) or bought (*Kinh*) a large paddyfield area (3000 to 3500 m²/worker). Paddy is the base of the system. Rice surpluses (~2 tons / year) are sold or used to fatten pigs. Profits from paddyfields are reinvested in small machines (huskers, water pumps, or hand tractors) or used to hire help for livestock maintenance or assistance during periods of peak labor demand. Hired labor allows the construction of fences, permitting winter crops and spring crops on ricefields. Paddy income also buys seeds and chemical inputs. These households also own large tracts of sloping land, but with neither the labor capacity nor the need, have not invested in fruit trees, instead letting the forest regenerate. Most families in this group have ceased slash-and-burn practices. It is these households who most often occupy positions of administrative authority, and are often lenders of money, machines, and animals.

Table 2: Types of farming systems in Thanh Mai as of 2000.

| Lowlanders (irrigated rice based production systems) | | |
|---|---|---|
| Type 1 | Type 2a | Type 2b |
| <ul style="list-style-type: none"> - large paddy area (~3000 m²/w) - winter cash crops in paddyfields - pig fattening - capital accumulation - hired labor force - village lenders | <ul style="list-style-type: none"> - medium paddy area (600 - 2500 m² / worker) - forest product gathering and slash -and-burn cultivation | |
| | <ul style="list-style-type: none"> - small sloping or forest land area - low-investment animal raising (pigs, fish, goats) - borrow small amounts of money | <ul style="list-style-type: none"> - larger sloping or forest land area - started fruit tree plantations - fish ponds - long-term borrowing |

| Shifting cultivators (slash-and-burn based production systems) | |
|---|---|
| Type 3a | Type 3b |
| <ul style="list-style-type: none"> - little or no paddyfield area (often converted to fish pond) - minimal capital - rice insufficient - few buffaloes, if any - house near paddyfield | |
| <ul style="list-style-type: none"> - young families with high mtf/w - small upland areas - forest product gathering or working as a carpenter | <ul style="list-style-type: none"> - older families with lower mtf/w - maize, cassava, rice, sesame, green beans on hillsides - low-investment pig fattening - forest product gathering |

| Diversifiers (varied cropping and husbandry systems) | | |
|---|---|--|
| Type 4a | Type 4b | Type 5 |
| <ul style="list-style-type: none"> - diversified production on farms outside of village centers - increasing proportion of income from upland cultivation - highly diverse group (e.g. fruit trees, timber trees, cash crops, terraced ricefields, aquaculture, goats, cows) | | <ul style="list-style-type: none"> - <i>Phieng Luong</i> (lumbering site) households - paddyfields with one rice crop/year plus other annual crops - large plots of forest land |
| <ul style="list-style-type: none"> - sufficient paddy area - established perennial cropping and animal husbandry systems - access to long -term credit | <ul style="list-style-type: none"> - small paddyfield area - moderate forestland allocations - perennial plantations and animal husbandry systems not yet established - access only to small credit | <ul style="list-style-type: none"> - diversified crop and animal husbandry systems - few fish ponds |

Type 2 families own medium paddy areas (600 to 2500 m²/worker), acquired either through inheritance (*Tây*) or purchase (*Dao*). As with Type 1, paddy is the cornerstone of the system. Families usually harvest enough paddy to cover their food needs, selling a small surplus or feeding it to pigs. Paddy production is complemented by forest product gathering or slash-and burn cultivation of cassava, maize, and green beans. Unable to afford hired labor, these households cannot build fences, making winter crops in paddyfields unfeasible. Upland surface areas subdivide this type:

In *Type 2a* are families with access only to small usable sloping land areas. These families have begun to invest in animal husbandry to supplement their incomes. Pig fattening and fish raising are seen as the best ways to invest in the future. However, husbandry at present provides only limited benefits (pigs must be fattened for more than one year, and fish are raised only for family consumption).

Type 2b encompasses families who have larger amounts of forest and fertile sloping land. They have started to plant fruit trees and are yearly extending their plantations.

