Viện Khoa học Kỹ thuật Nông nghiệp Việt Nam
Vietnam Agricultural Science Institute
VASI

IRD
Institut de recherche pour le développement

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International Rice Research Institute

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Cover picture:
Farmers terracing a new paddy field beside an upland rice field
(Photo: J.C. Castella)

Under the socialist system of collectivized agriculture, *Viet Nam* was a nation of chronic food shortages. Now, thanks to the dramatic *doi moi* economic reforms, *Viet Nam* has transformed itself into one of the world's leading exporters of rice, coffee, rubber, tea, and other agricultural products. This remarkable economic success has been concentrated in the lowland "rice bowl" regions, where farmers had the means to take advantage of the new *doi moi* policies. But in the northern mountains, poverty levels remain high and environmental degradation threatens the continued livelihoods of farmers.

This volume presents a series of monographic and analytical studies vital to understanding the heterogeneity and potential of the mountains of northern *Viet Nam*. The Mountain Agrarian Systems Program (SAM) has used an interdisciplinary approach to analyze the needs and possibilities of farmers in the mountainous province of *Bac Kan*. The multiple-scale analysis showed that we need to create not only a spirit of "thinking globally and acting locally", but just as importantly, a spirit of "thinking locally and acting globally". The research provides a foundation for development practitioners and policy makers to identify the successes and failures of past policies and projects, and to target the groups most in need of development assistance today.

Jean-Christophe Castella
Dang Dinh Quang

Doi Moi in the Mountains

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

Edited by
Jean-Christophe Castella
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Part 2: Thematic studies

Preface

It is fitting that the United Nations is celebrating the International Year of Mountains as we enthusiastically release this compilation of research on the mountain agrarian systems of northern *Viet Nam*. Over a period of five years (1998-2002),the SAM Program (French acronym for Mountain Agrarian Systems) has investigated and documented the heterogeneity of the human and natural environments of the mountainous zones. The SAM Program represents a unique partnership among the Vietnam Agricultural Science Institute (VASI), the Institut de Recherche pour le Développement (IRD), the International Rice Research Institute (IRRI), and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD). The partnership has involved an interdisciplinary team of scientists ranging from agricultural scientists to economists and from geographers to anthropologists.

SAM Program researchers and students spent long months living and interacting with mountain populations, often in challenging situations. The empirical data that came out of these remarkable experiences are summarized in the monographic studies presented in the first part of this book. These studies made it possible to document and analyze the rapid and fundamental transformations of the mountain agrarian systems that resulted from the *doi moi* reforms of the late 1980s. For the first time, it was possible to develop a framework for understanding the driving forces of agricultural change in the 1990s and the ways that these forces affected individual farmers' production strategies.

Sectoral studies, five of which are presented in the second part of this book, examined in detail each factor of change identified in the previous phase: (i) geographic distribution and dynamics of natural resources in the mountain landscapes; (ii)land use policies both in lowland sand on hillsides; (iii) accessibility in a context of rapid changes; (iv) complex relationships among crops, livestock, and forests at the local level; and (v) the local application and appropriation of national environmental and agricultural policies.

To guide and synthesize all of its work, the SAM Program used a holistic approach that combined GIS and remote-sensing tools with ground-level surveys to analyze agro-ecological and socioeconomic changes at a range of scales: family farms, villages, communes, districts and finally, whole provinces. This rigorous methodological approach, which relied on cross-fertilizing participation of farmers, policy-makers and researchers, helped identify the key intervention points for addressing rural development problems. As a result, several development projects already have been initiated in *Bac Kan* Province based on the research presented in this book.

At a time when the Ministry of Agriculture and Rural Development is reinforcing its research-and-development activities in the northern mountains, we sincerely hope that this book can stimulate further discourse mad partnership among researchers, development practitioners, and policy makers. We would like to extend our sincerest gratitude to the People's Committee of *Bac Kan* Province for the valuable assistance that they offered to the SAM Program. We hope that the strengthening of the ties and friendship between VASI and *Bac Kan* Province authorities can contribute to continued sustainable development in *Bac Kan* Province.

Prof. Dr. Bui Ba Bong
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Ministry of Agriculture and Rural Development
of the Socialist Republic of Viet Nam

Scaling up local diagnostic studies to understand development issues in a heterogeneous mountain environment: An introduction to the SAM Program

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Abstract

The mountain rural communities in northern *Viet Nam* are among the poorest in the nation, and have benefited the least from the recent economic growth, The Mountain Agrarian Systems Program (SAM) has been working in *Bac Kan* Province since 1998, studying the complexity of the mountains in an interdisciplinary fashion to understand the needs and possibilities of farmers in the area. A research methodology was developed to deal with the extreme diversity, rapid institutional changes, and substantial external influences at play in the studied region, and consisted of multiple monographic studies and a regional geographic approach. A scaling-up process allowed us to generalize our site-specific results to broader areas. The studies indicate that the pessimistic outlooks of certain authors are exaggerated, although much work remains in order to raise the living standards of the mountainous regions to those of the rest of the country. Future development activities in the mountainous areas should focus on making efficient use of scarce resources, building on social capital toward community-based resource management, and diversifying tanner income sources. The SAM Program results also offer indicators to identify those individuals in greatest need of development assistance.

Keywords: mountain agriculture, socioeconomic transition, systems approach, scaling up, *Bac Kan* Province, Viet Nam

1. Introduction

In the last decades of the twentieth century, *Viet Nam* progressed from a nation of chronic food shortages to one of the world's leading exporters of agricultural products that include rice, coffee, rubber, and tea (Box 1). This economic growth,

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marked by a doubling of gross domestic product between 1991 and 2000, was largely made possible by the *doi moi* reforms of the 1980s. *Doi moi* consisted of two successive reforms: the allocation of the means of production (especially land) to individual households, followed by economic liberalization and the opening to external markets.

The remarkable economic growth that resulted from the reforms was based largely on the rural household, which had become the new elementary unit of agricultural production. The technical, economic, and social changes that accompanied the transition transformed agricultural production, resource management, land use, and the institutions that defined resource access and distribution. However, the impact of the changes varied widely across different regions. In particular, agricultural growth in the past decade has benefited the delta regions far more than the more-remote mountainous areas (Kerkvliet and Porter, 1995; Poverty Task Force, 1999; Minot and Baulch, 2002).

Mountainous areas represent 75% of *Viet Nam* and contain 21% of the nation's population. Within northern *Viet Nam*, the disparity in economic growth benefits between the delta zones and the mountainous regions will likely grow during the next decade. For example, the poverty rate in the Red River Delta region is expected to fall from 15.0% in 1998 to only 3.8% by 2010 (National Center for Social Science and Humanities, 2001). In contrast, in the northern mountainous regions it is expected over the same period to rise from 28.1% to 34.4% (World Bank, 2001).

Some authors have attributed the predicted rise in poverty in the mountains to the vicious circle of increasing population, environmental degradation, increasing poverty, and marginalization of ethnic minority groups (Kerkvliet and Porter, 1995; Rambo et al., 1995; Le Trong Cuc and Rambo, 2001; Alther et al., 2002). Donovan et al. (1997) identified seven major difficulties faced by residents in the mountainous regions: (i) biophysical constraints (steep slopes and uneven terrain, access difficulties, acidic low-quality soils, harsh climate); (ii) environmental degradation (deforestation, erosion, floods); (iii) infrastructure constraints (underdeveloped communication and transportation networks); (iv) economic constraints (subsistence agriculture, lack of capital and limited market access); (v) high population pressure (high growth rates, land fragmentation, immigration, high unemployment); (vi) cultural constraints (low education levels, multiplicity of ethnic languages, conflicts among ethnic groups); and (vii) intellectual constraints (insufficient scientific knowledge about the mountains, attachment to the idea of a single development plan for all of the mountainous areas).

This last constraint is a major obstacle to development plans for the mountainous areas. Experience has shown that successful development plans for the delta regions often fail to achieve satisfactory results when transferred to the diverse human and natural environment of the mountains (Jamieson et al., 1998). The

Box 1 : *A short history of Viet Nam*

The historical origin of *Viet Nam* dates to 258 B.C. when Co Loa was the capital of the *Au Lac* Kingdom. In 111B.C. China conquered the northern part of present-day *Viet Nam* and instituted a 1000-year rule, marked by tenacious Vietnamese resistance and repeated rebellions. This ended in 938 A.D. when the Vietnamese won their freedom and built up an independent state. The country developed under the rule of 14 successive Vietnamese dynasties. External control was imposed once again at the end of the 19th century, however, when *Viet Nam* was occupied by the French. This new period of occupation ended on September 2nd **1945** with Ho Chi Minh's declaration of independence and the establishment of the Democratic Republic of *Viet nam*. The first Indochina War ensued, culminating in the French military defeat at *Dien Bien Phu* in **1954**. The Geneva Accords of 1954 temporarily divided *Viet Nam* into two zones (the Communist north and the anti-Communist, US-supported south). Tension between north and south mounted over the next few years, until in **1964** full-scale war erupted. The second Indochina War lasted for the next eight years and ended in 1975 with the defeat of the pro-American regime. In July **1976** the country was reunified and renamed the Socialist Republic of Vietnam. In the decade that followed, the socialist economy was extended to the whole country. In particular, agricultural production was controlled by cooperatives, ownership of all land was collectivized, and production was distributed to workers according to a labor-point system. However, *Viet Nam* was not growing enough rice under collectivized agriculture to feed itself. In **1978**, the country entered into two new wars against Cambodia in the south and China in the north. The economy continued to deteriorate under the combined strain of these war efforts, the embargo imposed by western countries, and deteriorating trade relations with the Soviet Union. Early in the 1980s, *Viet Nam* witnessed the most serious ever socio-economic crisis. By 1986, the economy had almost collapsed; the annual inflation rate rose to a record 774.7%, and a poor rice harvest threatened famine.

At the **December 1986** Sixth National Congress, the Vietnamese Communist Party announced the adoption of a program of market socialism called *Doi moi* ("Renovation"). This bold announcement is usually considered the beginning of reform. However, even before 1986 the State had begun instituting policies to improve the cooperative system. Some key policies that have shaped agricultural production include:

Resolution #6 (1979, Sixth Party Plenum). Facilitated the allocation of agricultural outputs, and initiated the agricultural reform process.

Decree #100 (1981). Allocated land-use rights for paddy fields based on number of people in a household (whether productive or non-productive). Each household was required to contribute a quota of rice to the cooperative, but could keep any surplus.

Resolution #18 (1988, Party Politburo).The virtual decollectivization of agriculture. Allocated long-term land-use rights for paddylands according to the number of productive workers in a household. Households were free to keep all production. Households, rather than cooperatives, became the elementary unit of production

Forest Protection and Development Code (1991). Began the process of allocating land-use rights for hillside lands and forestlands.

Land Law (1993) and Decree 02-CP (1994). Supplied additional details for allocation of upland land-use rights.

These ongoing reforms have transformed the (ace of *Viet Nam's* economy and society. *Viet Nam's* annual GDP growth rate averaged 7.2% during the 1990s. Although *Viet Nam* remains one of the poorest countries in the world, it has received international recognition for achieving the highest poverty-reduction rate in SE Asia. Poverty has been reduced considerably, from 58% in 1993 to 37% in 1998. Agricultural production has undergone a similar transformation, and since 1997 *Viet Nam* has been the world's second or third largest exporter of rice.

The country has entered a new phase of international integration by joining ASEAN in 1995, and APEC in 1998. It is now preparing for WTO accession.

difficulty of working within the extreme diversity of the mountainous regions is exacerbated by the lack of empirical data on these areas. Further, the data that are available often are fragmented and strung together from geographically-limited case studies. In the institutional and natural environment of the northern mountains in *Viet Nam*, new diagnostic methods need to be developed that can analyze data across multiple scales.

Like single-scale analyses, single-sector analyses (focusing, for example, only on forests, livestock, poverty, or inequity) do not adequately capture the complexity of the mountainous regions. Development plans need to be holistic, identifying the interactions among multiple sectors and working with all of those sectors that transform household livelihoods (Le Trong Cuc and Rambo, 2001).

To address the need for multi-scale and multi-sector analysis, in 1998 the *Mountain Agrarian Systems Program* (or SAM, the French acronym) was Developed as a partnership among the Vietnam Agricultural Science Institute (VASI), the Institut de Recherche pour le Développement (IRD), the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), and the International Rice Research Institute (IRRI). The goal of the SAM Program was to study the complex interactions among local stakeholders, agricultural production, land use, and environmental changes, so as to propose concrete innovations for improving (i) agricultural productivity, (ii) natural resources management, and (iii) living standards of highland ethnic minority groups in *Bac Kan* Province. Holistic analyses of the transformations in the rural mountainous areas have enabled us to (i) identify the driving forces behind the *doi moi* reforms and (ii) evaluate the impact of those reforms on land use and farmers' strategies. This book presents our analyses and recommendations.

It is our hope that this work can put into context the pessimism that has developed toward the mountainous regions in recent years, while helping researchers to identify subjects that can develop the agricultural potential of the area. Our analysis of agricultural transformations in the mountains have already generated original diagnostic methods adapted to the particular biophysical and socioeconomic conditions of the mountainous areas (Castella et al., 1999; Castella et al., 2001), and technical land organizational innovations for sustainable agricultural development (Husson et al., 2000; Bal et al., 2000).

We will not repeat all that here. instead, in this introductory chapter, we will first Present the systems-oriented diagnostic methods implemented in *Bac Kan* between 1998 and 2001. We will then introduce *Bac Kan* Province in terms of its geography, followed by a summary of each monographic and thematic study. We will conclude with a short section on what we have learned about research and development in our time in *Bac Kan* Province.

2. Methodology

2.1. Methodological constraints in the mountains

Development research programs in the mountains face three major obstacles that make traditional methods of diagnosis inappropriate.

First, the *extreme diversity* of the region, both social and ecological, makes it very difficult to generalize local results to larger areas. It is not easy to identify a district, commune, or village that is sufficiently representative of the complex mosaic that exists at a higher scale. This greatly complicates the procedures for choosing sample sites, data collection, and extrapolation of local results.

