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Recent Changes in the Composite Swidden Farming System of a Da Bac Tay Ethnic Minority Community in Vietnam's Northern Mountain Region

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Abstract

Deforestation and land degradation associated with shifting cultivation have caused great concern about land-use sustainability of the northern uplands of Vietnam. Composite swiddening is a traditional land-use system that appears to be relatively sustainable. The system practiced by the Da Bac Tay ethnic minority in Tat hamlet in Da Bac district of Hoa Binh province is relatively diverse and flexible, and seems to hold considerable potential for intensification. However, recent changes in agricultural and economic conditions in Vietnam have also brought about changes in the farming system. This study was undertaken to describe the changes in the farming system in Tat hamlet over the past 15 years (1988–2003), and to identify factors influencing those changes.

At the beginning of the study period, households were essentially economically undifferentiated and all were engaged in traditional composite swiddening, mainly for subsistence. Farming system differentiation began after the management of agricultural land was returned to individual households by the cooperative. By the end of the study period, farming systems of individual households had become more diversified, substantially differentiated, and oriented more toward commercial production. In later years, the contribution of swiddening to household income decreased, while those of livestock, non-timber forest products (NTFPs), and off-farm activities increased. At the household level, there were great variations in the ways that the farming system changed. Important factors influencing these changes included population increase, government policies on management of agriculture and forest land changes in the macro-economic environment, improved infrastructure and communication, improved access to market, government development programs and services, changes in family structure and the adaptive strategies of individual households, and environmental degradation. In particular, the shortening of the fallow period and the consequent decline in soil fertility poses a serious threat to long-term sustainability of the composite swidden system. Unless means are found to rapidly regenerate soil fertility, swidden areas will continue to suffer degradation and their productivity will continuously decline.

Keywords: composite swiddening, farming system diversification, household dynamics, land-use changes, Vietnam's northern mountain region

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Introduction

Over the past 15 years, farming systems in the northern uplands of Vietnam have undergone rapid changes resulting from institutional and policy reforms, development programs, population growth and establishment of new economic zones [Le Trong Cuc and Rambo 2001]. During this period, grain outputs have increased somewhat, although not sufficiently to ensure local food security, and there has been a gradual shift toward commercialized production. However, deforestation, land degradation, and unsustainable land-use practices have also been occurring in many parts of the mountains [Fox *et al*. 2000; Jamieson *et al*. 1998; Patanothai 1998; Rambo 1997]. These changes have caused great concern about land-use sustainability of the region.

Among the farming systems practiced in the northern uplands, composite swiddening appears to be relatively sustainable. It is a unique type of farming system that integrates both permanent wet rice fields and rotating swidden plots into a single household farming system [Rambo 1998]. This type of land use has existed for centuries in the mountains of northern Vietnam as well as in southwestern China [*ibid.*], Nan province in northern Thailand [Kunstadter 1978], the Cordillera of the Philippines [Prill-Brett 1986] and Luang Prabang province of the Lao PDR [Gillogly *et al*. 1990]. The composite swiddening system of the Da Bac Tay ethnic minority in Tat hamlet in Da Bac district of Hoa Binh province in northern Vietnam is composed of several components, including wet rice fields, home gardens, fishponds, livestock, tree plantations and rice and cash crop swiddens. The system is relatively diverse, dynamic, and flexible, and seems to hold considerable potential for intensification [Rambo 1998]. However, recent changes in agricultural and economic conditions have brought about changes in practices of composite swiddening in Tat hamlet. In the past, all households adopted composite swiddening as a means to achieve food security. In recent years, however, the households have begun to diversify their farming systems. Currently, not all households in Tat hamlet practice composite swiddening, and for those who do, the components are not exactly the same as those in the earlier days [*ibid.*]. In-depth understanding of these changes and their causes and consequences are needed to assess the sustainability of the system and its potential for intensification. This study was undertaken to describe the changes in farming systems in Tat hamlet over the past 15 years, and to identify factors influencing those changes.

Materials and Methods

The Study Site

This study was conducted in Tat hamlet of Tan Minh village, Da Bac district, Hoa Binh province in Vietnam's northwestern mountains (latitude 20°N and longitude 105°E—Fig. 1). This hamlet is inhabited by the Da Bac Tay ethnic minority group who have practiced com-

posite swiddening for at least the last century [*ibid.*]. In addition, a small number of Muong and Kinh (lowland Vietnamese) households have recently settled in the community. The hamlet is located in a winding narrow valley surrounded by steep mountains [Rambo and Tran Duc Vien 2001]. The location of the hamlet is about 300 m above sea level at the valley floor, with the peaks of surrounding hills and mountains reaching an elevation of 800 to 950 m. The climate is monsoon tropical with a dry season from October to January, followed by a period of little rainfall from February to April and a rainy season from late April to September. The average air temperature over 20 years (1978–98) is 22.9°C, and the average annual rainfall over the same period is 1,824 mm [Nguyen Van Dung *et al*. 2002]. The hamlet has a total natural land area of 743 ha, of which only 20% has a slope of less than 25 degrees, with only the narrow valley floor being flat enough for permanent settlement, roads, and paddy fields [Rambo and Tran Duc Vien 2001]. The surrounding mountains have slopes of 30–60 degrees, and are occupied with active swidden fields, fallowed swiddens, and grass, bush and secondary forest. Previously, fields were cropped for 4–5 years and left fallow for 7–10 years, but the length of rotation cycle has been shortened to 2–3 years of cropping and 4–5 years of fallow [Tran Duc Vien 1998]. The paddy area is only 8.4 ha (8.8% of agricultural land). Per capita area is only 169 m^2 for paddy and 1,600 m^2 for swidden in 1999 [Le Trong Cuc and Rambo 2001]. Annual household income is 209 US dollars. Population in the hamlet has increased from 389 persons in 1993 to 476 persons in 2003, or by approximately 2.8% annually. Previous research in this village found that actively cultivated swidden fields displayed strongly negative nutrient balances whereas the nutrient balance of the paddy fields was slightly neutral or positive [Tran Duc Vien *et al*. 2004]. This indicates that land degradation is occurring in the swiddens so that the long term sustainability of compos-