Type 3 families lack both adequate land (750 m²/worker maximum) and capital. Because of small size or low yield, paddyfields cannot produce enough rice for the family. These families have thus often converted their lowland areas into fishponds (for family consumption only) or occasionally into gardens. Their production system relies on slash-and-burn cultivation and forest product gathering. Buffalo ownership is rare, and there is barely enough time or capital to invest in other animals. To maximize lowland productivity, houses are often built next to the paddyfields. The type can be subdivided based on labor availability:

Type 3a are young couples with high mtf/w ratios and neither adequate paddyfields nor uplands. The need to take care of the children requires one parent to be present in the house every day, leaving little time for hillside cultivation. Instead, one parent works off the farm, usually gathering bamboo culms and shoots, roots, and creepers of forest plants. The man can sometimes work as a carpenter, which makes staying at home profitable.

Type 3b consists of large *Dao* families with low enough mtf/w ratios to permit cultivation of large amounts of upland crops. However, the sloping or forest area that they received is either too small or too degraded to plant fruit trees. Workers are assigned every day to gather forest products.

Type 4 families are a very heterogeneous group, with ricefield area/worker ranging from 200 to 3000 m². However, all families within Type 4 started to diversify their production systems on farms outside of the village centers some years ago. As systems diversify, paddy production is losing importance compared with upland production in terms of time investment and total income generation. Most families are cultivating fruit and timber plantations; they have also occasionally cleared or even terraced the least steep upland areas and started to

grow three cycles of cash crops per year. Livestock systems have diversified with fishpond development and the possibility of conflict-free goat and cow raising. Many of these systems are in transition, as some households have just begun to plant fruit trees and split their time between the new farm and the village, whereas others are already definitively settled in their new houses. The type can be subdivided based on access to paddyfields, and therefore to capital:

Type 4a families have enough paddy area to cover household consumption and were able to borrow money from the bank to start their new activities sooner. Depending on their mtf/w, these families can now assign one or more permanent workers to the newly built houses to protect crops and fish from theft, and to tend the animals.

Type 4b families do not have sufficient ricefields to cover family consumption. Unable to borrow money for long-term investments, they have nonetheless made the most of forestland allocations. They spend most of their time on the new farm, using extra time to gather forest products or distill alcohol for sale.

Type 5 families come from *Phieng Luong*. Their ricefields could meet family needs if double-cropped, but more than 70% of the area lacks water and only one rice crop per year is possible. Paddy fields are usually fenced, permitting at least a second lowland crop (usually spring maize or peanuts). Maize and peanuts are also planted on the riverbanks, and fruit trees on the small hills. Cropping systems exhibit the same diversification characteristics as Type 4. As former State lumber workers, families in *Phieng Luong* were the first to learn of the forestland allocations and received very large plots (1 to 5 ha/worker) that they now are about to exploit. Livestock systems are also as diversified as in Type 4, with the exception of aquaculture, which is constrained by a lack of water and suitable sites to build fishponds.

5.3. Differentiation processes and farming systems trajectories

Between 1990 and 1993, after the end of the cooperatives, some families recovered the ricefields that their ancestors had controlled before 1960. A second group of families obtained paddyfields by purchasing them with accumulated capital. Families with low mouth-to-feed/worker (mtf/w) ratios were able to accumulate capital during collectivization, and then use that capital to buy ricefields in 1990-1993 and start new activities. To a large extent, differentiated access of farm households to land and capital assets across these two periods were the determining factors of the current farming system typology. These historical trends were discussed in detail in Section 4.1, and are summarized in Table 3.

The current typology is merely one point along a continuous trajectory, as farmers' strategies and situations change in response to their environment (Figure 6). In order to facilitate desirable future changes via relevant research and development efforts, it is essential to understand farming system trajectories and their underlying causes.

Table 3: Historical differentiation patterns that produced the current farming systems typology.

| Ratio mtf/w during the 1980s | Area of paddyfield before 1960 | | | | | |
|------------------------------|--------------------------------|-------------------------|---------|--------|----------------------|--------|
| | > 7000 m ² | 500-7000 m ² | | | < 500 m ² | |
| < 2 | Type 1 | Type 1 | Type 4a | Type 2 | Type 4b | Type 3 |
| > 2 | Type 4a | Type 2 | | | Type 3 | |

The main trends presented in Figure 6 are conditioned by the following factors:

- Access to lowland fields.
- Access to forestland and official allocation of land-use rights in the hills.
- Possibility of exchanging, buying, or selling pieces of land.
- Access to credit and sources of non-agricultural income.
- Access to long-term outlets for products from timber plantations, orchards, annual cash crops, and animal husbandry.