Secondly, the region has undergone *rapid institutional changes* in recent years, particularly since decollectivization began some twenty years ago. The political reforms accompanying *Doi moi* frequently restructure the relationships between farmers and the environment, as well as farmers' relationships with each other. Constantly adapting to new circumstances (industrialization, market integration, population migrations, etc.), farmers often seize upon innovations that offer short-term opportunities in the current institutional setting, even though the innovations sometimes have negative social and ecological effects over the longer term. This highlights the need for research results to be made available quickly. However, the results of research have often become obsolete by the time the research is complete.

Finally, there are many *external influences* with major impacts on the mountains. Policy changes and State interventions, the influences of the Chinese or Western markets, and large State-driven migrations are only a few of the external factors that have affected agricultural systems in the studied area. Such factors will remain important in the coming decades. Research undertaken in a small geographic area needs to adopt a broader perspective that includes consideration of these factors. Unfortunately, even research that professes an understanding of agrarian dynamics at the multi-province scale is rarely applicable beyond the scale at which the research was conducted.

2.2. Methodological approach of the SAM Program

Treat diversity as a research asset, not a constraint. The extreme biophysical, technological, and social heterogeneity encountered in the northern mountains makes it a challenge to generalize research results from a single studied area to anywhere outside of that studied area. However, we treated within-region diversity as a source of information, hypothesizing that it reflected production systems in various stages along multiple trajectories. The wide variety of situations observed thereby became an asset to us, allowing the study of a range of transitional stages in the evolution patterns of farming systems.

Scaling up from the individual field to the region. The sustainability of agricultural production depends on the compatibility between natural resource management at various scales. The majority of observed failures in natural resource management were results of conflicts between scales (Rabbinge and van Ittersum, 1994). Analyzing the viability of village agro-ecosystems necessitates considering natural processes, social dynamics, and resource management at levels both larger than the village (e.g., the district, the State) and smaller (e.g., local farmers, government officials). It is also necessary to quantify relationships among these multiple scales of analysis (e.g., indicators, multiple-scale geographic information systems, etc.).

Systems approach and interdisciplinarity. The analysis of the relationships among changing biophysical and socioeconomic environments forces us to integrate many components of a complex system. Using a systems approach, we integrated information from diverse disciplines (ecology, biometrics, socioeconomics, geography, etc.), leading to a holistic understanding of the processes taking place.

A people-centered approach, focused on the interactions between local villagers and their environment, led researchers to spend large amounts of time in the field, living and sharing experiences with local peoples. In this way, we gained the confidence of locals, an important step in the development of honest dialogue between researchers and development stakeholders.

Involving development stakeholders, particularly farmers, in each stage of the research process ensures that the work undertaken will address the perceived needs of local people. “Expert” researchers cannot expect to impose solutions on populations; instead, researchers need to accompany local stakeholders in a collective learning process that leads to sustainable development.

2.3. Research approach

Our research framework was influenced both by the methodological considerations presented above and the institutional mechanisms of the SAM partnership.

An original approach to sealing up

Our research consisted of three components as described in Figure 1.

A. Monographic studies. These studies were conducted in each of the six rural districts of *Bac Kan* Province, and typically consisted of four consecutive steps undertaken over a period longer than one year:

- First, an agro-ecological zoning of the district characterized the diversity of natural and human-influenced environments, leading to the selection of the commune that best represented the main characteristics of the district in which it was embedded.

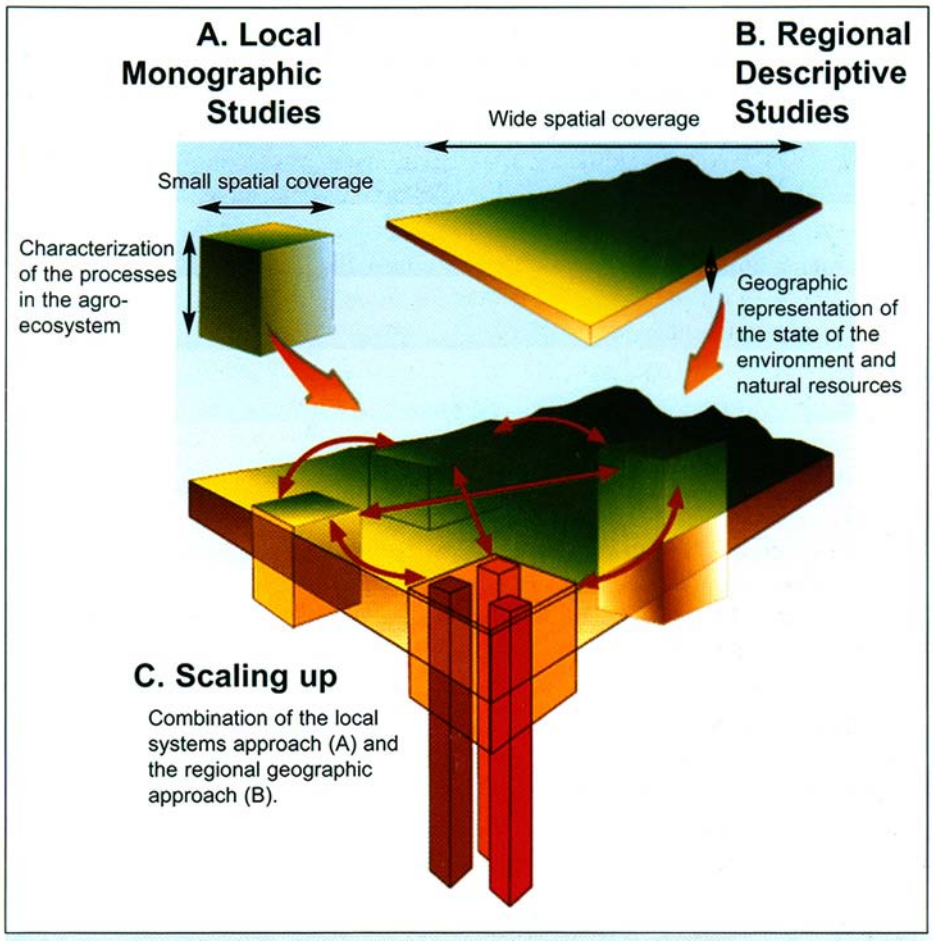

Figure 1: *The scaling up process: a combination of local systems analysis and regional geographic representation*

- Then, the agricultural histories of the studied area were traced through interviews with selected residents in the commune. From this information, we determined the driving forces of local changes as well as the factors responsible for household differentiation.
- Next, a representative sample of farming households (about fifty per commune) were selected for in-depth interviews addressing production strategies and their evolution over time, the performance of crop and livestock systems, non-agricultural sources of income, and farmers' integration in the village social network, among other topics.
- Finally, we integrated the above information into an analysis of trajectories of agricultural systems and household differentiation. We then related this

information obtained through surveys to geographic data generated from historical land-use maps, satellite images and aerial photographs, validating the processes described in the interviews and determining their ecological impact, particularly in terms of changes in forested area.

B. Regional geographic component. The SAM Program was able to benefit from results obtained by an earlier project in *Bac Kan* Province, specifically a geographic information system (GIS) with twenty layers of essentially biophysical information including geology, hydrology, soils, relief, and climate (Brabant et al., 1999). We complemented this GIS with our own socioeconomic data (population, ethnicity, poverty rates, accessibility, etc.)obtained from surveys, provincial statistics, and land use maps.

C. Scaling up was accomplished by combining the local systems component (A) mad the regional geographic component (B).

The comparative analysis of the various research sites made it possible to apply the lessons learned in the villages to wider geographic areas (districts, provinces), while still taking into account the internal heterogeneity of those wider areas. We then used methods based on GIS, multi-agent modeling tools, and role-plays (Castella et al., 2001; Castella et al., 2002a) to validate the indicators developed in the previous stages. After validation, these indicators will allow us to generalize our data to the provincial scale with remote sensing and GIS tools. The validation stage of the research is not presented in this book as the work is still in progress, but it is worth mentioning as the culmination of the methods presented above. This final step will confirm whether the chosen indicators (i) have meaning for both the local and regional stakeholders of rural development, and (ii) are useful in progressing from research to action.

Procedure for selecting research sites

A prerequisite in the research-action approach is that local stakeholders have to agree upon a common problem. Their acknowledgement of a problem makes it more likely that they will take ownership of project activities. The role of researchers is to elucidate the aspects of the problem at a range of scales and from a variety of viewpoints. For this reason, we chose our research sites from a perspective oriented toward specific problems. The institutional partners of SAM Program selected *Bac Kan* Province from among several mountainous provinces of northern *Viet Nam*, based on the following criteria:

- *Socioeconomic*: *Bac Kan* is classified as the poorest province in *Viet Nam*. It lies between *Thai Nguyen* Province (to the South), which benefits from proximity to the delta zones, and *Cao Bang* Province (to the North), which draws economic benefits from a shared border with China (commercial exchanges). In the absence of industrial and commercial activities, the farmers of *Bac Kan* are largely dependent on subsistence agriculture.

-*Ecological: Bac Kan* is one of the major focal points of the Ministry of Agriculture and Rural Development because of the large number of farmers still practicing slash-and-burn cultivation on the hillsides, the growing population pressure, and the already-substantial deterioration of natural resources.
-*Political:* The province was created only in 1997, and provincial authorities have shown a great interest in studies that can describe the state of provincial affairs. Such descriptions could serve as a basis for adapting national agricultural and environmental policies to the provincial context.
- *Institutional: Bac Kan* Province was an ideal site for our project because of the other projects that already were working there, with which we could create synergies mad partnerships. The existence of the geographic database described earlier (Brabant et al.,1999) facilitated the selection of research sites within the province. As the poorest province in the northern region, it is also targeted by a variety of national and international programs focused on rural development and poverty reduction.
The synchronic and diachronic aspects of the study both played a role in selecting study sites within *Bac Kan* Province. The diachronic analysis required sites for which sufficient historical data were available, while the synchronic analysis necessitated that the study sites be selected in terms of their current phase in the evolution process (market integration, infrastructure, rural exodus, etc.). To satisfy both of these requirements, we selected research sites that covered the regional diversity along each of these axes: agro-ecological diversity and the full gradient of market integration (Castella et al., 1999).
Finally, we related our findings to those of other partner project sites in *Bac Kan* Province, both to compare sectoral approaches and to validate the representativeness of our selected sites (Figure 2).

3. *Bac Kan* Province

Bac Kan is a mountainous province in northern *Viet Nam*, extending from 21°48 , to 22°44' , N latitude and from 105°26' , to 106° 15', E longitude. Several rivers have their sources in this province, and play major ecological roles in downstream provinces. The regional climate is subtropical mountainous, with mean annual precipitation of 1500 ram. The monsoon weather cycle is characterized by two distinct seasons (Figure 3):
The hot, rainy season, from April to September. Maximum rainfall occurs in July, with art average of 263 mm. Rainfall in this season represents 82% of annual precipitation. Temperatures vary between 22.9°C and 27.3°C.
The cold, dray season, from October to March. Average monthly precipitation in this season varies between 13.0 and 70.5 mm, and the average temperature is 18°C. Winter temperatures can drop dramatically, to a s low as 2.2°C.

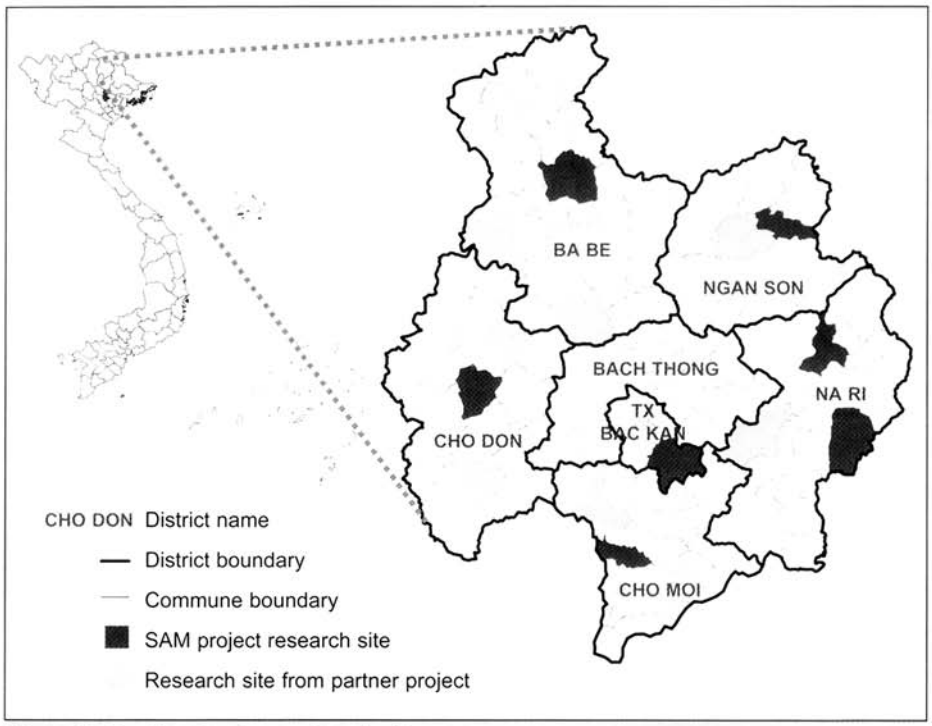

Figure 2: *Bac Kan Province and study sites*

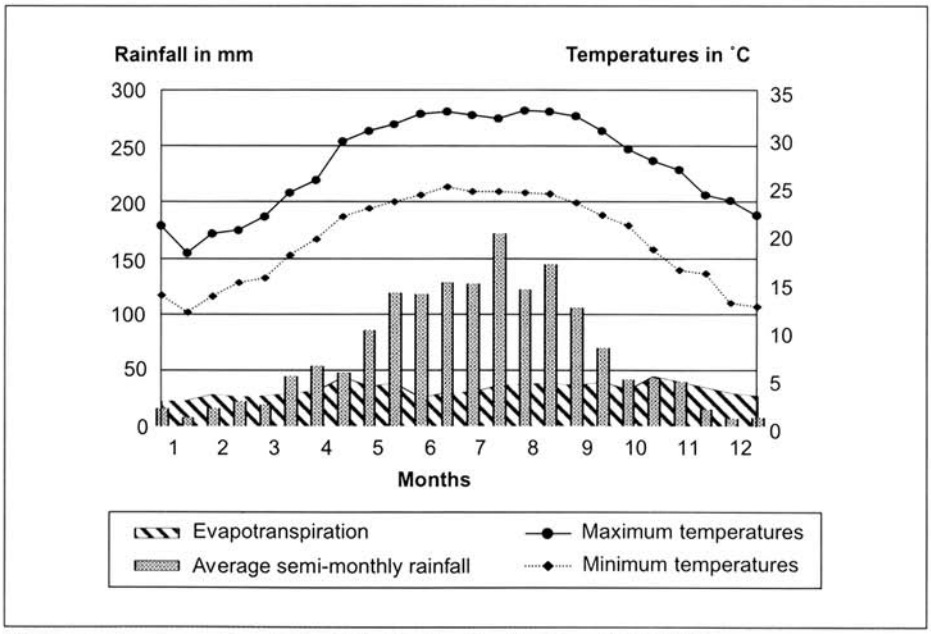

Figure 3: *Average meteorological data for Bac Kan Province (1985-1995)*

These two seasons determine the schedule of agriculture activities for *Bac Kan* farmers (Bal et al., 1997).