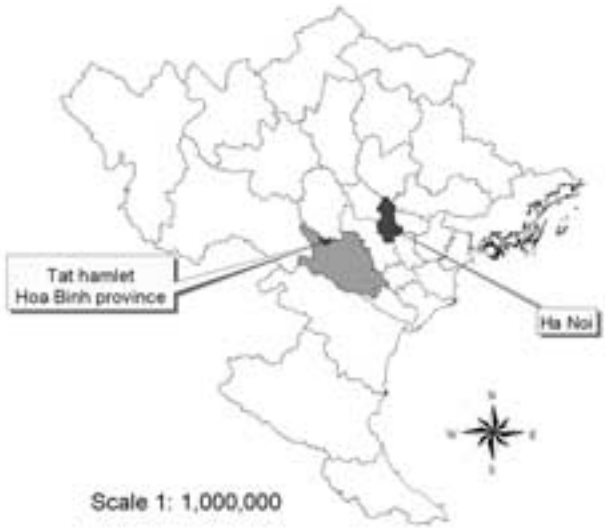


Fig. 1 Location of Tat Hamlet in Hoa Binh Province of Northern Vietnam

ite swiddening is in question.

Methods

This study is based on analysis of secondary data collected in previous surveys of households in Tat hamlet, followed by collection of additional household data using a semi-structured interview and a formal questionnaire. Secondary data from Rambo [1998] and Tran Duc Vien and Rambo [2001] were used to describe the farming system in Tat hamlet in the mid-1990s. Data collected in 1998–99 by the Center for Agricultural Research and Environmental Studies (CARES) on 42 randomly selected households (out of 95 households) in Tat hamlet were used to characterize farming systems at the end of the 1990s. These data included agricultural and non-agricultural activities, household income and expenditure, debt, farm size and composition, tenure, production of all commodities, and age and sex of all household members. Finally, additional surveys were done by the authors in 2003 on these same households to collect additional data, initially by a semi-structured interview, followed by a formal survey with a questionnaire.

Results

Before the cooperative period from the nineteenth century until the mid-1950s, there were only a few households in the hamlet, all of whom engaged in traditional composite swiddening [Rambo and Tran Duc Vien 2001]. During the cooperative time, composite swiddening continued, but farming was managed by the cooperative with households contributing labor and receiving payment according to number of work points they accumulated. Thus, there was little economic differentiation among households. The household management period began in the mid-1980s following the issuance of Directive 100, which returned control over agricultural production to the individual households. The land, though still belonging to the government, was allocated to individual households with long-term use and inheritance rights. It was during this period that households in Tat hamlet began to become differentiated, and their farming systems also gradually changed. This study examined these changes during the period from 1988, which is the early stage of the household management period, to 2003, when the final field surveys were conducted.

Changes in Farming Systems and Other Conditions at the Village Level from 1988 to 2003

To facilitate the identification of changes in Tat hamlet, the period 1988–2003 was divided into three stages: Stage 1 covers the years 1988–94, Stage 2 from 1995–99 and Stage 3 from 2000–03. Table 1 shows major characteristics of Tat hamlet and its farming systems in each of the stages.

Stage 1—The Early Stage (1988–94)

Toward the end of this stage in 1993, when the first statistics were collected, Tat hamlet had a population of 389 people with a population density of 52 persons per km^2. It had 69 households, all of which were Da Bac Tay except for 3 Muong households that had recently migrated from the area flooded by the Hoa Binh reservoir.

At that time Tat hamlet was quite remote and inaccessible and had a very poor infrastructure. The road connecting it to the district capital was a dirt track that was only passable to jeeps in the rainy season. Bus transportation was not available, and only a few logging trucks passed through the hamlet at irregular intervals. There were only two small shops in the hamlet selling food stuffs, clothes, and few agricultural tools. People traveled to the nearest district market, 15 km away, on foot or more rarely by motorcycle. Only few houses had a mini-hydropower electric generator of their own.

The farming system in Tat hamlet at the beginning of Stage 1 was traditional subsistence-oriented composite swiddening. Farming system differentiation began when the paddies and agricultural tools of the cooperative were divided among the individual households as per the Resolution 10-NQ/TW (April 4, 1988) on renewal of household responsibility in agricultural management. The hamlet headman recalled that the cooperative lands were divided among individual households based on family size at a rate of 350 m^2 per person. Land use at that time was governed by two systems. Agricultural lands were managed under the customary system in which land uses were governed by local social organizations and traditional norms. On forest lands, however, laws to protect the forest were in principle enforced by state and village administrative authorities, although in practice, local farmers could still freely exploit forest land to construct new paddy fields and clear swiddens. Many households converted some upland areas at the foot of the hill slopes into paddy fields. One farmer recalled that his family constructed 1,500 m^2 of paddy in addition to the 1,350 m^2 they received from the cooperative. Average paddy area per household at that time was only 1,400 m^2 with a yield of 2.5 tons per ha per crop, giving each family only 650 kg of unhusked paddy rice annually [Rambo 1998].

Besides constructing new paddies, the area of other components of the composite swiddening system also expanded quickly in the hamlet. An old farmer recalled that each household normally planted a rice swidden with an area equivalent to 1.2 to 2 ha, and harvested 600 kg to 1.5 tons of unhusked rice. The survey in 1993 showed that 9 randomly selected households had total swidden areas of from 6,500 to 23,400 m^2, of which rice swiddens had an average area of 10,000 m^2 per household, followed by cassava occupying areas of 2,000 to 10,000 m^2. The average yield of the rice swiddens was 0.59 ton per ha [*ibid.*].