Several trends may change the relative availability of land. For example, households of Types 1 and 5 might invest in non-farm activities (especially trading activities). For Type 1 households, the income taken from agriculture is enough to pay for the children's education and allow them to leave behind the agricultural life, thereby reducing competition for land. Some families in Type 2 moving towards Type 4 and some families in this latter group will likely soon give up their paddyfields close to the village center to concentrate on their new farm activities close to their forest plots. All these trends should make it possible for those who do not have enough paddy area to acquire some more. In addition, a further distribution of forestlands to those who did not benefit from the previous distributions could make it easier for Type 2 or Type 3 households to transform themselves into Type 4.

The trends described in Figure 6 reflect household livelihood systems in 2000 and therefore are centered on agricultural and forestry activities, as opportunities for non-farm activities are still very limited. But the trends described above imply that many of today's farming families will need to leave agriculture and begin non-farm activities or at least that the new generation will find job opportunities outside of the villages. The shift of workers out of agriculture and into non-farm activities will probably be a "mega-trend" in the coming decade and must be considered even in remote mountainous areas. A report from the Asian Development Bank states, "In Viet Nam, the percentage of the population in agriculture has fallen by 7 percentage points per decade ... If this trend continues, the share of the population working in agriculture will decline from 67 percent in 2000 to about ... 53 percent in 2020" (ANZDEC Consultants, 2001). Moreover, the report from the 9th Party Congress emphasizes the development of rural industries as a strategy to create employment opportunities and limit rural exodus.