The 122 communes of *Bac Kan* Province are grouped into six rural districts (*Bach Thong, Cho Moi, Na Ri, Ngan Son, Ba Be, Cho Don*) plus one that contains the town of *Bac Kan* (Figure 2). The total provincial land area is 4,857 km^2, and the population in 2000 was 281,872 giving a population density of 58 inhabitants per km ^{2}.Between 1991 and 2000, the population grew by 2.2% per year. According to a 1999 census, five major ethnic groups live in *Bac Kan* Province: the *Tày* (55%), the *Dao* (17%), the *Kinh* or Viet (13%), the *Nung* (9%), and the *H'mong* (5%) (*Bac Kan* General Department of Statistics, 2001). The other ethnic groups (*San Chay, Hoa*, etc.) constitute less than 1% of the provincial population.

The population is partitioned into two major groups:

The *Tày, Nung,* and *Kinh* compose the majority group in the province. They live along the major channels of communication and transportation, close to population centers such as *Bac Kan* town and the district administrative centers. They control most of the political and administrative institutions in the province. Their settlements are close to rivers and streams, and they predominantly engage in paddy rice cultivation. Helped by good accessibility and market integration, they sell much of their agricultural production.

The rest of the population of *Bac Kan* Province (*Dao, H'mong, San Chay*, etc.) lives in remote areas that are difficult to access. They have limited areas of irrigable flatland suitable for paddy rice. Instead, these people often rely on extensive hillside slash-and-burn cultivation systems, the yields of which are very vulnerable to climatic variability. Agricultural production is mostly for household consumption. Although many of these ethnic groups were nomadic peoples in the past, most have switched to sedentary production systems since the cooperative period.

Most of the subsistence agriculture in *Bac Kan* Province is founded on paddy rice cultivation in the limited valley-bottoms that cover only 2.6% of the province's land. Other important subsistence crops include maize (21,000 ha in 2000) and cassava (26,700 ha), which are used mainly for feeding pigs and are not traded commercially. Cash crops include soybean (1080 ha), sugarcane (460 ha), peanuts (400 ha),and tobacco (175 ha). Although cash crops do not cover a large proportion of the provincial area, they nevertheless can provide an important proportion of farmers' incomes. In addition, the raising of large ruminants (cows and buffaloes)is stable or has decreased during the past few years because livestock represents both a pressure on the natural resources and a major source of conflicts associated with crop damage and resource use (Castella et al., 2002). Finally, perennial plantations (fruit and timber) have developed rapidly in recent years, helped along by projects' training and subsidies for tree growers.

Agriculture represents 58% of provincial GDP, whereas services make up 31%, and industry and construction the remaining 11% (*Bac Kan* General Department of Statistics, 2001). Provincial GDP increased by nearly 60% between 1996 and 2000, driven both by agricultural development and the doubling of public investments in construction during this period (*Bac Kan* General Department of Statistics, 2001). The main beneficiaries of growth in construction and services are urban households, representing only 14% of households in the province, while most of the poorest families remain in rural areas. Development in the agricultural sector has caused the poverty rate to drop from 29% in 1998 to 17% in 2000. The mechanisms behind these macroeconomic changes are revealed in our studies at the commune and village scales.

4. The monographic studies

The first part of the book consists of five monographic studies covering five different districts of *Bac Kan* Province. These studies demonstrate that the trajectories observed at the village level result from an interaction between historical factors and internal household characteristics (i.e., area of paddyfield and household composition).

In Chapter 1, we present a short history of recent changes in land use and agriculture and their governing institutions, tip to the *doi moi* reforms of 1980, using examples from *Xuat Hoa* Commune located in the district of *Bac Kan* town. This chapter provides the background to the remaining monographic studies, which for the most part begin their analyses at the time of *Doi moi*. The historical events presented in Chapter 1 took place in similar form and with similar effects throughout the mountains of northern *Viet Nam*. Likewise, the present-day situations described in Chapter 1 (e.g., high population pressure, changing rules of resource access, and a process of integration with the broader market) also exist throughout the northern mountains. Chapter 1 presents the hypothesis that is central to this book, namely that household differentiation is based upon two major factors: (i) abundance of labor force relative to the number of mouths to feed in a given household, and (ii) access to land, particularly to paddyland. This hypothesis is further developed in the subsequent chapters.

In *Cho Don* District, through the case of *Ngoc Phai* Commune (Chapter 2), we examine the role that ethnicity plays in determining farmers' production systems and circumstances. Historically, ethnicity was the key factor determining farmers' livelihood systems, with some ethnic groups making their living through shifting cultivation on the forested hillsides while others lived in fixed settlements around lowland irrigated paddyfields. However, circmnstances have since changed. Chapter 2 shows that up to the 1980s, ethnicity helped to define production

systems as they are now observed, but has since faded in importance for the analysis of production strategies.

In Chapter 3, we look at *Cho Moi* District. In *Thanh Mai* Commune, the production systems have changed dramatically in response to policy reforms. Farmers have responded to population pressure by diversifying their production systems. Facing paddyland scarcity, some of them have moved to secondary houses in secluded forested areas to tap resources distant from their village centres and develop new agroforestry systems. This chapter clearly demonstrates the diversity of the mountainous regions, and the fact that a single national policy can have a wide range of effects in different areas, even within one commune.

In Chapter 4, we look at two villages within *Duc Van* Commune in Ngan Son District that have reacted in very different ways to the *doi moi* reforms and that have very different outlooks on the future. We examine these differences in light of the relationships between local farmers and the State.

Chapter 5 combines two villages from *Ba Be* District and one from *Ngan Son* District with one village from neighbouring *Cao Bang* Province for a comparative analysis of the effects of accessibility (or road access) in defining livelihood strategies. An analysis of accessibility provides a link between biophysical factors and farmers' socioeconomic constraints. Accessibility also helps predict the degree to which regional policies will achieve the desired results in a given area.

5. The thematic studies

In the second part of the book (Chapters 6-10), we address five development issues that were prioritized through the monographs:

1. Geographic distribution and dynamics of natural resources in the mountain landscapes,
2. Farmers' access to paddyland,
3. Farmers' access to forestland,
4. Crop-livestock interactions, and
5. Conflicting environmental and development policies.

These five sectoral studies aim at understanding the complex relationships among individual farmers' decision making, the institutions that regulate access to resources, and the biophysical and socio-economic environment in the recent period of transition.

Chapter 6 integrates geographic data with our monographic study of *Cho Don* District. We show that the latest round of forestland allocation has indeed halted forest deterioration, though such a macroscopic view ignores the different effects of the policy on individual farmers. Indeed, this chapter shows that forest cover quality has ameliorated primarily in the wealthier *Tày* villages that have extensive

paddyfields. In contrast, forest cover quality continues to deteriorate in the poorer *Dao* and *H'mong* villages that are still reliant on forest resources for survival.

Chapter 7 examines in detail the hypothesis that production strategies are driven by two main factors: access to paddyfields, and the level of rice self-sufficiency attained by a household in those paddyfields. An extensive typology of 300 farm households in our monographic-study sites confirms that montane paddy rice is the cornerstone of production systems in this region. We classified farmers according to the area of paddyfield owned and the cropping intensity in their paddy fields. This classification remains a major component of our understanding of mountain agriculture.

In Chapter 8, we look at four communities whose production systems rely almost exclusively on the forested hillsides and the impact of *Doi moi* on farmers there. Like chapters 4 and 5, this chapter shows that a single policy (here, forestland allocation) can have markedly different effects on different groups of' farmers even within a very small region.

Chapter 9 addresses the issue of crop give stock interactions, a central point in our holistic understanding of food-feed production systems in the northern mountains. A typology of animal-husbandry systems demonstrates the diverse roles of cows and buffaloes in the production systems of different kinds of farmers.

Finally, Chapter 10 looks at *Ba Be* National Park, and the conflicting goals of rural development and biodiversity conservation in this region. Chapter 10 shows that development policies have a much better chance of producing the desired effects if they take into account the circumstances and interests of stakeholders within the targeted areas.

The positive impacts of the *doi moi* reforms on the northern mountains are undeniable. However, this second set of chapters demonstrates clearly that while the reforms removed many obstacles to economic development for most farmers, they caused new problems for other farmers, particularly those reliant upon slash-and-burn cultivation. The latest forestland allocation policies have left these farmers with production strategies that are no longer adapted to their institutional environment, and farmers must now adapt or face emigration to urban areas that will pose harsh new challenges.

6. Conclusions

The four years that we have spent working with farmers in *Bac Kan* Province have convinced us that the "doom and gloom" hypotheses of earlier authors (Jamieson et al.,1998; Le Trong Cuc and Rambo, 2001) do not represent the only possible future for farmers in the mountains of northern *Viet Nam*. Indeed, several successful SAM Program innovations have demonstrated that farmers have the capacity to find new production practices and modes that are sustainable in the

present institutional and environmental context (Husson et al.,2001). The following approaches have the potential to increase agricultural production and income sustainably for farmers in the northern mountains.

Making efficient use of scarce resources

Our work has already demonstrated that mountain resources can be more efficiently used through agro-ecological innovations (e.g., improved fallow management, direct seeding into cover crops, multiple-use forage crops, etc.) (Husson et al., 2000). These innovations enabled both farmers with no paddyfields to make more efficient use of the hillsides, and farmers with paddyfields to intensify their production sustainably.

Although these technical innovations offer substantial sustainable increases in agricultural productivity, experience has shown that their adoption is often constrained by the institutional and social environment (e.g., weak social control of crop damage by animals, tree planting in collective pastures, theft, etc.) (Castella et al., 2002).Technical innovations need to be accompanied by organizational changes, for example in livestock management and collective pasturing systems, that can create an environment in which all villagers can benefit.

Building on social capital to achieve community-based resource management

Up to now, the technical innovations we have observed have been initiatives by individuals. As resources become scarce, all stakeholders in a community need to work together to increase the carrying capacity of their ecosystem. If projects are to have long-lasting impacts, they need to utilize the adaptive and location-specific process of building on social capital by working in active partnership with farmers. Although slow, this process is the only way that farmers themselves will take ownership and sustain the changes being introduced. This participatory, multi-stakeholder process also generates increased social cohesion, which has the potential to help the poorest and most marginalized of community members to benefit from the economic growth in their areas.

Development in the future will be based upon coordination among multiple stakeholders, and must move beyond the family sphere to which it has been confined since the 1980s. VASI and its partners in the Red River Program (VASI-GRET, 2000) are already working with farmers' organizations that are showing promising results. Institutionalizing these participatory methods should lead to a growing political confidence among farmers, empowering them to make their voices heard in policy-making and project development.

Diversifying income sources

At present, agriculture is at the center of rural development in Bac Kan Province, in spite of the province being disadvantaged with respect to the delta in terms both of productivity and market accessibility. Agriculture alone will not be able to

support the growing population in the mountains. Instead, the future must see households moving to non-agricultural sources of income, particularly as infrastructure projects make the mountains more and more accessible. Both the development of rural industry and the strengthening of education need to be vital components of sustainable rural development in the mountains.

The need for research and development activities in these communities remains stronger than ever, and each chapter in this book closes with a short section on the implications of the research for future development activities. However, more than anything, the results presented in this book should make clear that development must be based on a solid understanding of different local contexts and variables in mountainous regions that drive farmers' livelihood strategies and determine the chances of successfully implementing innovations in the future. It is our hope that this book will help researchers and development workers to identify priority themes for development in the mountainous areas in the years to come.

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Part I:
Monographic Studies

A short history of land use changes and farming system differentiation in Xuat Hoa Commune, Bac Kan Province, Viet Nam

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Abstract

Xuat Hoa Commune, located in the mountainous province of *Bac Kan*, *Viet Nam*, was the subject of a diagnostic study on past agrarian dynamics and their impact on the current diversity of farming systems. We interviewed farmers and local development stakeholders in order to assess the role of socio-ecolaomic transfomations as a driving force of agrarian dynamics. A farming system differentiation model was proposed, based on the ratio of units of labor force to number of mouths to feed in each household up to the early 1990s, and thereafter on the modality for allocation of ricefields. The differentiation model explains content diversity of farming systems in the light of recent economic and institutional transformations (including distribution of the means of production to farmers, land entitlements, and new governance systems). A chronological series of aerial photographs from 1954 to 1998 shows that land use changes have had a tremendous impact on the resource base, particularly in the form of deforestation. However, our field surveys suggest a reverse trend of relative forest recovery since the recent allocation of forestlands to households (1992) and associated government reforestation programs. Finally, an analysis of the production strategies of diverse fanning households leads to concrete proposals for future development activities.

Keywords: farming systems, social change, rural development, farming system differentiation, mountain agriculture, northern *Viet Nam*

J.C. Castella and Dang Dinh Quang eds. (2002) Doi Moi in the Mountain. Land use changes and farmer's livelihood strategies in Bac Kan Province, Vietnam. The Agricultural Publishing House, Ha Noi, Viet Nam. 21-46.

1. Introduction

Land use in *Bac Kan* Province is diverse, and substantial geographic variability exists within a range of several kilometers. The Mountain Agrarian Systems Program (SAM) was initiated in this context to develop methodology to rapidly characterize the present diversity of the region's agricultural production systems, and past patterns of evolution (Castella et al.,1999). We selected six communes to encompass the diversity in agro-ecological conditions and degree of market integration found within *Bac Kan* Province. This monograph focuses on data from one of the six selected communes: *Xuat Hoa* Commune. A comparative analysis of the data obtained from these six communes in 1999 and 2000 allowed us to explain functional relations between local and regional scales (Castella et al., 2002). This kind of diagnosis aims to better orient development activities by basing them on a firm understanding of local dynamics. Generalizing these results to the provincial level will allow us to (i) evaluate the requirements for extrapolating research results to larger geographical areas and (ii) propose alternatives to currently unsustainable agricultural practices.