Home gardens and fishponds during this stage were mainly used for home consumption. About half of the households had mixed home gardens with native fruit and vegetable species with areas from 100 to 400 m^2 [*ibid.*]. Most households had small fishponds of 100 m^2, and only a few households had large fishponds of 700–2,000 m^2. Several carp species and tilapia were commonly raised with grass and cassava leaves.

Table 1　Major Characteristics of Tat Hamlet and Its Farming Systems in 1988–94, 1995–99 and 2000–03

Category	Stage 1 (1988–94)	Stage 2 (1995–99)	Stage 3 (2000–03)
Demography			
Population (persons)	389 (1993)	432 (1998)	476 (2003)
No. of households	69 (1994)	91 (1998)	107 (2003)
Density (persons/ km^2)	52	58	64
Migration	3 hhs moved in	2 hhs moved out	None
Policy			
Forest land use	Controlled by government and the local authorities	Land allocation to households by 327 program	Land allocation to households by 01 and 02 decrees NQ/TW
Agriculture	Allocation of paddy land to households Development assistance provided by national Program on Fixed Cultivation and Sedentarization,[1)] Agricultural taxes	Extension program for paddy, no state credit, agricultural taxes	Extension programs, credits for cattle and fish raising, no agricultural taxes
Transportation			
Road condition	Rough dry season dirt road	Improved all season gravel road	Hard surface road
Bus to Hanoi	None	One trip in every two days from 1997	Several trips daily
Trucks passing	Few each week	Daily	Several per day
Travel to market	Walking, motorcycle	Bus, motorcycle	Bus, motorcycle
Electricity	Few mini-hydropower electric generators	Mini-hydropower electric generators commonly used	National electricity service installed in 2001
Marketing			
Village shop	Only 1–2 shops belong to the cooperative	5–6 private shops, early stage of marketing network	15 private shops, well developed marketing network
Agricultural products	Small amounts of cassava and maize	Cash crops especially ginger; high price of ginger in the early stage and then dropped abruptly	A broad range of cash crops; crop prices gradually decreased
Forest products	Timber	Timber and NTFPs	NTFPs
Ratio of cash/ total in-kind income	n.a.*	0.4	0.4
Household types			
Composite with rice swidden	95%	60%	53%
Modified composite without rice swidden	0	21%	28%
Swidden only	5%	17%	17%
No agricultural land	0	2%	2%

[1)] Cuc Dinh Canh Dinh Cu

* n.a. = not available

Table 1—Continued

Category	Stage 1 (1988–94)	Stage 2 (1995–99)	Stage 3 (2000–03)
Paddy			
Area/hh (m^2)	770–1,750	300–2,770	200–2,770
Yield (ton/ha/crop)	2.5	3.2	3.8
Chem. Fertilizer	Rarely used	Commonly used	Increasingly used
Rice varieties	Local and a few improved varieties	Mostly improved varieties (CR203, C70, Q5)	Entirely improved or new hybrid varieties
Swidden			
Total swidden area/hh (m^2)	12,500	8,800	6,400
Rice swidden (m^2/hh)	10,000	5,550	3,310
Yield (ton/ha/crop)	0.59	0.60	0.43
% households planting	100	77	70
Cassava (m^2/hh)	2,000–10,000	2,000–5,000	1,000–2,000
% households planting	100	100	97.5
Maize (m^2/hh)	n.a.*	100–3,500	300–6,000
% households planting	100	75	58
Varieties	Local	Improved and local	Hybrid
Canna (m^2/hh)	n.a.*	1,180	500–5,000
% households planting	n.a.*	80	75
Ginger (m^2/hh)	n.a.*	475	624
% households planting	Few hh	100 (1995–96) but reduce to 35 (1998)	12.5
Varieties	Local	High yielding	High yielding
Forest			
Natural forest	Scattered patches of degraded primary forest, extensive area of dense secondary forest	Secondary forest abundant	No forest with big trees; grass, bamboo, bushes abundant
Tree plantation	Palm, *Melia azedarach, Styrax tonkinensis*	Eucalyptus, Acacia, bamboo	High value bamboo on allocated land, supported by government
Fallow			
Fallow length (yr)	5–8	4–5	3–5
Fallow vegetation	Small trees, bush and bamboo	Bush, bamboo, tall grass, imperata	Bamboo, tall grass, imperata and bush; pressure on grazing land (conflict)
Garden			
Area/hh (m^2)	100–400	100–400	100–400
% households	55.6	57.5	57.5
Varieties	Local varieties with low economic value	New fruit varieties in several households	Mango, litchi, longan, persimmon in several households

*n.a. = not available

Table 1—Continued

Category	Stage 1 (1988–94)	Stage 2 (1995–99)	Stage 3 (2000–03)
Fishpond			
Area/hh (m^2)	50–2,000	50–2,000	50–2,000
% households	78.8	62.5	62.5
Purpose	Home consumption	Home consumption	Home consumption and sale, more investment (credit)
Fish species	Carps, tilapia	Carps, tilapia	Old and hybrid
Livestock			
No. of buffalo and cattle (heads/hh)	1	2	2.5
Ratio of buffalo to cattle	1 : 1	0.83 : 1	0.54 : 1
Pigs (no./hh)	1	1	0.5
% houses having cattle or buffalo	90	73	63
Breeds of cattle and pigs	Local	Local and improved varieties	Improved varieties in majority

Livestock raising was still based on traditional practices with free grazing and native breeds. The numbers of buffalo and cattle were about equal, although the value of buffalo was higher than cattle because buffalo could be used for both land preparation and logging. Native pigs freely roamed around the houses, and their feed supply was inadequate. The number of poultry varied among households and only few chickens survived periodic disease epidemics. No veterinary service was available in this period.