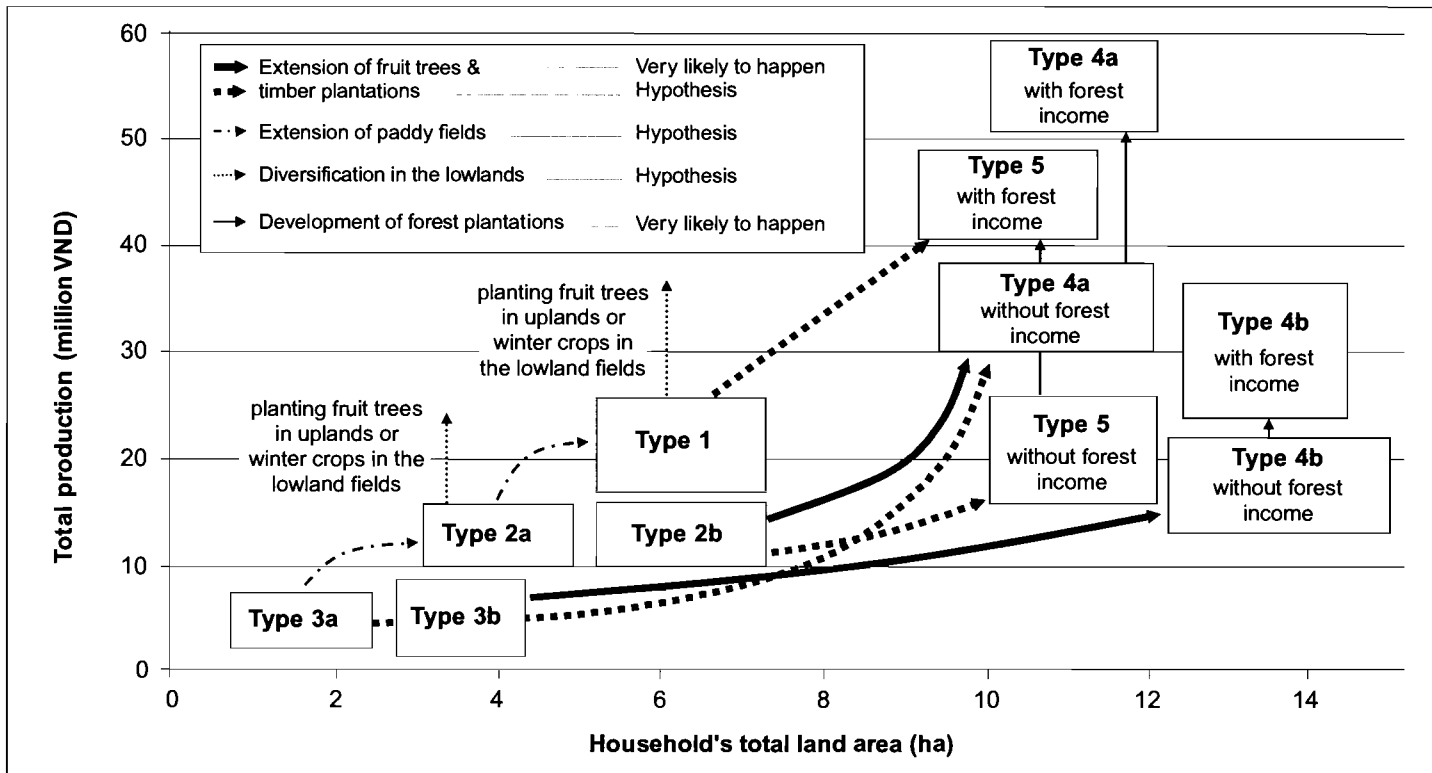


Figure 6: Evolution of the farming system types from 1990-2000, and projected future evolution.

N.B. The evolutions that are "very likely to happen" are those already on-going at a very limited scale and that have a high potential for expansion. The "hypotheses" are trends not yet observed in the commune but that existed in the past or that are reviving in neighboring communes and therefore have a good chance to develop in Thanh Mai in the future.

In *Thanh Mai*, farm households are very enthusiastic about these policies that are beginning to have concrete local effects. For example, in 2001, they welcomed the announcement of a future paper mill in *Cho Moi* District that will provide a local market for their timber production and job opportunities for their children. This new policy is too recent for them to realize how these changes could occur on a larger scale and how they or their children could be involved. However, they have shown a remarkable capacity of adaptation to the successive changes that have occurred during the last decades and are ready to grasp any new income generation opportunities.

6. Recommendations

As demonstrated in the typology, the social differentiation among households already is wide (the wealthiest households have incomes eight times greater than those of the poorest households) and continues to widen. The possibilities for struggling households depend on effective use of the land across the entire commune, not just near the village centers. As households spread out to land farther from villages, they need to be supported with information about local markets, as well as a means of bringing their household production to that market. Through the course of our study, we identified a number of technical and/or organizational innovations that would facilitate the ongoing transformations.

Forest management. Since construction of the road through the commune, forest exploitation has intensified, and many farmers rely on the forest for additional income. At first, only bamboo culms were harvested from forests. Later, the *Phieng Luong* lumbering site provided an outlet for marketing timber, especially hardwood trees. Since 1993, Chinese traders have provided marketing outlets for many kinds of medicinal plants (especially roots). The plundering of forest resources in recent years has become so severe that, to collect a given quantity of products, some gatherers now need ten times as many days as in 1990. A new kind of forest industry will develop in the future thanks to governmental timber tree plantation projects and new market opportunities with the new paper mill planned by the district authorities. In the individually-owned plantation plots, a new kind of forest management should accompany these changes.

Livestock systems. Since its introduction in the 1980s, goat rearing has drawn the efforts of many farmers. For Type 2 and 3 households, goats are a secure and steady source of income that requires little investment. For Type 4 households, goats are the best way to pay back a loan (usually used for planting fruit trees or digging a fishpond). However, the frequent conflicts caused by free grazing animals indicate a need for alternative fodder sources and innovations to protect crops from animal damage (for example, living fences). Village attempts to reserve some upland for collective pastureland have largely failed, indicating a

need for new community-based livestock management rules (Castella et al., 2002).

Although *Thanh Mai* has a natural endowment favorable to aquaculture, the productivity of fishponds remains low. Farmers need training to increase the number of fish-harvest cycles from one to two per year, improve feeding practices, and reduce losses from fish diseases. Training would also go a long way toward improving the effectiveness of local pig- and poultry-raising systems.