2. Methods

Our approach consisted of analyzing the evolution over time of farming systems, and relating it to changes in the biophysical and socioeconomic environments. This required the integration of many facets of a complex reality, which is why we have chosen a systems approach.

We studied land-use changes through the interpretation of a chronological series of aerial photographs from 1954, 1977, and 1998. The longitudinal study of more than forty years of changes helps to explain present-day land use and the features of the present farming systems.

We divided *Xuat Hoa* Commune into three separate homogenous zones to Facilitate surveys and to avoid confusion between different agro-ecological and socioeconomic contexts. In each zone, the fieldwork had three phases:

- A series of interviews with local informants, to identify past land use dynamics.
- More-detailed surveys on recent differentiation and the current variety of production systems. From the results of this phase, we developed a preliminary typology to use as a basis for the third phase.
- Surveys of archetypal households representative of each category in the preliminary typology.

Table 1 shows the number of interviews in each phase. However, in this chapter we have presented mainly the results acquired from analyses of *Tày* villages. The *Tày* ethnic group has been at the root of agricultural changes in *Bac Kan* Province (Castella et al., 2002a).

We first present the transformations of the farming systems that led to the villages' current landscape. Then, we examine households' livelihood strategies and categorize family farms according to their production systems. Finally, we analyze the combinations of cropping and animal husbandry systems, which allows us to identify farmers' production constraints and prioritize future options for sustainable development.

Table 1: *Number of surveys in each of three Homogeneous zones*

Dominant Ethinic Group	Number of villages	Number of individuals interviewed		
		Phase 1	Phase 2	Phase 3
Tày	7	5	22	29
Dao	1	2	16	12
Kinh	2	–	17	8
Total	10	7	55	49

3. Evolution of land use

3.1. The four stages of lowland transformation

The historical analysis of the studied area is presented in Figure 1. Two important points emerged from the analysis:

- *Xuat Hoa* Commune has been colonized and farmed in various ways for centuries. The landscape is shaped by humankind.
- Historical land use in the region was characterized by low labor productivity and inconsistent yields from rainfed farming. Therefore, the harvesting of forest products (wild yams, bamboo shoots, wild game) was an important factor in meeting the population's needs. This was possible because the area was once covered by forests.

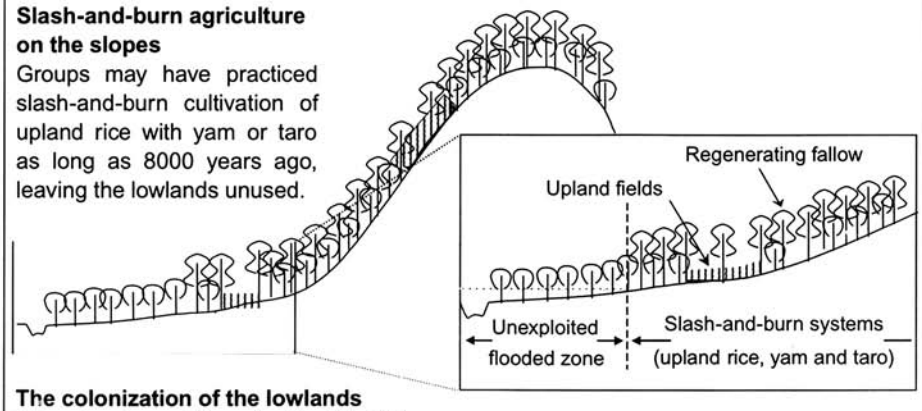
Land use in the middle of the twentieth century was characterized by a tiered ecosystem of lowlands and uplands, where the *Tày* and the *Dao*, respectively, practiced different agricultural systems. Figure 2 illustrates the interaction between land uses of the different landscape units. The 1954 land use map (Figure 3) shows the impact of the two systems on the landscape.

The *Tày* sedentary production system

In the western part of *Xuat Hoa*, agriculture was centered on lowland paddy fields. The lower slopes were farmed manually, whereas the flatland fields were cultivated with animal traction. The *Tày* system had a minimal impact on the forest. Land inequalities were based on the order in which families had settled the commune. The founding families owned the largest and most productive paddyfields. *Tày* farmers with fewer paddyfields worked the fields of the founding families in exchange for rice. The main determinant of households' production strategies was social access to irrigation water (Mellac, 2000).

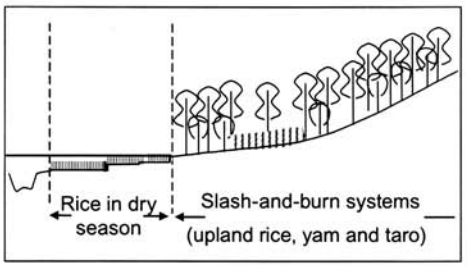
Slash-and-burn agriculture on the slopes

Groups may have practiced slash-and-burn cultivation of upland rice with yam or taro as long as 8000 years ago, leaving the lowlands unused.



The colonization of the lowlands

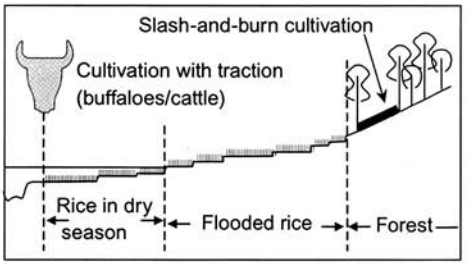
Migrants from China in the Neolithic period, ancestors of the *Tày* people, were likely the first cultivators of paddy rice in the lowlands. They also practiced slash-and-burn farming on the hillsides. Land preparation and the construction of bunds for water level control led to a progressive terracing of the lowlands.



Water control and terracing

Approximately two thousand years ago, Chinese invasions brought the animal-driven plow. Soil compaction from plowing minimized percolation in the coarse soils of the hillsides, which allowed the settlement of the terraced lower slopes.

Animal traction brought increased labor productivity, leading to an intensification of work on the rice fields and a decline in slash-and-burn farming.



Irrigation and ricefield expansion

By the middle of the twentieth century, irrigation systems that diverted water from rivers into paddy fields were well established in *Xuat Hoa* Commune. Improved water control allowed paddy fields to be developed farther away from water sources, leading to higher and more stable yields.

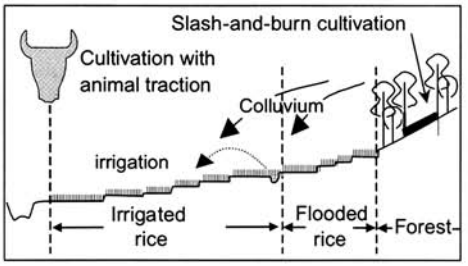


Figure 1: *History of land use and transformation of the cultivated ecosystems*

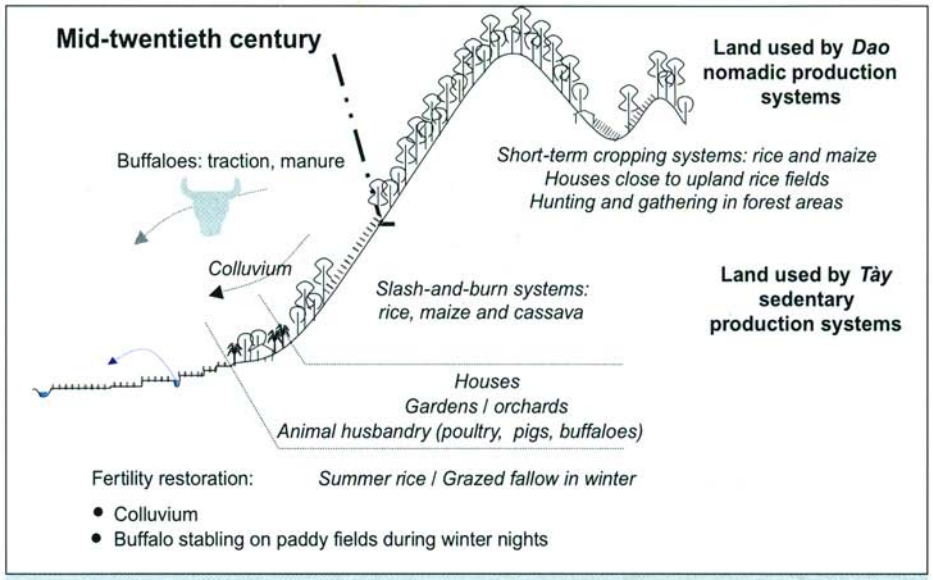


Figure 2: *Dual agrarian system based on Tày and Dao use of distinct landscape units.*

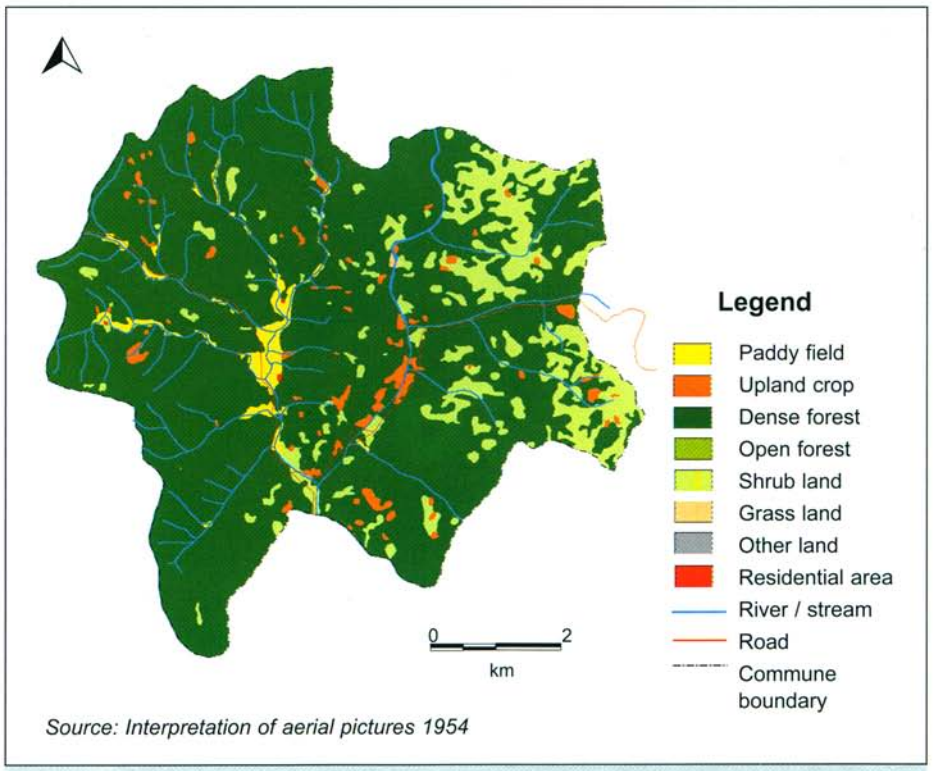


Figure 3: *Land use map of Xuat Hoa Commune, 1954.*

The rice cultivation system in the lowlands had the following characteristics:
- Monoculture: a single annual rice crop, followed by six months of grazed fallow;
- Land preparation (plowing and harrowing) with animal traction (buffaloes);
- Soil fertility restored by run-off bringing buffalo nlanure from the slopes;
- Generally satisfactory water control in the ricefields.

The *Dao* shifting cultivation system

Dao families lived in the eastern half of the commune, grouped in small hamlets. Settlements were located near the land that was being cultivated, so that it could be guarded against damage from wild animals. Every three years or so, when the swiddens became less productive, the *Dao* would move on, leaving the forest to regenerate. The impact of the *Dao* system on the forestland is unmistakable (i.e. patchwork of vegetation at diverse regeneration stages). By about 1940, the shifting cultivation system began to fail, as population density in the region had increased from 4 people/km^2 in 1990 to 15 people/km^2 (Piquet and Puvilland, 1992).

Two kinds of cropping systems were present on the slopes:
- Short-term cultivation on land cleared from forests, mainly practiced by nomadic farmers. Rainfed rice and maize monocultures would be planted annually for two to three successive years, then the field was abandoned and the forest allowed to regenerate. Soil fertility was restored by long fallow periods (15-30 years).
- Long-term cultivation on cleared land. After two or three years of cereal crops, land fertility was restored with a cycle of soybean followed by cassava.

Both systems relied entirely on human labor. The extent of each was limited by the labor requirement of weeding.

3.2. The agricultural cooperatives (1958 - 1981)

From about 1958 to 1981, the State actively encouraged agricultural cooperatives and collective production throughout the country. The cooperative period brought about substantial changes in land use and social organization. Between 1958 and 1962, the State resettled palay traditionally-nomadic ethnic minorities. Within *Xuat Hoa* Commune, the resettlement program led to the creation of the *Dao* village of *Tan Cu*, allowing authorities to keep better track of the descendants of nomadic *Dao* families. Having joined the cooperatives, the *Dao* shifted from traditional slash-and-burn farming to intensive rice cultivation in irrigated valleys. The *Dao* community was now making use of the same ecosystem tier as the *Tày*, though with less paddy field area.

Gradually, the cooperative gained ownership of the means of production, though pigs, fowl, gardens, and ponds remained privately held. From 1958 to 1960,

mutual aid, already a common practice in both *Tày* and *Dao* communities, was systematized. Working collectively helped to overcome the limitation of seasonal peaks in labor requirements, allowing the expansion of cultivated land, particularly on the slopes. The new social policy reinforced community solidarity, resulting in better collective management of irrigation systems. The historical context of the post-war period and the propaganda of the time further facilitated the collectivization process.

Collectivization brought an agricultural revolution, with a shift to two rice crops per year in 1962. Other innovations of the Green Revolution (Box 1) were introduced in 1967. Collective agricultural activities were based in the lowlands while private farming was concentrated on the hillsides. Needy families grew upland rice, while others grew maize and rnanioc for pig raising (Figure 4). Collective work was remunerated on a labor point system. Laborers received approximately 70% of total paddy production for their work, and the remaining 30% went to the cooperative for administrative expenses, agricultural taxes and the like.