Dense patches of degraded primary forest and large areas of secondary forest were still observed on the mountain slopes surrounding the hamlet. Cash income from forest products was mostly from timber, and more rarely from hunting and collection of non-timber forest products (bamboo shoots and broom grass). However, the government had implemented several fixed cultivation and sedentarization programs to encourage abandonment of swiddening. As a result, more than half of the households had converted up to 2.5 ha of their swidden areas to tree gardens of palm, tea, *Melia azedarach*, and *Styrax tonkinensis* for household and commercial purposes.

Stage 2—The Middle Stage (1995–99)

By 1998, the number of households had increased to 91 with a population of 432 persons (58 persons per km^2). Two households, however, left the hamlet to settle in a new economic zone established by the government.

During Stage 2, the infrastructure of the hamlet improved significantly. The road connecting the hamlet to the district town was upgraded into an all weather gravel surfaced road. The number of local private shops increased to 5, but the supply of commercial goods was still limited. A canna root processing plant was built at the center of the village, and sev-

eral households had their own rice mills. In 1997, the hamlet bus station was opened with a bus service to Hanoi once in every two days. Access to information of the local people was also improved, both from training for agricultural technology transfer and from radio and television.

To prevent further forest degradation, the government launched the 327 program during this period. Under this program, forest land was allocated to individual households to look after, and each household annually received 47,000 VND per ha in return. Clearing of swiddens was forbidden on this land [Rambo and Tran Duc Vien 2001]. The hamlet authorities delimited some relatively small areas of forest land where swiddening and grazing were permitted. These measures restricted the area available for swiddening, making the long rotation cycle no longer possible. Consequently, the fallow period was reduced to 4–5 years.

Variation in paddy areas among households became more pronounced as many households gained more paddy land from opening up new fields, while others had to share paddies with their children when they married and established independent households. During Stage 2, the paddy area per household ranged from 300 to 2,770 m^2. Productivity, however, increased to 3 tons per ha per crop with the use of new rice varieties and chemical fertilizers in addition to compost, green manure, and ashes.

Swidden cultivation began to shift from purely subsistence to semi-subsistence. The rice swidden area per household gradually declined to 5,550 m^2, while swidden areas for canna and ginger, which were new cash crops, increased. The average yield of the rice swiddens was 0.6 ton per ha per crop. At the beginning of this stage, ginger price was high and all households planted the crop. The price of ginger dropped drastically in later years and the number of households planting ginger declined to 35% in 1998. All households still planted cassava, but only part was sold while a part was used by them for animal feed. The area of maize declined to some extent, as did the percentage of households planting maize, but new varieties were increasingly used.

Due to the scarcity of cultivated land nearby the settlement, 5 households moved their houses to establish new farmsteads in the largest swidden area 2 km away from the residential area of the hamlet. There they engaged in typical composite swiddening with paddy fields in the bottom land and swidden fields on the surrounding hillsides. One owner said that the reasons he opened the new farm were that he could take better care of paddy and swidden crops, and could secure land ownership for his descendants.

Although the areas of home gardens and fishponds in Tat hamlet during Stage 2 remained the same as in Stage 1, their management was intensified. New fruit species such as longan, litchi, plum and persimmon were planted in the gardens. Several households had small vegetable (mustard and onion) gardens of 20–100 m^2 protected by bamboo fences. Fishponds were dug deeper and fish were raised at a higher density with additional feed provided. However, most of the products from gardens and fishponds were still used only for home consumption.

The number of livestock in Stage 2 also remained more or less the same as in Stage 1,

but there were changes in species composition and breeds. The ratio of buffalo to cattle declined to 0.83 : 1 as the use of buffalo for logging was diminishing due to forest degradation and its allocation to individual households to protect. Several households had 2 or 3 large animals, and one had 8 large animals. Hybrid pigs were introduced to Tat hamlet with new production practices recommended by extension officers. About 8–10 chickens or other poultry were commonly observed in a household. During this stage, the village veterinary service was being established and each hamlet had a quota to send one local farmer for veterinary training. However, the service facilities were rather poor, and, as one informant recalled, animal diseases could still easily spread throughout the whole hamlet.

During this stage, the market-oriented economy began to have a significant impact on the households of Tat hamlet. Firstly, the farmers had experienced drastic drops of cash crop prices, first in ginger, followed by cassava and canna. Secondly, non-timber forest products and fallow vegetation became a major source of cash income of the households. As a consequence, people spent more time collecting forest products so that their swidden areas gradually declined. Moreover, after 3–4 years of improved gardening, several households faced a risk on their long-term investment. For instance, the price of apricots dropped drastically from 2,000 VND per kg when the trees were planted to 200 VND per kg when the trees started to produce fruits. Farmers responded to this by cutting down their fruit trees or leaving them unattended. Several households turned to doing business as an alternative source of extra income.

Reallocation of the household labor force was also observed in this period. In the past, family labor was freely expended in the rice and cassava swiddens. But in this period, a part of labor force of both men and women was engaging in business and off-farm activities, so that, the amounts of labor spent on swidden cultivation substantially decreased. Most women took care of cash crops, rice transplanting, raising pigs and collecting medicinal plants and bamboo shoots in the forest and broom grass in fallow fields. Men took care of land preparation for swidden and paddies, logging, and collecting bamboo. Cattle and buffalo were tended by children and elderly people when they got back home from their swiddens.

Stage 3—The Late Stage (2000–03)

The population of Tat hamlet kept on increasing with the number of households rising to 107 and the population to 476 (64 persons km^2) in 2003. The infrastructure was further improved with significant contributions from the 135 program. The road was paved, and several trucks passed through the hamlet each day. The bus service to Hanoi and Hoa Binh with 4 routes also operated on a daily basis. The number of shops in the hamlet increased to 15, with more variety of merchandise. The national electricity service was also extended to most households in Tat hamlet.

By the beginning of this stage, the supply of land that could be made into new paddies had been nearly exhausted. Only few households were able to construct small paddy areas of 200–300 m^2. However, the yield of paddy rice increased to 3–4 tons per ha per crop with

the use of hybrid rice and improved practices recommended by the extension workers.