Crop diversification. On the hillsides, farmers face erosion and decreasing soil fertility due to shortening fallow periods. Types 1, 4, and 5 have relieved unsustainable pressure on their upland plots either by growing perennial crops or by intensifying lowland production. Finding ways to increase the productivity of both lowland paddyfields and upland perennial crops, and developing secure marketing channels, are two ways to continue to reduce the pressure on upland systems. Of course, any further intensification in either upland or lowland requires some kind of defense against the damage caused by free-grazing animals.

Accessing and sharing information. *Thanh Mai* farmers lack information. The greatest constraint on investment in new production is the absence of information about market outlets. Those with access to some knowledge through personal experience, field trips, or participation in training courses tend to keep it for themselves. Organizing farmers' meetings to discuss a broad range of agricultural and marketing issues within the *Thanh Mai* farming community could assist the diffusion of existing knowledge within the commune. In particular, information should be broadly diffused after any training sessions. The Farmers' Association, which in 2000 included about 100 families out of 460, is a potential mechanism for information sharing.

Farmers would benefit greatly from information on a wide array of crops suitable for their land, together with technical information about the specific techniques that would be required for each. In the current situation, farmers usually wait for the extension services of the district to propose plantation programs. Although these programs can be helpful, they often lack quality control procedures. Some negative experiences in the past include seedlings that all were the same sex and therefore failed to set fruit, and farmers who asked for litchis but received apricots. In the future, apart from information related to markets and agricultural extension, farmers will need better access to information on non-farm job opportunities.

Investment capacity. Last but not least, considering the wide range of activities in which farmers are engaged, a wide range of credit facilities needs to be made available to them. In particular, the standard three-year repayment period for bank loans is unsuitable for fruit tree plantations (4 to 5 years without income), cow breeding (6 years), or timber tree plantations (at least 7 years). In contrast, for annual crops, short-duration loans could facilitate investment in inputs.

7. Conclusions

The analysis of *Thanh Mai* agricultural evolution shows the strong reactivity of farmers to policy and institutional changes. In less than ten years, many farmers shifted from lowland rice-based production systems near village centers, driven by the need to optimize labor productivity, to scattered farms with perennial crops or livestock systems, driven primarily by land productivity concerns. Along this evolutionary path, a wide range of diversified sub-systems appeared, combining fish raising and pig fattening, fruit- and timber-tree production, and annual cash crop cultivation.

At a glance, the changing landscape of *Thanh Mai* is a paragon of State plans for the nation, perhaps because of its market integration: land allocations have led to lowland field intensification and development of fruit tree plantations. Forest protection policy seems to have put an end to the problems of deforestation.

But this cursory view overlooks a wide diversity of current situations that require a diversity of solutions. The transformation process is constrained by many factors and has not included all farmers. First and foremost, the shift to diversified upland production depends on access to lowland ricefields, which are still the most reliable way to cover family needs and secure bank loans. Access to forestland is also crucial as households who were left out of the allocations can only watch the transformation processes from the sidelines.

The household relocations that have taken place in *Thanh Mai* were an unintended consequence of forestland allocations, but are nonetheless a positive trend, both reducing population pressure on the land near the villages and diversifying production possibilities for farmers. However, it is vital that these farmers are supported in their new locations with information on markets and the means of participating in those markets.

Acknowledgements

The authors are very grateful to Paul Novosad for his contribution in editing this chapter.

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The Agricultural Publishing House
Ha Noi, Viet Nam
2002

Vietnam Agricultural Science Institute

VASI, Thanh Tri, Ha Noi, Viet Nam

Institut de Recherche pour le Développement

IRD, 213 rue Lafayette, 75480 Paris Cedex 10, France

International Rice Research Institute

IRRI, DAPO Box 7777, Metro Manila, Philippines

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Jean-Christophe Castella and Dang Dinh Quang (eds.) 2002

Doi Moi in the Mountains:

Land use changes and farmers' livelihood strategies in *Bac Kan* Province, *Viet Nam*

1. *Viet Nam*. 2. Rural development. 3. Mountain agriculture

Published in *Ha Noi, Viet Nam*

by

The Agricultural Publishing House

Publishing Permit No. 1/861

dated 21/06/2001