As the collective management system became more bureaucratized and inflexible, it created tensions among farmers for a number of reasons. Firstly, a proportion of production was being given to a growing number of administrative staff who were not directly productive. Meanwhile, as the population increased (augmented by immigration from delta regions), each individual's share of production declined. Secondly, though farmers were already poor, a part of their production was being diverted to support war efforts mad help other areas hit by natural calamities (e.g. flooding, drought). Before long, cooperative activities were no longer able to meet families' basic needs, even with the addition of forest resources. To meet their growing needs, cooperatives transformed the hillsides around the lowlands into large swidden fields. The impact of swiddening on the landscape is dramatically apparent on the western half of Figure 5.

Box 1 : T*he Green Revolution: two stages in modification of rice cultivation systems*

First phase: rice double-cropping

- Increase in mineral uptake from soil, creating need for fertilization with manure;
- Innovations in animal husbandry, animal stabling to collect manure;
- Increased need for the Chinese plow;
- Irrigation becomes necessary => water was the limiting factor for the second crop, but farmers invested little in irrigation infrastructure during this phase.

Second phase: high-yielding varieties

- Introduction of high yielding rice varieties, which were also short cycle, more demanding of inorganic fertilizer, and more susceptible to insect pests and diseases;
- Increased pesticide use.

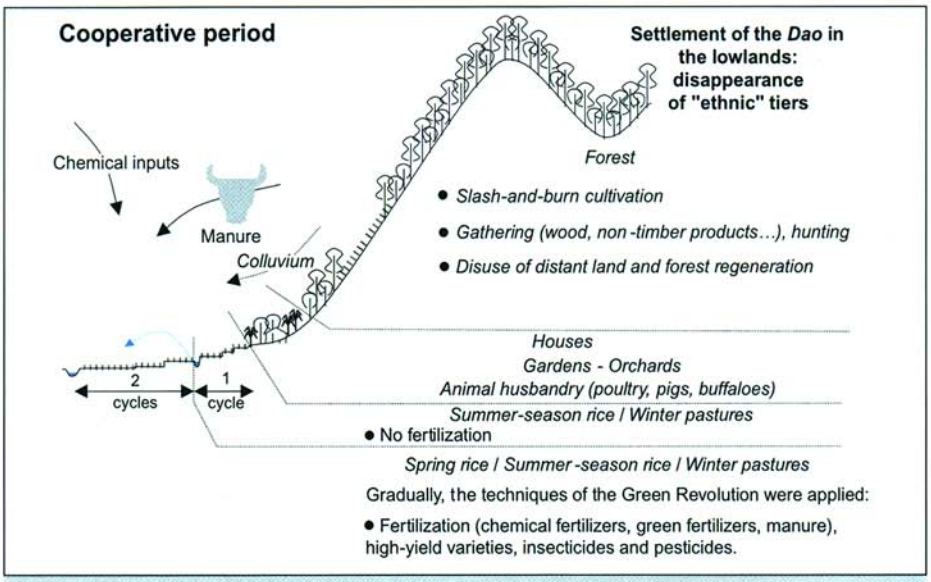


Figure 4: *Cultivated ecosystem land use in the cooperative period (1962-1982)*

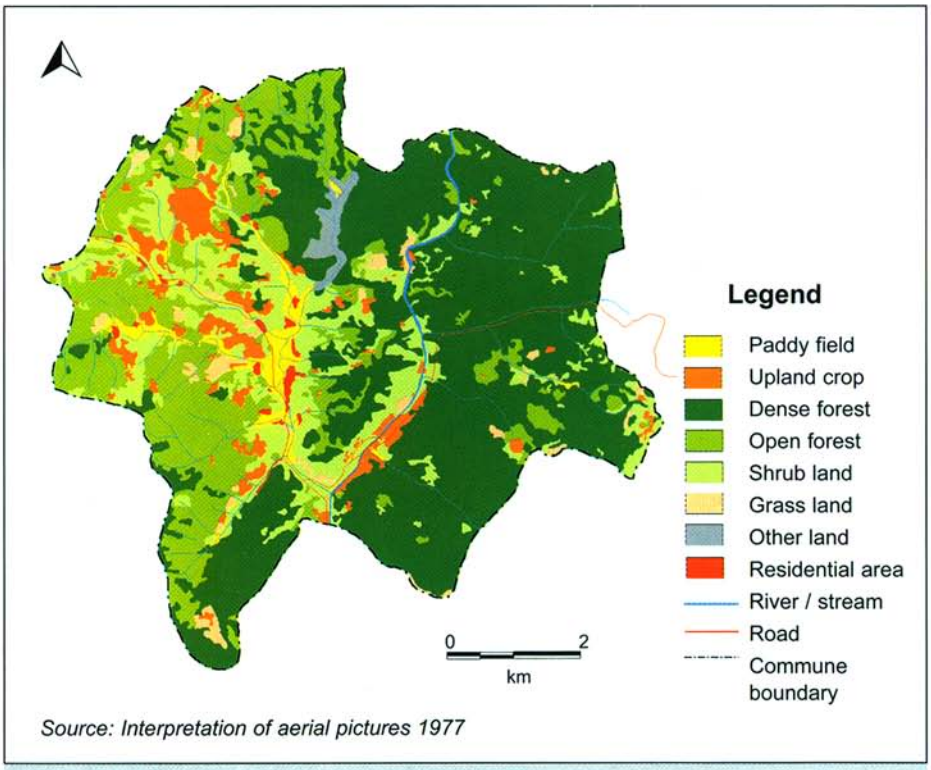


Figure 5: *Land use map of Xuat Hoa Commune, 1977*

Farmers were dividing their time between cooperative labor in the lowlands and private labor in forests and on swidden fields. Cooperative labor shifts were in the mornings and afternoons, so private work took place in the evenings, and occasionally in the early morning before the beginning of cooperative work. The rugged landscape restricted households to using only the gently sloping land nearest the villages, which allowed substantial forest regeneration to take place in the remote areas. By the end of the 1970s, forest cover had become dense again in the eastern part of the commune (Figure 5).

Toward the end of the 1970s, the disciplinary arm of the cooperative was weakening, faced with food shortages and increasing tensions along the Chinese border. The outbreak of war with China in 1979 further complicated matters for the cooperative administration, in the context of war, it was difficult for officials to outlaw slash-and-burn practices while the State itself was encouraging large-scale agriculture on massive swidden fields. Private swidden fields were multiplying as farmers maximized the profitability of their labor and land. At first, extensive private hillside cultivation was restricted to plots located far from villages, difficult to access and out of sight of authorities. With time, the practice became more and more open.

3.3. Progressive economic liberalization (1982-1995)

In 1981, the national "Decree 100" established limited private land-use rights. This began a series of reforms that eventually would lead to the dissolution of the cooperative system (Table 2). The rules of the cooperative seemed to be constantly changing. Farmers adapted their land-use systems to each new restructuring. Systems were selected based on the relative return of various crops, available capital, technical knowledge, and local regulations.

The new policies resulted in three stages of intensified ecosystem use:

1. Labor productivity was maximized by an expansion in the area of upland used. Upland area seemed inexhaustible, and plots were readily abandoned as soon as yields began to decrease.
2. By 1986, all clearable forestlands had been cleared. The community then moved to increase the productivity of available paddy lands, turning to two rice crops per year, chemical fertilizers, and increased animal husbandry (for manure).
3. Beginning in 1990, individual ownership first of paddy fields, and then of sloping lands in 1995, led to increased investment in labor and inputs (Figure 6).

The reforms had different impacts in different regions. In many areas, the changes prescribed by the new regulations had already taken place; the new policy only legitimized the unofficial system. For example, by 1986, although officially land was owned collectively, in reality *Xuat Hoa* Commune already had developed a system of private land-use rights very similar to that decreed by Resolution 10, the 1988 agricultural-reform policy.

The environmental impact of the period's land use systems was considerable. The unsustainable use of upland resources between 1982 and 1986 drained the commune's forest capital (Figure 7). Meanwhile, the changes in land use were accompanied by a notable household differentiation (discussed in Section 4, below). Disparities in capital accumulation and families' access to various types of land during this time largely determined the present-day household livelihood strategies.

3.4. The current landscape

Figure 6 shows the present-day land use in the studied region. The *lowlands* continue to be used exclusively for rice cultivation. Production has become intensified in terms of both labor (for weeding and application of manure) and capital(for chemical inputs and, in some cases, mechanization). Except where limited by the availability of water, farmers grow two rice crops per year.
The *lower slopes* continue to be used for vegetable gardens for family consumption and orchards.

Table 2: *Agrarian dynamics and policy reforms in Xuat Hoa Commune*

Dates and policies	Modification of organizational rules	Short-terms consequences for agriculture	Ecological impact
1982 Decree 100	- Privatization of production activities, producers give fixed quota of rice to cooperative. - Privatization of buffaloes.	- Extensive shifting cultivation tapped upland resources - Gradual increase of herds (buffaloes / cattle)	- Rapid disappearance of old-growth forest - Erosion
1986 Adjusted contract	- Privatization of labor gains. - Land remains collective.	- Decrease of upland field area, temporary end of upland rice cultivation. - Switch to two rice crops per year where irrigation permitted.	- Forest entirely cleared. - Reduced soil fertility on sloping lands.
1990 Resolution 10	- *Tày* reclaim ancestral land. - Many households left out of paddy field distribution.	- Increased time and capital investments in the lowlands (paddy fields, gardens, etc.) - Migrations to the South - Slash-and-burn Farming with short fallow periods by landless farmers	- Buffaloes begin to damage swidden fields, causing disputes, degrading forests, and becoming obstacles to the development of perennial crops.
1994 Upland Allocations	- Gradual allocation of uplands (local rules based on size of swidden fields cleared in earlier periods)	- Substantial investment in plantations (orchards) -Agricultural diversification - Mechanization and large investment in paddy fields	- Relative regeneration of forest cover - Rice intensification causes problems with pesticides

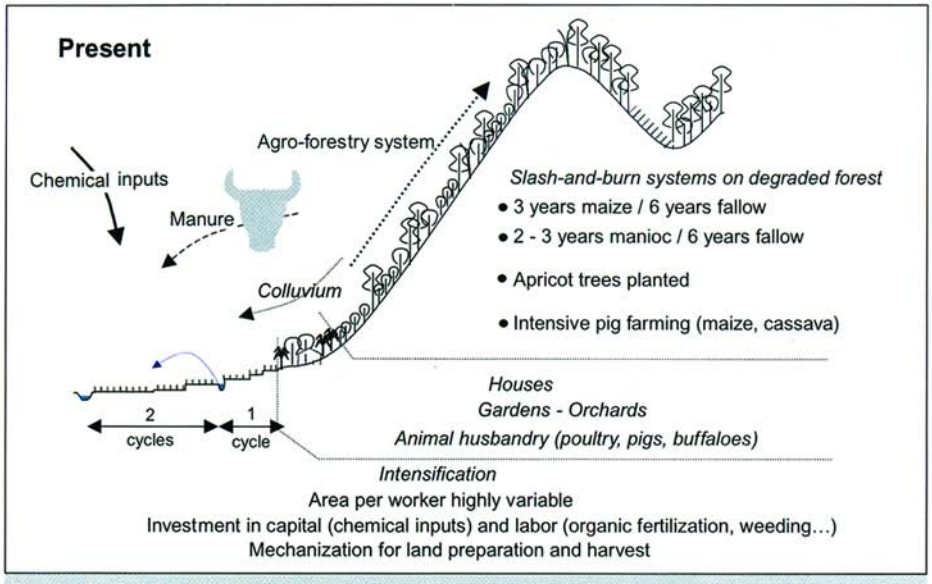


Figure 6: *Current land use in Xuat Hoa cultivated ecosystem*

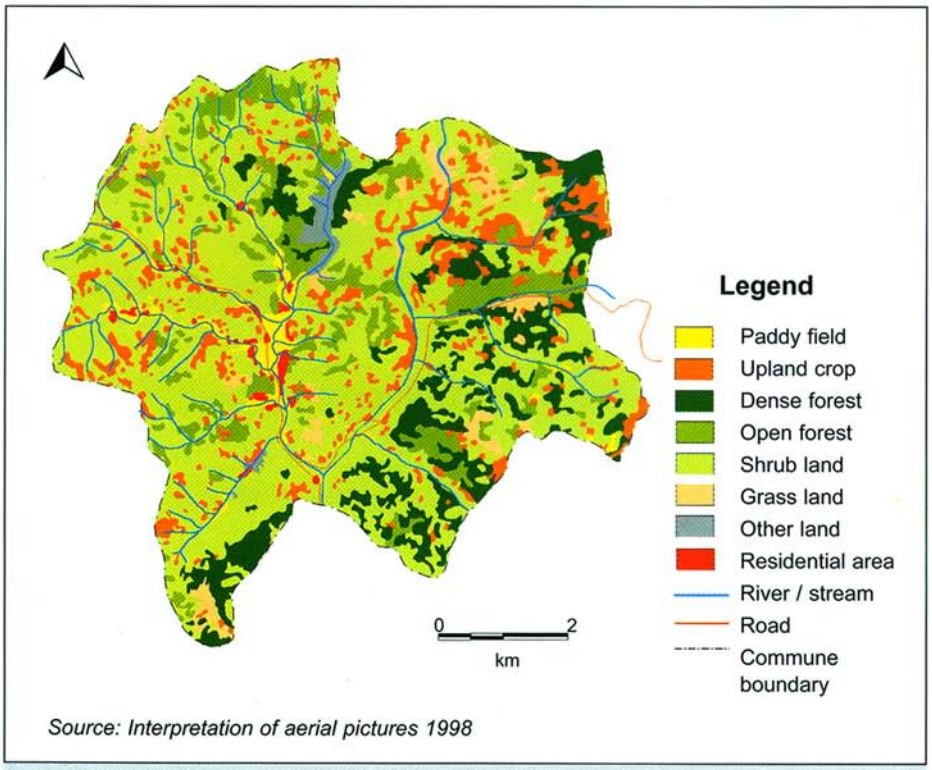


Figure 7: *Land use map of Xuat Hoa Commune, 1998*

The uplands are being used more and more intensively, but in a manner that nonetheless may be environmentally sustainable. Unsustainable slash-and-burn systems have given way to perennial plantations, assisted in the early 1990s by several government reforestation programs in *Bac Kan* Province. The first such program arrived in *Xuat Hoa* Commune in 1998, supported by the World Food Program (WFP). Plantations of *Manglieta*, a timber tree species, have since increased substantially in number and extent, covering approximately 2000 ha in 2001 (Figure 8). Farmers have several reasons to be interested in reforestation programs:

(i) They can clear young forests, which would otherwise be legally protected from cultivation. They can then grow several cycles of annual crops on the cleared plots before tree cover thickens; and

(ii) In their first three years of participation, they receive large rice subsidies. By the time the subsidies expire, the plantation itself should yield profits.