Pressure on swidden land became critical so that a few households even cut down small areas of their allocated forest to plant swidden rice without permission from the district authorities. These households suffered from food shortage and could not find suitable land for rice growing in the restricted area designated by the authorities for swiddening. Recognizing the seriousness of this problem, the district authorities then allowed the villagers to implement an agroforestry model in their forest land in which upland rice was intercropped with bamboo (*Dendrocalamus mebranaceus*). Farmers were supported by the extension of bamboo seedlings and fertilizers.

Total swidden area also greatly declined with the rice swidden area per household decreasing to 1,000–5,000 m^2. The yield of rice swidden decreased to 0.43 ton per ha, largely because of increased damage by rats and insects. The market greatly influenced the kinds of cash crops planted. Although most households still planted cassava, the area per household decreased to 1,000–2,000 m^2 as it was mainly used for livestock. A few farmers still planted ginger around their houses to maintain the stock. Local varieties of maize were replaced by high yielding hybrid varieties with the area per household ranging from 300–6,000 m^2. Canna area generally increased with the area per household ranging from 500–5,000 m^2. However, none of the households grew only a single crop in a large area. Apparently, farmers had used crop diversification as a strategy to cope with price fluctuation.

Home gardens continued to be developed with more planting of several new fruit species. However, these were generally cared for by the elderly people. The younger generation paid little attention to their home gardens due to lack of time.

A new credit program for cattle raising was initiated. According to the hamlet headman, 30 households obtained this credit. After three years (1999–2001), the number of cattle had doubled and several households had raised the size of their herds to 20 heads. The proportion of buffalo to cattle further declined to 0.5 : 1.

Credit was also provided by the government to improve fish rearing. Eight households that had sufficiently large fishponds received loans of 1,000,000 VND each, and were trained in fish raising practices. Among them, five were successful, but three lost all of their fish because of disease.

Poultry and pig raising had shifted more toward commercial purposes. Two households had raised 50–300 chickens in one year, then had to quit because of diseases. Integration of crops, livestock and fish was also implemented by local people. For instance, a number of households raised ducks in their fishponds and also released them in paddy fields after rice harvesting. In additions, pig stables were built on fishpond bunds, directly supplying manure to the fish.

Changes in the Farming Systems at the Household Level from 1988 to 2003

At the beginning of Stage 1 in 1988, all households in Tat hamlet presumably practiced traditional composite swiddening (except for 3 Muong families, who had recently migrated from

the site of Hoa Binh dam to live at the end of the village. These households had no paddy because they were outsiders so were not allocated paddy land from the former cooperative, thus, could not practice the system). Farming system differentiation began at the time when the households were allocated land, and continued after that. As data from the same 42 households were available for 1998–99 and 2003, we were able to examine the changes that occurred between these two points.

Household Farming Systems in 1998–99

The 1998–99 survey data for 42 households were used to classify these households into different types based on the structure of their farming systems. Four types of households were recognized: Type 1 practiced traditional composite swiddening consisting of paddy, rice swidden and cash crop swidden. Type 2 engaged in modified composite swiddening consisting of paddy and cash crop swidden but no rice swidden. Type 3 practiced only swiddening including both rice swidden and cash crop swidden but no paddy. Type 4 had no agricultural land, thus, had neither paddy nor swidden. In 1998–99, 25 households (59.5%) were Type 1, 9 (21.4%) were Type 2, 7 (16.7%) were Type 3 and 1 (2.4%) was Type 4. All of these households also had other components of farming systems, i.e. home garden, tree plantation, livestock and fishpond. Characteristics of households in Types 1–3 are shown in Table 2.

Type 1 households that practiced traditional composite swiddening with rice swidden in 1998 were either the original Da Bac Tay residents, who had been allocated paddy fields by the cooperative, or newly established families who received paddy fields from their parents. Some households also constructed new paddies when they could find suitable lands. However, paddy area per capita was still small (averaging 226 m^2). Thus, these households had to produce much of their rice in swiddens, and 55% of swidden area was devoted to rice. These households were allotted less forest land than those of Types 2 and 3.

Type 2 households, who practiced modified composite swiddening without rice swiddens, were households headed by government officers and teachers who had salaries, and merchants and elderly people. All were Da Bac Tay. These households had more paddy area and less swidden area per capita than those of Types 1 and 3. These households used to plant swidden rice in mid-1990s but gave up this practice and devoted all of their swidden areas to cash crops. Labor shortage was given as the reason for the change as most adult members worked full time as government officers, while some were too old to work in the swidden. This type of household earned their income from salary, animal husbandry, and collection of non-timber forest products (NTFPs).

Type 3 households that practiced only swiddening were newly established families that did not receive any paddy field from their parents or households that migrated in from other places. Young couples originating from families with small paddy area normally did not receive any paddy land when they established separate households. The newly resettled households were Muong and Kinh who were not allotted paddy fields by the cooperative because they were considered outsiders. These households had no fishponds and only

poorly developed home gardens, and had to depend on rice swidden and NTFPs for their living.

The Type 4 household that had no agricultural land is a Kinh family that had migrated to Tat hamlet after the construction of Hoa Binh dam. This family owned a shop in the hamlet and earned its income from trading and animal raising. In 1998, it had 10 cattle, 3 pigs, and 30 chickens. This household was also allotted a small plot (3,000 m^2) of forest to look after.

Changes in Household Farming Systems between 1998–99 and 2003

By comparing survey data collected from the same households in 1998–99 and 2003 we were

Table 2 Characteristics of Households of Types 1, 2 and 3 in 1998

Category		Type 1[1)]	Type 2[1)]	Type 3[1)]
Number of households		25	9	7
Age of household head (yr)	range	20–78	25–69	25–50
	mean	38	39	33
Family size (no. of members)	range	3–10	2–10	3–5
	mean	5	6	4
Paddy area per capita (m^2)	mean[2)]	226	317	0
Total swidden area per capita (m^2)	mean[2)]	1,974	572	2,934
Rice swidden area per capita (m^2)	mean[2)]	1,092	0	2,252
Rice production per capita (kg)	range	80–617	5–500	121–506
	mean[2)]	229	175	158
Cassava swidden area per capita (m^2)	mean[2)]	467	278	396
	(% of hh)	100.0	100.0	100.0
Maize swidden area per capita (m^2)	mean[2)]	140	111	200
	(% of hh)	72.0	67.0	86.0
Canna swidden area per capita (m^2)	mean[2)]	229	119	47
	(% of hh)	92.0	67.0	43.0
Ginger swidden area per capita (m^2)	mean[2)]	46	65	39
	(% of hh)	32.0	33.0	57.0
Homegarden area per capita (m^2)	mean[2)]	26	13	39
	(% of hh)	60.0	67.0	57.0
Tree garden area per capita (m^2)	mean[2)]	135	9	478
	(% of hh)	24.0	44.4	28.6
Fish pond area per capita (m^2)	mean[2)]	33	54	104
	(% of hh)	36.0	100.0	29.0
Forest land area per capita (m^2)	mean[2)]	3,466	9,770	6,458
	(% of hh)	80.0	67.0	71.0
Buffalo and cattle (head/capita)	mean[2)]	0.4	0.6	0.1
	(% of hh)	80.0	78.0	43.0
Pigs (animals/capita)	mean[2)]	3.7	3.4	2.5
	(% of hh)	100.0	100.0	100.0

[1)] Type 1 = composite swiddening with rice swidden
Type 2 = modified composite swiddening without rice swidden
Type 3 = swiddening only

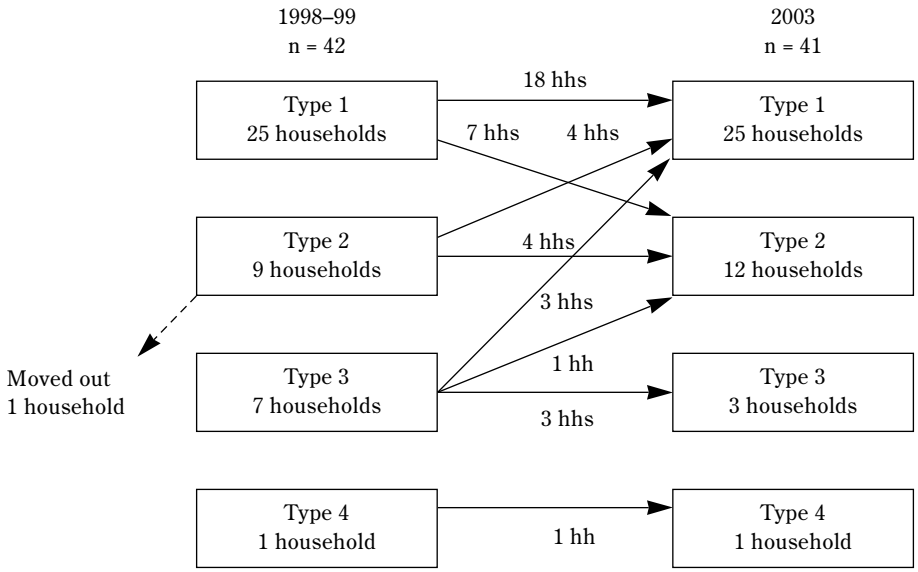
[2)] Mean of households having this land category or type of livestock

able to trace changes in their farming system during a 5-year period. Fig. 2 presents the changes in type of farming system from 1998 to 2003 of the 42 households interviewed. Overall, the number of Type 1 households (households that practiced composite swiddening with rice swidden) and Type 4 households (no agricultural land) in 2003 remained the same as in 1998, but the number of Type 2 households (modified composite swiddening without rice swidden) increased from 9 to 12, and that of Type 3 households (swidden only) decreased from 7 to 3.

Of the 25 Type 1 households that had practiced composite swiddening with rice swidden in 1998–99, most continued to do so in 2003 but more than one third shifted to Type 2. One half of Type 2 households maintained their farming system, but the other half became Type 1. On the other hand, more than half of the Type 3 households obtained paddy fields and shifted to Type 1 or Type 2, while the remainder still only cultivated swiddens.

In examining the changes in farming systems at the household level during 1998-2003, we also looked at the numbers of households who increased, maintained constant or decreased their involvement with individual farming system components during this period. These are presented in Tables 3 and 4 for crop and livestock components, respectively.

Among the 40 households interviewed in both 1998–99 and 2003 (i.e. excluding the household with no agricultural land and the one that moved out), 33 (82.5%) planted paddy



Type 1 = Composite swiddening with rice swidden
Type 2 = Modified composite swiddening without rice swidden
Type 3 = Swiddening only
Type 4 = No agricultural land

Fig. 2　Changes in Type of Individual Households between 1998–z99 and 2003

rice in 1998–99 and the number increased to 37 (92.5%) in 2003. Each household has 2 to 5 paddy fields at various locations surrounding the settlement area. A few households have newly constructed paddies about 2 km from the hamlet. Paddy area per household shows less change than for the areas of other annual crops. The average paddy area per household decreased slightly from 1,237 m^2 in 1998 to 1,170 m^2 in 2003 (Table 3). The average paddy area per capita, however, was slightly higher in 2003 than in 1998–99 as several households obtained additional paddies and the numbers of persons in some households were less in 2003 due to the separation of their children into independent households or death. During this period, more than half of the sampled households maintained the same paddy areas, one-third had more, but 15% had less. The latter were those that gave some paddy land to their children who separated out to form new households. Yield of paddy rice, however, increased from 3.2 to 3.8 tons/ha/crop due to the increased use of hybrid varieties and chemical fertilizers (See Table 1).