The history of the region during the 20th century can be summarized as a succession of four different kinds of land use (Figure 9, Figure 10, Box 2).

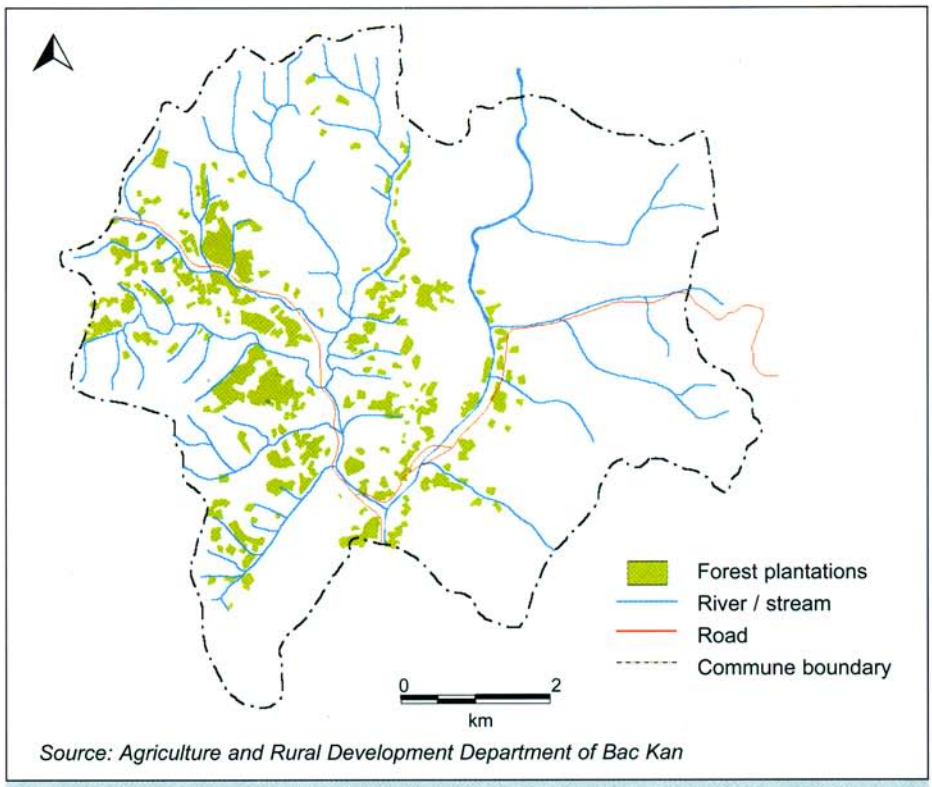
A. Before 1954, land use was not intensive. Lowland use consisted mainly of a single rice crop per year, characterized by extensive rice monoculture. Uplands were used for slash-and-burn agriculture with long fallow periods. The *Tày* occupied the lowlands, whereas the *Dao* lived in the uplands.

B.During the collective period(1960-1988), lowland rice production was intensified with the technology of the Green Revolution (Box 1). Cultivation of the hill sides was for bidden by local regulations, and the practice was restricted to a few small fields near the village. Some forest regeneration occurred in the eastern part of the commune (Figure 7).

C. In the late 1970's and early 1980's, agricultural production could not keep pace with the growing population of the region, while the hillsides continued to be under-exploited. The resource base was maintained but the food needs of people were not being met. This failure culminated in an abrupt return to traditional shifting cultivation practices and an uncontrolled rush to clear and appropriate as much upland area as possible. Within several years most of the forests in the commune had been cleared.

D. In the 1990's, sustainable land uses emerged, characterized by intensification of paddyland production and perennial plantations on the hillsides (Figure 6). However, not all families have been able to take part, due to the large capital investments required.

Intensification happened in two main ways: (i) land use modification in the lowlands (Green Revolution, new technology, mechanization), and (ii) permanent agro-forestry systems or expansion of maize area (associated with pig raising) in the uplands. Over the past 50 years, the region has seen an increase in labor productivity coupled with a decrease in per capita area of arable land.



Source: Agriculture and Rural Development Department of Bac Kan

Figure 8: *Areas planted with Manglieta under World Food Program from 1998 to 2000*

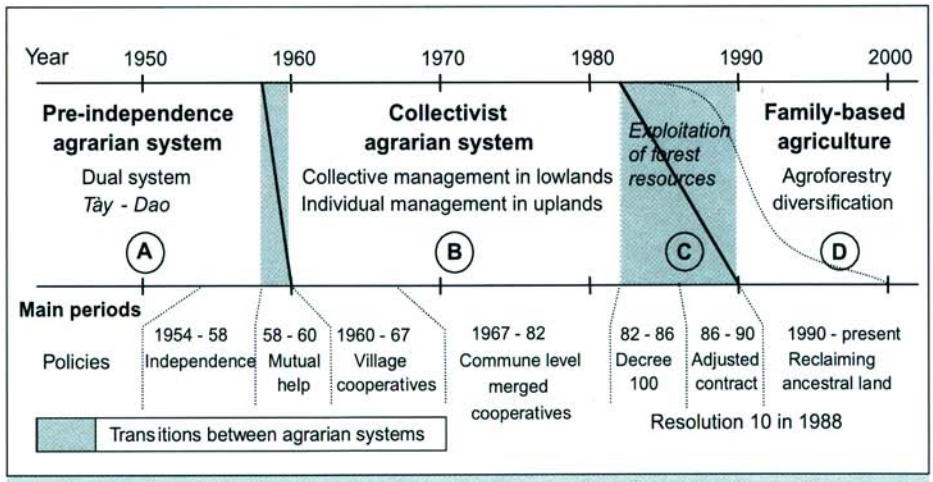


Figure 9: *Agrarian systems timeline*

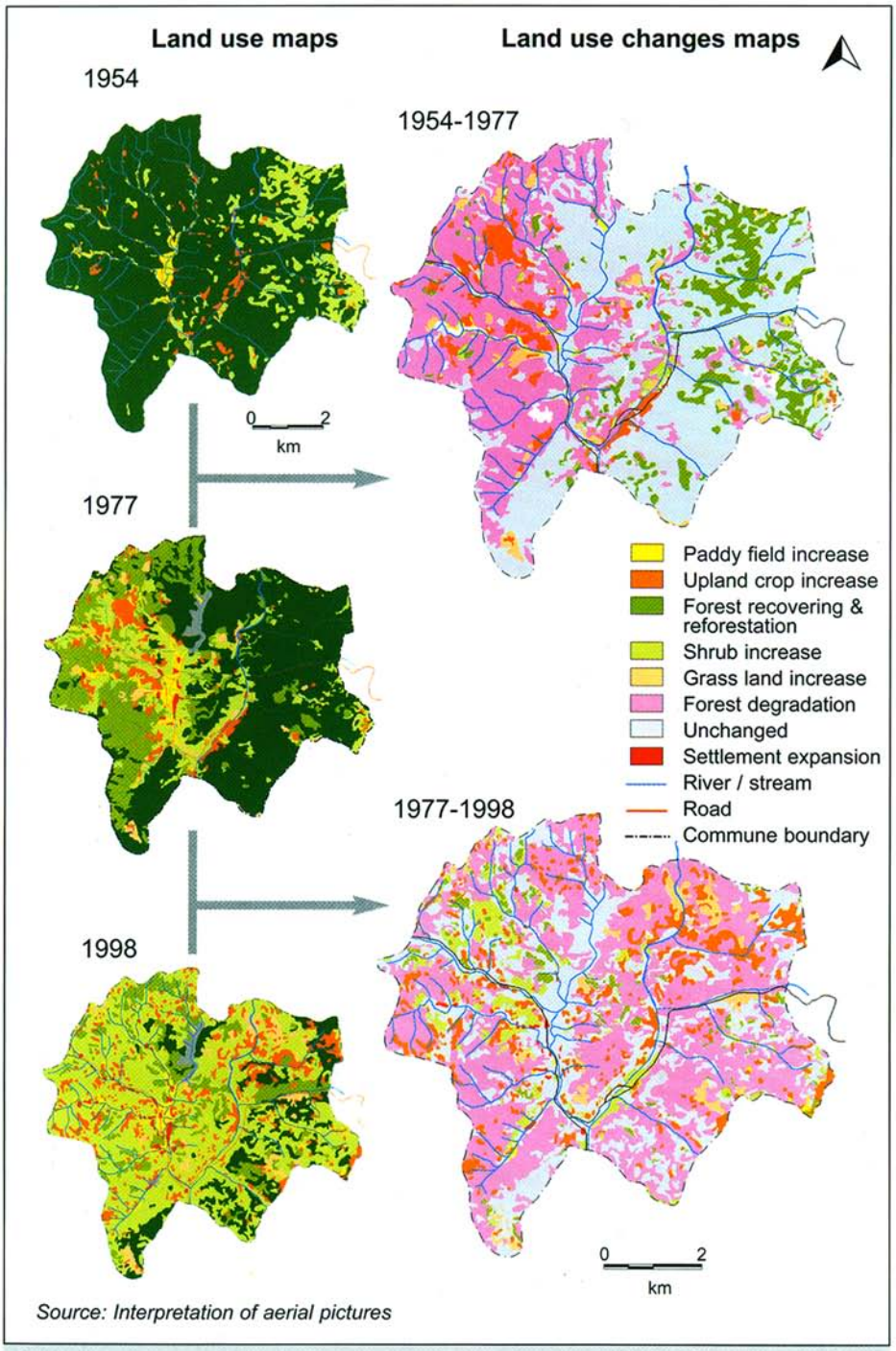


Figure 10: *Land use change map of Xuat Hoa Commune*

Box 2: *Agrarian transitions and ecological dynamics*

The graphs below were developed from a quantitative analysis of maps in Figures 3, 5, and 7 presented above.

Intense deforestation

Graph 1 demonstrates the severe reduction in forest cover that took place over the last fifty years. By 1998 only 15% of the 1954 forest cover remained, covering only 12% of the total commune area. Forest deterioration was even more marked than can be seen in Graph 1, as the steep reduction in forest quantity was combined with a substantial deterioration in forest quality. Over the period shown, the region's secondary forests were totally destroyed and replaced by degraded forests (Graph 3).

Slash-and-burn practices accused...

The agrarian history of *Xuat Hoa* Commune shows that the deforestation of the region had many causes (slash-and-burn practices, logging, etc.), across different time periods and regions. The increase of slash-and-burn practices (Graph 2) over the last 40 years has nonetheless played an undeniable role in deforestation.

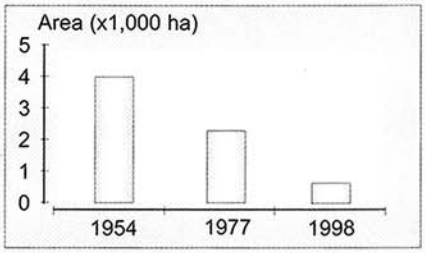
Fallow period reduction

We can see from Graph 3 that the impact of slash-and-burn practices on the state of forests was considerably higher in the 1977-1998 period than during the period before that. Shrub area increased at a faster rate than deforested area, indicating a reduced fallow period. The forest no longer had enough time to regenerate.

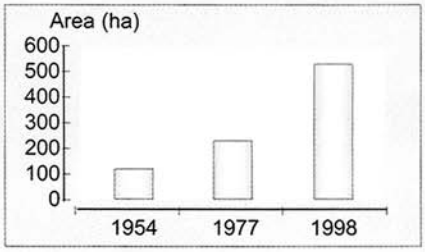
The tragedy of the commons

Collective management led to a sharp increase in the size of swidden fields. The increase in slash-and-burn practices in the following individualist period, combined with population densities considerably greater than in the previous 50 years, led to the exhaustion of forest resources.

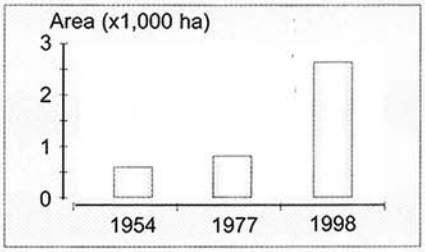
1. Decrease in forest area



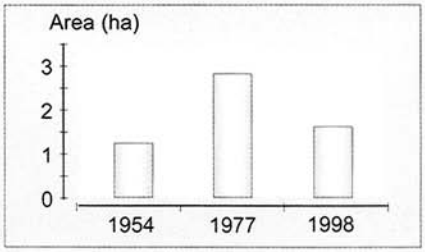
2. Increase in upland crop area



3. Increase in shrub area



4. Average area of upland crop fields



4. The farming system differentiation process and the diversity of current production systems

4.1. The driving forces of differentiation in the 1980s

When economic reforms began to take place in the 1980s, agricultural production systems were very homogeneous. In terms of explaining recent differentiation, we have taken pre-1980 differences among production systems to be negligible (Sadoulet, 1999). Whatever social differences that may have existed before collectivization (e.g., differences based on paddy areas, wealth, and farming skills) had been effectively leveled by the cooperative system. Starting around 1980, the reform and eventual dissolution of the cooperative system created new disparities, and allowed some old disparities to resurface.

Decree 100: the fallacy of a system that should have been equitable

Decree 100, passed in 1982, reorganized the distribution of lowland fields and the remuneration for paddy field labor as follows:

- Lowland area was allocated according to the number of individuals in each family, with the intention of giving each family enough land to feed themselves;
- Families owed a fixed quota ofrice field production to the cooperative, based on the size and quality of their ricefields. Any surpluses beyond this fixed amount could be retained.
- Cooperative labor (rice field work, construction of irrigation systems, animal tending, etc.) was remunerated on a labor point system.