In 1998–99, all of the 40 households interviewed practiced swiddening. In 2003, the num-

Table 3 Changes in Crop Components of Farming Systems of 40 Households in Tat Hamlet from 1998–99 to 2003

Category	Paddy	Swidden (rice and/or cash crops)
Households planting in 1998–99	33 (82.5%)	40 (100%)
Households planting in 2003	37 (92.5%)	39 (97.5%)
Households with increased area	13 (32.5%)	13 (32.5%)
Households with the same area	21 (52.5%)	1 (2.5%)
Households with reduced area	6 (15.0%)	26 (65%)
Average area/household in 1998–99 (m^2)	1,237	8,842
Average area/household in 2003 (m^2)	1,170	6,398
Average area/person in 1998–99 (m^2)	255	2,142
Average area/person in 2003 (m^2)	274	1,492

Category	Rice swidden	Cassava	Maize	Canna	Ginger
Households planting in 1998–99	32 (80.0%)	40 (100%)	30 (75.0%)	32 (80.0%)	14 (35.0%)
Households planting in 2003	28 (70.0%)	39 (97.5%)	23 (57.5%)	30 (75.0%)	5 (12.5%)
Households with increased area	9 (22.5%)	12 (30.0%)	12 (30.0%)	18 (45.0%)	5 (12.5%)
Households with the same area	7 (17.5%)	17 (42.5%)	7 (17.5%)	10 (25.0%)	14 (35.0%)
Households with reduced area	24 (60.0%)	11 (27.5%)	21 (52.5%)	12 (30.0%)	21 (52.5%)
Average area/household in 1998–99 (m^2)	5,550 (54.4%)	1,951 (19.1%)	1,051 (10.3%)	1,181 (11.6%)	475 (4.7%)
Average area/household in 2003 (m^2)	3,310 (36.8%)	1,793 (19.9%)	1,139 (12.6%)	2,140 (23.8%)	624 (6.9%)
Average area/person in 1998–99 (m^2)	1,345 (59.4%)	418 (18.5%)	196 (8.7%)	223 (9.8%)	83 (3.7%)
Average area/person in 2003 (m^2)	772 (38.9%)	379 (19.1%)	220 (11.1%)	470 (23.7%)	142 (7.2%)

ber had declined to 39, while the average area both per household and per capita dropped sharply. Although the majority of households had smaller swidden areas than in 1998–99, 13 households had larger swidden areas.

Reduction in swiddening areas could be primarily accounted for by the reduction in the size of rice swiddens. In 1998–99, the average area of rice swidden per household was 5,550 m^2, equivalent to 54.4% of the household's total swidden area. The area declined to 3,310 m^2 or 36.8% of the household swidden area in 2003 (Table 3). The number of households cultivating rice swiddens also declined from 32 in 1998–99 to 28 in 2003. Differences among households were also observed for the changes in areas of rice swidden during this period. Most of the households had reduced swidden rice areas but 9 had increased areas and 7 had the same areas as in 1998–99.

Cash crop swiddens, on the other hand, remained more or less the same from 1998–99 to 2003, both in terms of number of the households cultivating them and the average area per household. In fact, most households (39 of 40) cultivated cash crop swiddens in both years. However, the areas of individual crops grown by a household as well as the numbers of households that grew a particular crop varied from year to year, responding to the fluctuation in prices of these crops. Cassava was less affected by price fluctuation as the crop was grown both for sale and for animal feed, and could be left in the field for variable lengths of time. The crop was planted by almost all households throughout this period. Although the numbers of households planting maize and canna declined somewhat, both areas per household and per capita increased for both crops. Ginger faced a problem of serious price reduction, and the number of households growing this crop dropped greatly. Again, there were variations among households in area changes of individual crops.

For livestock components, the total number of buffalo remained more or less the same from 1998–99 to 2003, but the number of cattle substantially increased (Table 4). The number of pigs was greatly reduced. The increase in the number of cattle was the result of the government promotion program which provided loans for livestock raising. However, the frequency of conflicts caused by livestock damaging crops in actively cultivated swiddens greatly increased. Similar to the crop components, changes in numbers of individual animals of all kinds varied among households. Some households increased animal numbers; some

Table 4 Changes in Livestock Components of Farming Systems of 41 Households in Tat Hamlet during 1998–2003

Category	Buffalo		Cattle		Pigs	
	1998–99	2003	1998–99	2003	1998–99	2003
Total no. of animals	39	37	47	69	102	48
Households with no animals	19	18	24	19	11	20
Households with animals	22	23	17	22	30	21
Households with increased no.	12		15		9	
Households with the same no.	17		17		10	
Household with animal	5		4		4	
Household without animal	12		13		6	
Households with reduced no.	12		9		22	

maintained the same numbers and some reduced the numbers of animals. Apparently, each household follows its own strategy in making its living.

Discussion

Over the past 15 years (1988–2003), farming systems in Tat hamlet have undergone major changes. At the beginning of the study period, households were essentially undifferentiated. All households engaged in traditional composite swiddening, as the cooperative lands had just been allocated to individual households for their own management, with each family receiving both paddy and swidden areas on a per capita basis. Components of the farming system included paddy, rice swidden, cash crop swidden, home garden, fishpond and livestock. These were managed mainly for subsistence, and local varieties or breeds and traditional practices were used. After the management of land was returned to individual households, farming system differentiation began. By the end of this period, farming systems of individual households had become more diversified and substantially differentiated. Farming activities were oriented more toward commercial production, although a decreasing part, particularly rice production, was still for subsistence. As the length of fallow period was shortened and soil fertility declined, the contribution of swiddening to household income decreased in later years. On the other hand, livestock, NTFPs, and off-farm activities played an increasing role as sources of household income.

At the household level there was great variation in the ways that the farming system changed. Thus, for all farming system components, there were households with increased, the same, and decreased involvement with any particular component. With additional sources of income from non-farm activities, individual households became more differentiated both in terms of activities and wealth.