The system seemed simple and equitable: the households with the greatest food needs had the largest areas allocated to them. But the new policy only created new disparities:

- The high productivity of slash-and-burn practices discouraged families from investing any more effort than was obligatory in the paddy fields. Because of the cooperative's poor input delivery management, paddy yields remained low, attaining but rarely exceeding production quotas;
- Families with few laborers but many mouths to feed had a proportionately high ricefield surface area per laborer, sometimes more than the workers could handle, resulting in poor yields;
- An under-valuation of working time on the paddy fields led to a transfer of the fruits of labor from underprivileged households with small labor forces to those with sufficient labor to engage in other cooperative work that received a higher valuation.
- Unable to attain their paddy field quotas, labor-poor families could not take part in slash-and-burn cultivation, the most profitable work of that period.

For two or three years, many families were poorly paid for their obligatory paddy field work. It was at their expense that food security in the commune was attained. Between 1982 and 1990, various practices allowed farmers to accumulate capital:

- High-yielding upland cultivation from 1982 to 1986. The potential for this practice soon vanished, as widespread slash-and-burn cultivation of upland rice, maize, and cassava soon exhausted soil fertility on sloping lands.
- Harvesting of high-value timber from 1982 to 1990, for those families with enough laborers to undertake the task.

Since 1990, unequal access to land and private property

In 1990, there was a spontaneous movement among the *Tày* to reclaim the paddy fields that had been collectivized in 1960. Families took back the paddy fields of their ancestors and distributed them amongst themselves, reproducing the land inequalities of the pre-independence system. Families who had joined the cooperatives in later years were deprived of the fields on which they had been working for years.

In 1994, the State initiated allocation of long-term rights to use upland. In 1995, individual households received stable titles for specific upland areas in *Xuat Hoa* Commune. The land allocation tended to give households the same areas that they were already cultivating, including fallow fields. Of course, households with large upland fields were those who had enjoyed labor surpluses during the Decree 100 period. The redistribution of uplands thus only entrenched the land-access inequalities that had already developed.

The roots of the present-day social disparities seen in *Xuat Hoa* Commune can therefore be found in the 1980s (Figure 11). The driving forces of the differentiation process fit into three categories:

(i) The inequality of the "Decree 100" system according to the households' relative abundance of labor force in comparison with the number of mouths to feed;
(ii) Private profits from unsustainable forest use and other private activities (oppommities for which depended on labor surpluses during the Decree 100 time period); and
(iii) Since the early 1990s, the movement to reclaim ancestral lowlands. The size of paddy fields inherited from ancestors relative to the number of descendants among which it was shared, influenced households' production strategies.

4.2. Current livelihood strategies defined by access to the means of production

The range of options in cropping and animal husbandry systems

Xuat Hoa households' livelihood strategies consist of one or more crop or livestock production system, sometimes combined with non-farm income. We can

classify the activities of *Xuat Hoa* households into categories of agricultural production systems, with each category defined by combinations of cropping and animal husbandry systems. For instance, when a household grows rice in the lowlands, maize and apricots on the slopes, and raises pigs for sale and buffaloes for land preparation, one can identify three interrelated production systems: (i) a rice production system comprising rice cultivation and buffalo raising; (ii) a pig production system including maize cultivation for feed; and (iii) an apricot tree cultivation system.

We find in *Xuat Hoa* three principal rice-based production systems:

- Rice cultivation including buffalo raising for draft power;
- Mechanized rice cultivation, allowing the farmer to rent plowing services to other households;
- Manual rice cultivation, with mutual aid.

The main systems observed on the hillsides are:

- Maize cultivation for sale;
- Maize cultivation for pig fanning, combined with the purchase of supplementary feed;
- Apricot tree cultivation, intercropped with maize for two to three years;
- *Manglieta* timber plantation, subsidized by the World Food Program.

Profitability of production systems

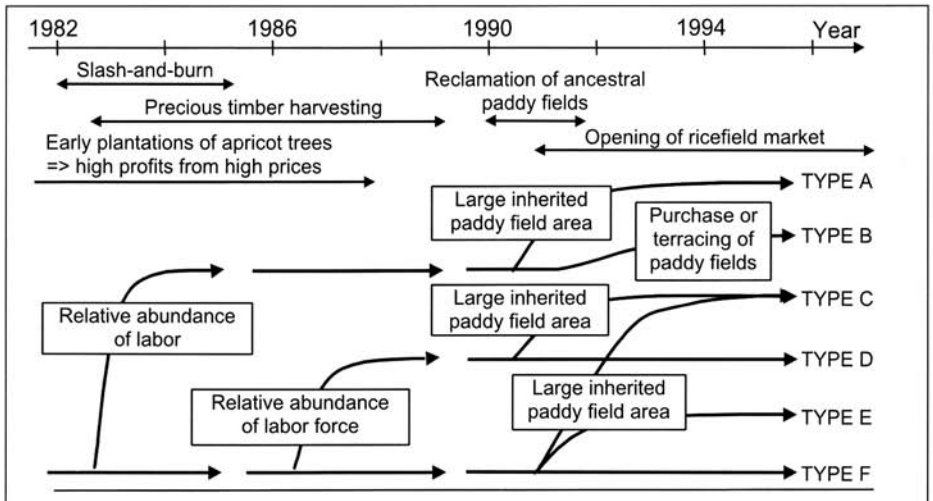
Table 3 shows the profitability of the different production systems in *Xuat Hoa* Commune. Figure 12 compares the profits of the different production systems per unit area of production and per day of labor.

Rice, the staple food of most *Xuat Hoa* families, continues to be of strategic importance, with relatively stable yields although only generating an average income of 20,000 VN Dong / working day. Although the maize-pig system offers high profits, the lower initial investment for growing rice makes it a more feasible investment. Pig fanning is most commonly practiced by households that lack paddy fields but have access to capital.

Cassava and maize cultivation systems are even less profitable than rice per unit of land area but their labor requirements are comparable to other systems (Figure 12).

Taro is a special case, with very high profitability per unit of land and relatively high profitability per unit of labor. Like all vegetable products, though, the market demand is small, and taro requires non-acidic soil conditions.

Perennial trees (apricot trees, *Manglieta*) are very profitable with respect to labor, but require large land areas and offer unstable returns. The market for fruit is uncertain, and the market for *Manglieta* timber is unknown to farmers as this tree is a new arrival in the region.



TYPE A: Combination of large areas of paddy fields and perennial trees. Few upland fields.

TYPE B: Average paddy field area, highly varying returns on the slopes (arboriculture)

TYPE C: Large paddy field areas, gradual capitalization and perennial tree plantation, progression to TYPE A

TYPE D: Serious rice shortages. Cash crops on the slopes with varying returns (pig raising, cassava)

TYPE E: Average paddy field areas, production on the slopes with stable returns (cassava, taro)

TYPE F: Few paddy fields, minimal capital. External work, debt.

Figure 11: *The differentiation process of production systems and the current typology.*

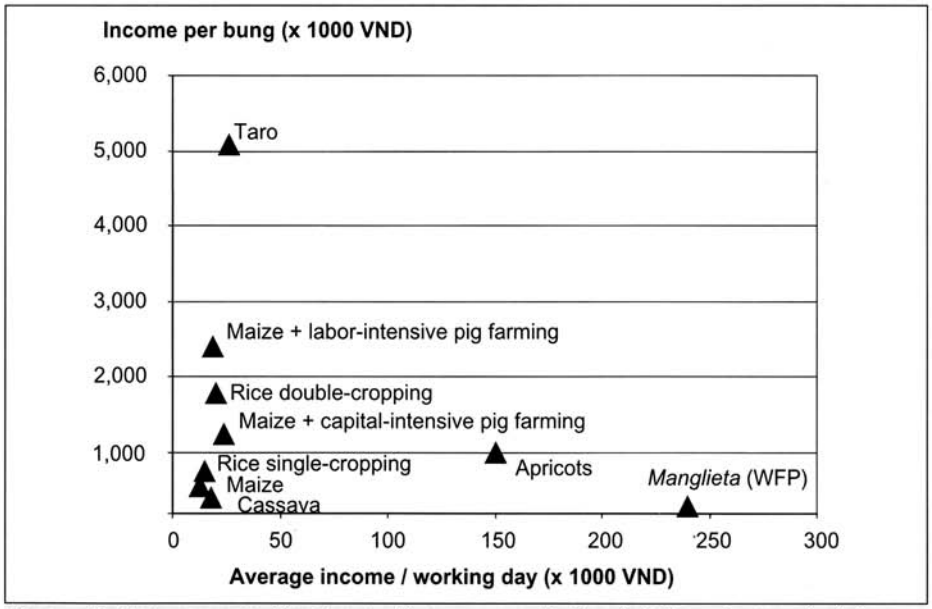


Figure 12: *Income per working time and income per unit of land of elementary production systems (1 bung = 1,000 m²)*

Table 3: *Relative profits and requirements of production systems*

	Profits (thousands of VN Dong)		Capital needs (thousands of VN Dong)		Labor requirements	
Production System	Per working day	Per 1000 m^2 cultivated	Rotated capital per 1000 m^2 cultivated (e.g. inputs, hired labor)	Initial investment required indicate lower per 1000 m^2	Maximum area Per laborer (m^2) (larger areas requirements labor requirement)	Peak labor
rice + buffalo	20	1,700	250	1,500	1,200	March and June-July
rice + hand tractor	21	2,100	250	1,000	1,200	
rice (hired labor)	15	1,300	600	7,000	2,000	
maize for sale	13	120	-	-	2,500	July
maize for pigs	19	2,300	120	-	1,500	
maize for pigs with additional feed	23	1,140	450	-	2,000	
apricots	150	900	-	-	6,000	March-April
Manglieta	220	48	-	subsidized WFP	> 10,000	none

Timing of peak labor requirements

There are two peaks of labor requirements: from March to April, and from June to July. At the moment of planting a given crop and then during each peak period, the most important factor in farmers' decision-making is the marginal income per working day (Table 4). Between March and April, rice production is the highest priority, both because it is profit able and because it ensures the household's food security. Maize and apricots are second priority. Rice and maize are rarely produced by the same household on large areas because of their concurrent labor peaks.

Between June and July, labor is divided between maize and rice cultivation. If time is insufficient, families do not plant a second maize cycle. For households with small ricefield areas, the high profitability of the maize-pig system makes it a common choice.

4.3. A typology of household livelihood strategies.

Table 5 displays the elementary production systems available to farmers, along with their advantages and disadvantages. Farmers' decisions about the amount of land and labor to devote to each elementary production system are based on:

(i) farmers' access to production means,

(ii) the relative profitability of elementary production systems, and

(iii) the timing of competing peaks of labor requirements.

Table 4: *Marginal, income of a working day during labor peaks*

Period	apricots	rice double-cropping	maize + labor-intensive pig farming	maize + capital-intensive pig farming	maize for sale
March - April	150,000	120,000	88,000	90,000	78,000
June - July	-	74,000	135,000	60,000	47,000

Remark: The marginal income of a working day is equal to the ratio of the income per ha to the working time per ha during the labor peak period.

Table 5: *Factors explaining the production combinations observed in Xuat Hoa Commune*

Production systems	Advantages	Constraints
Rice + buffalo	- food security - buffalo care maximizes labor force use (employing both children and the elderly)	- limited by available paddy field area
Rice + hand tractor	- food security - good return on investment	- large areas required to ensure investment profitability
Rice (hired labor)	- eases pressure on family labor force during labor peaks	- low return on labor - food security less assured
Maize for sale	- no investment required	- very low profitability - minimal available area and low return per unit of land
Maize + pigs	- return on labor comparable to rice fields	- labor required in July, at the same time as in the paddy fields
Maize + pigs with with additional feed	- substantial return on labor - regular work throughout year	- important initial investment - low return on labor during July peak labor demand compared to rice
Apricots	- potentially profitable - profitable with respect to labor	- unstable income
Manglieta (WFP)	- allows the clearing of new land for maize	- very low profitability per hectare

Farmers' combinations of these elementary production systems result in a set of household livelihood strategies that can be used to characterize the household types in the study area. As shown in Figure 13, current household livelihood strategies are largely defined by lowland access and accumulated capital (mostly during the 1980s, at the expense of the forest). These are important elements to take into account when examining the current situation of upland agriculture and orienting future development activities.

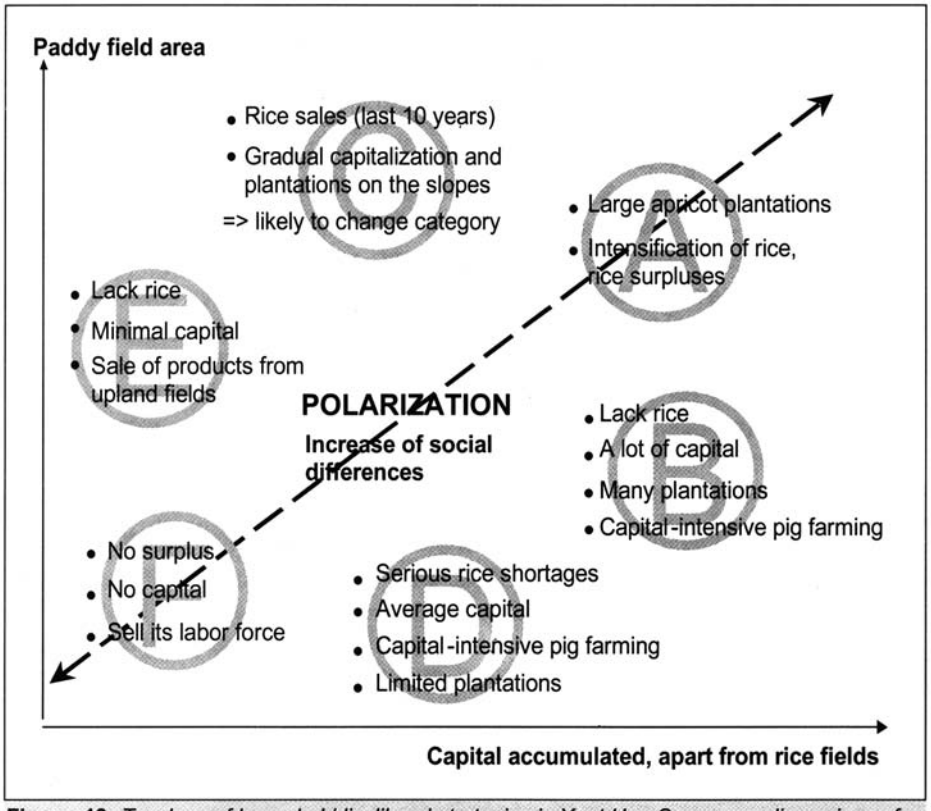


Figure 13: *Typology of household livelihood strategies in Xuat Hoa Commune: dimensions of polarization*

5. Conclusions

The historical background of the extremely heterogeneous mountainous region of northern *Viet Nam* needs to be considered when planning policy modifications or development interventions. By the end of the 1980s, the *doi moi* reforms had affected different households differently, according to the initial characteristics of the households. Whereas policies before 1980 tended to level the differences among households, policies since 1980 actually have accentuated those differences. Farmers do not react to institutional changes in a vacuum. In the future, as in the past (since 1980), different households will be obliged to develop livelihood strategies along different pathways. An understanding of the interactions between household characteristics and the historical and institutional context in which they develop their livelihood strategies is crucial for policy-makers and development practitioners.