These changes were the consequence of several factors acting both individually and in combination. Important factors include population increase, government policies on management of agriculture and forest land, changes in the macro-economic environment, improved infrastructure and communication, improved access to market, government development programs and services, changes in family structure and ages of family members that influenced the adaptive strategies of individual households, and environmental degradation.

Population growth has affected food security, which is a primary concern of all households. Local farmers increased the productivity of paddy rice by employing high yielding varieties and chemical fertilizers. However, even with increased productivity, the rice harvest from their paddy fields was not enough to maintain food security for most farmers due to small area of paddy per capita (169 m^2). Therefore, many households still had to plant rice swiddens to obtain sufficient rice to meet their consumption needs. As paddy is a productive and reliable source of rice for consumption, suitable areas were sought and made into new paddy fields wherever they were found. However, because of hilly topography, there was not

much additional land that could be converted to paddy. As a result, the total paddy area was only slightly increased. With increasing population and new households being formed, paddy area per household decreased in later years. Consequently, households have had to find alternative sources of income in order to purchase needed rice and other commodities.

The most important government policy affecting agriculture was the change from the collective production system to the individual responsibility system governed by Directive 100 and Resolution 10-NQ/TW which returned management of agricultural production to the hands of individual households, with lands allocated to them for long-term use. This allowed the households to make their own management decisions and provided a strong incentive for them to make changes to improve production.

The government policy on forest protection had significant implications for swiddening in Tat hamlet. In implementing this policy, plots of forest land were allocated to individual households to look after and clearing of swiddens on them was strictly prohibited. Swiddening was only permitted in some relatively small areas designated by local authorities so that the area for swiddening was insufficient for a long fallow period. The consequence was a reduction of the length of fallow period from 7–10 years to 4–5 years. Such a short fallow period is insufficient to allow for full recovery of soil fertility. Hence, yields of swidden rice have declined. Several villagers complained about the difficulty of finding sufficiently fertile land to grow swidden rice. Such a condition made farmers reluctant to grow swidden rice as the crop demands high labor input. Improved productivity of paddy rice and availability of other income sources provided alternatives to several households to achieve rice sufficiency. Consequently, planting of swidden rice declined substantially in later years.

Progress in the overall development of Vietnam has resulted in a great change in the macro economic environment of the country, which has impacted Tat hamlet in several aspects. Infrastructure and communications were greatly improved, access to market became easier, marketing opportunities were broadened and income sources were diversified. Modernization has also created greater demand on the part of the villagers for consumer goods and material comforts. As a consequence, the livelihood of the villagers became more and more dependent on cash. To earn more cash income, farmers turned toward commercial production, which is subject to price fluctuations of agricultural commodities. This was evident in the fluctuation of prices of swidden cash crops, particularly the drastic drop of ginger price. Changes in areas of these crops occurred in the response to market demand and prices. Improved transportation also created greater market opportunity for NTFPs, and these had become a major source of cash income of several households in Tat hamlet.

Government development programs and services also contributed significantly to the improvement and diversification of household farming systems. The uses of high yielding and hybrid varieties, chemical fertilizers and recommended cultural practices for crops and the uses of new breeds and improved management for animals were partly the results of training for technology transfer and provision of agricultural services. Loans provided to

farmers under the livestock promotion program resulted in a substantial increase in number of cattle in the hamlet. Implementation of an agroforestry system also was the result of the support provided by the extension service. These programs and services provided households with more alternatives to improve production and diversify their income sources.

Differentiation among households reflected adoption of different strategies by individual households to cope with all these changes. In addition to skill, preference and available resources, changes in family structure during the family development cycle also had a great influence on the choice of household adaptive strategy. A young couple with a newly established household has limited land and labor so would follow a different strategy from a large well-developed household with more labor and land. Similarly, the household of a government officer with a monthly salary might choose different farming activities from a household without any regular source of cash income. Differentiation in subsistence production and income earning activities had also resulted in a wide variation in economic status of households in Tat hamlet.

The carrying capacity of the composite swiddening for a given area is considerably higher than that of pure swiddening. This is because the paddy fields produce about one half of the grain needed to meet the local population's consumption requirements so that the per capita area needed for rice swiddens is only half that of a pure swiddening system. Additionally, the high diversity of components in the composite swiddening system reduces vulnerability to risks of crop loss due to weather or pests and provides some buffering against fluctuations in market prices of different crops.

Environmental degradation, especially the decline in the quality of land available for swiddening, has exerted a particularly strong force for change in the farming system. Because of growing land scarcity, farmers have intensified their cultivation of existing swiddens, extending the period of cultivation from 2–3 years to 4–5 years and reducing the fallow period from 5–8 years to 4–5 years. Consequently, as is discussed in detail in Nguyen Thanh Lam [2004], the fertility of the swidden land is declining and the productivity of swidden rice and cash crops falling accordingly. Many farmers have given up trying to grow swidden rice because they cannot find plots with sufficiently fertile soil to make the effort worthwhile. Others, unable to find sufficiently fertile land in the areas where swiddening is permitted, have illegally cleared plots in the forest land allocated to their households to protect.

Conclusions

Composite swiddening has successfully met the subsistence needs of the people of Tat for more than a century. It has supported a much higher population density than would have been possible with pure swiddening. The system has also displayed great flexibility by allowing farmers to modify their production strategies in response to new constraints and opportunities, most notably those associated with increased integration into the market economy.

In recent years, however, the long-term viability of composite swiddening has come under threat, largely as a consequence of environmental degradation. Population growth, increased need to grow cash crops, and, especially, government restrictions on clearing of new swiddens on forest land have forced farmers to drastically shorten the length of the fallow period, to the extent that there is no longer sufficient time to fully restore the fertility of the soil. Unless ways can be found to accelerate the regeneration of fallow plots within a time frame of only 4–5 years, yields of the swiddens will continue to decline, threatening the future ability of the farmers of Tat hamlet to adequately meet their survival needs.

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