Contribution of the study in scientific terms

During the political transformations of the past 50 years, *Xuat Hoa* Commune systematically reinterpreted national policies at the local level. Indeed, this is representative of *Bac Kan* Province as a whole. The need to reinterpret at local level likely came about from the differences among the ecosystems in which policies had to be implemented. It is unrealistic to expect policies developed in the context of the delta region to solve problems in the markedly different and highly heterogeneous mountainous region (Sikor and Dao Minh Truong, 2000; Le Trong Cuc and Rambo, 2001).

The study of *Xuat Hoa* Commune has revealed the existence of a dramatic process of household differentiation that began with the decollectivization process. Our diagnostic work led us to define a set of indicators that have become the basis of a comparative study of the differentiation process in various research sites within *Bac Kan*. These indicators (see Figures 12 and 13) have been integrated into a multi-agent computer model (named SAMBA), which has allowed us to validate them and evaluate their relative importance in past dynamics (Castella et al., 2000). The results, which provide a thorough understanding of local realities, will lead to concrete recommendations for better collective management of the local resources (Castella et al., 2000).

Contribution of the study to development

Diagnostic studies implemented in *Bac Kan* Province (*Cho Don* District) in the early 1990s, the peak period of slash-and-burn agriculture, predicted a major environmental crisis in the province (Piquet and Puvilland, 1992). Farmers avoided the crisis by turning to new systems of intensive upland cultivation that seem more sustainable than previous systems. Land allocations were undoubtedly the main cause of this change in production systems.

Intensive agricultural systems often require more capital (e.g. maize/pigs) and/or generate unstable returns on initial labor investments (plantations of perennial trees, paddy field construction). These limitations exclude certain households from the development process(e.g., households with insufficient investment capital or which cannot bear the risk of unstable returns). These households often have little recourse beyond timing to less sustainable practices on the hillsides. It is these farmers who currently are in need of technical and organizational support to ensure the ecological and economic sustainability of their farming systems.

Some unresolved problems

Intensive but sustainable systems of upland farming with small initial investments need to be developed for struggling farmers who lack the means to invest in perennial trees (Husson et al., 2001).

Cattle and buffalo herds in the region are rapidly decreasing in size because of increased difficulties in pasturing. Conflicts are increasing over free-grazing and its resultant damages to crops, plantations, and forests. Further research is needed on new methods of cattle management (Eguienta et al., 2002). In light of the need to shift to more intensive crop systems on the slopes, it seems relevant to study the introduction of cattle husbandry in perennial plantations that include plants for upland feed production.

In *Xuat Hoa* Commune, private fruit tree plantations have been expanding, and fruit production has become an essential part of the revenue of many households. However, the future market for fruit is uncertain, as the apricot market has been in decline for the last five years. A study of be evolution of the market for perennial cash crops would be helpful in orienting the decisions of future producers.

6. Acknowledgements

The authors would like to express their sincere thanks to the authorities of *Xuat Hoa* Commune for the support provided to the field teams, as well as to the People's Committee of *Bac Kan* for its commitment to the research and development activities being carried out in the province. We are very thankful for the help of Dr. Tran Dinh Long and Dr. Le Quoc Doanh, Vice Directors of the Vietnam Agricultural Science Institute, who guided and facilitated the work presented above. Many thanks to Hoang Lan Anh and Paul Novosad for their help in translating and editing earlier versions of this chapter.

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The declining role of ethnicity in farm household differentiation: A case study from *Ngoc Phai* Commune, *Cho Don* District, *Bac Kan* Province, *Viet Nam*

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Abstract

Farming has changed dramatically over the last fifty years in *Ngoc Phai* Commune, as in all of *Bac Kan* Province. Historically, ethnicity has long been the key determinant of access to land in northern *Viet Nam* uplands, and thus the determinant of farmers' agricultural practices. However, major external policy changes have periodically altered the environment in which farmers plan their livelihood strategies. Agricultural cooperatives were established throughout the country in the 1960.'s, and then dismantled some twenty years later returning the land to individual family farms. During the cooperative period, all ethnic groups contributed to the intensification of paddyland productivity, thereby limiting agricultural pressure on the uplands, Nonetheless, rice production was not sufficient to cover food needs because of management problems in the cooperatives. Therefore, upland rice production became indispensable to meet the deficit in paddyland production. In the 1990s, the allocation first of paddyfields and later of uplands helped to slow the deterioration of the mountain ecosystem. However, the local reinterpretations of national land polities resulted in further inequalities, placing certain ethnic groups into extreme poverty and food insecurity. *Tày* farmers who could reclaim ancestral paddy lands were often privileged over the *Dao*, who traditionally had been shifting cultivators and thus were forced to return to slash-and-bum cultivation systems that were no longer sustainable under higher population pressure and a new institutional environment.

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Ethnicity was a major determinant of livelihood strategy in the past, and contributed greatly to the household differentiation that exists at present. However, distinctions among livelihood strategies can no longer be drawn along ethnic lines. Farmers of all ethnicities share the goal of attaining food security through paddyland rice production. Farmers who lack paddyland fields, whether *Tày* or *Dao*, are turning to shifting cultivation on the hillsides.

Keywords: mountain agriculture, farming-systems typology, land use changes, crop-livestock interactions, household differentiation, northern *Viet Nam*

1. Introduction

The unsustainable use of forest resources in combination with rising population pressure endangers the ecological and economic sustainability of traditional upland agrarian systems (Bal et al.,1997). High population pressure has made access to land that is suitable for agriculture a vital issue for subsistence farming households (Castella and Erout, 2002).

Vietnam Government authorities have long blamed northern *Viet Nam's* reduction in forest cover on ethnic minority groups, such as the *Dao* and the *H'mong*, that practice slash-and-burn shifting cultivation (Dang Nghjem Van, 1991; Morrison and Dubois, 1998). The *Dao* within *Ngoc Phai* Commune, despite having adopted fixed settlements since 1962, are included in the above group because they continue to use slash-and-burn practices.

The *Tày* ethnics were the first settlers in *Ngoc Phai* Commune, and now control the majority of the paddyfields there. However, it would be an oversimplification to view *Dao* agriculture as confined to the uplands and *Tày* agriculture to the lowlands. There are *Tày* who have been without paddyfields since the land reallocations of the early 1990s, and there are *Dao* who have gained access to lowland paddyfields through the recently-created land market in *Ngoc Phai*.

To assist households in developing production systems that are more environmentally sustainable, we must first understand the processes and circumstances that have led to people's current practices. We also must characterize the diversity of existing household production systems to ensure that our proposed technical and organizational innovations are adapted to the local community's objectives and constraints. Towards this end, this chapter presents two components of a monographic study of *Ngoc Phai* Commune: (i) an historical analysis of commune-level agrarian dynamics and their environmental impact, and (ii) a farm-household differentiation study.

2. Methods

2.1. Selection of Ngoc Phai Commune

Cho Don District, situated approximately 220 km north of *Ha Noi*, is one of six districts of *Bac Kan* Province. The total area of the district is approximately 92,000 ha and the population 46,800, for an average population density of 51 people / km ^{2}. The *Tày* ethnic group makes up 76% of the population. The other ethnic groups, in order of size, me the *Dao* (10%), the *Kinh* (10%), the *Nung* (2%), and the *H'mong.*

Within *Cho Don* District, we selected *Ngoc Phai* Commune for our monographic study based on the agro-ecological zoning of *Cho Don* District (Castella et al., 2002b). The commune captures the diversity of landscapes, ethnic groups, and agronomic issues present in the district (Bal et al., 2000).

2.2. Relating farming systems to land-use changes

The overall approach was based on relating farming systems to land-use changes. There were four main steps in the study:

- The agro-ecological zoning of the district, on the basis of which the *Ngoc Phai* Commune was chosen for the study. This was based on the analysis of secondary data (maps, statistics, etc.);
- An examination of agrarian system dynamics over the last five decades, with information gained from surveying witnesses to the commune's history;
- An examination of land-use changes, with the use of a cbronological series of aerial photographs (1983, 1989) and SPOT satellite images (1990, 1995 and 1998);
- Surveys of a sample of farmers (n = 250) representative of the diversity of groups present in the commune. Using a semi-structured questionnaire, we quantified the land use of individual farms and their associated options for future production systems. This allowed us both to explain the present diversity and to identify patterns of future agricultural land use evolution.

3. A tiered system of land use and access

3.1. Tày - Dao: a dual agrarian system (up to 1960)

The *Tày* and the *Dao*, historically the two dominant ethnic groups in the studied region, have traditionally occupied different tiers of the ecosystem. These two ethnic groups have distinct cultural norms and practices, and the evolution patterns of their land use systems have followed unique courses, even if shaped by the same State policies.

Until the establishment of cooperatives in 1960, the *Tày* inhabited the lowlands and the *Dao* inhabited the uplands. The *Tày* cultivated an annual irrigated rice crop, using a collective system of water and labor management based on mutual aid. The plentiful lowland area met the needs of a still-small population (density < 10 people / km^2). On the gentle slopes bordering the lowlands, *Tày* farmers cultivated maize and cassava as feed for pigs, or less commonly as a security against food shortages from poor rice harvests or natural disasters. Some families built terraces for rice production on sloping land, despite the availability of lowlands and the burden of such construction. Buffaloes were raised both for draft power and manure for fertilizing paddyfields. Social differentiation was based on land ownership; early arrivals to a village tended to gain possession of the largest and most productive paddyfields.

The *Dao*, the "people of the forest," were primarily producers of upland rice, but also cultivated maize and cassava. Their shifting cultivation system was based on swidden agriculture with long fallow periods, necessitating frequent migrations. The gathering of forest products (bamboo shoots, wild vegetables, mushrooms, etc.) and hunting of still-plentiful game played essential roles in the *Dao* system, particularly in times of food shortage. Fields were grouped together to limit crop losses to wild animals, but the typical hamlet consisted of only two to four households. Upland territory was subject neither to *Tày* like land regulations nor to taxes levied by the French colonial administration. A plot belonged to the family that had cleared it for the duration of use, but became available for other users as soon as it was abandoned. Given the lack of permanent property, land ownership was not a criterion for social differentiation. The socially elevated in a *Dao* community were those who had water buffaloes (up to six per family), which served as a kind of savings as well as being useful for transportation when hamlets were being relocated. Interactions between the *Dao* and the *Tày* were rare, as their respective production systems were based on very distinct landscape units. Table 1 presents the main characteristics of the pre-cooperative systems. With *Viet Nam*'s independence in 1954, the traditional system began to see growing intervention by the State.

Table 1: *Comparison of the traditional Tày and Dao cultivation systems*

Ethnic Group	*Tày*	*Dao*
System Type	Sedentary	Shifting
Location	Lowlands	Uplands
Main crop	Irrigated rice	Upland rice
Limiting factor of upland field area	Labor	Weeds
Type of upland fallow	Short (5-10 years)	Long (20 years)
Importance of forest products in diet	Medium	High
Role of buffaloes	Plowing, fertilizer	Capital, transport.

3. 2. Institutionalizing mutual aid

The first land reform occurred in 1954, and aimed to create equality in rural areas by confiscating land from wealthy landowners and giving it to the most impoverished. In *Ngoc Phai*, as in all of *Cho Don* District, the reform had only a minimal effect because of the low level of social differentiation (Tran Van Ha, 1993). In the lowlands, agricultural officers oversaw the creation of mutual aid groups composed of an average of five households each. At this stage, only the *Tày* participated. Thus, the mutual aid groups effectively institutionalized the traditional *Tày* system of mutual aid for water and labor management. The official mutual aid system made possible an increase in irrigable land area, which resulted in increased productivity.

3.3. The agricultural cooperatives

In 1960, the first cooperative, ten households in size, was in *Phieng Lieng* village, populated by the *Tày*. Its success encouraged all the other villages in *Ngoc Phai* Commune to organize themselves as cooperatives. Membership was voluntary, but with time the free-market system dwindled away, and it would have been difficult for any individual to exist separately from a village cooperative. Nonetheless, there were villages in *Bac Kan* Province that did not become cooperatives.

In 1961, a national program attempted to settle the country's ethnic minorities permanently. The goals of the program were to settle the ethnic minorities in regions where they could contribute to cooperative production, and also be more effectively observed and controlled by local authorities. This program placed eighteen *Dao* families into *Tày*-populated *Ban Cuon* village, on the terraced lower slopes. Some *Tày* families took the opportunity to leave *Ban Cuon* and join other *Tày*-dominated cooperatives, while others stayed to work alongside the *Dao* in the village. In spite of the departures of some *Tày* families from *Ban Cuon*, the arrival of *Kinh* migrants from the overpopulated Red River delta resulted in substantial net population growth in the area. Between 1964 and 1974, more than 4,000 *Kinh* passed through *Cho Don* District to build the road connecting *Bac Kan* and *Ba Be* towns, and some stayed behind after the work was finished. The result was a migration of the immigrant *Kinh* toward the interior of the commune and increased pressure on commune paddy fields (Figure 2).

In; 1962, *Ngoc Phai* Commune was composed of two distinct cooperatives: the predominantly *Dao* cooperative in *Ban Cuon* village, and the *Ba Ngoc* cooperative containing the other five *Tày* villages. Though founded on prin-ciples of egalitarianism, the cooperative system resulted in a marked diffe-rentiation of villages based on per capita ricefield area. Despite low population density (Figure 1)1, the return per person per day on a paddyfield was fairly unequal, ranging from 0.8 kg in *Ban Cuon* Cooperative to 1.5 kg in *Ba Ngoc* Cooperative. Like the

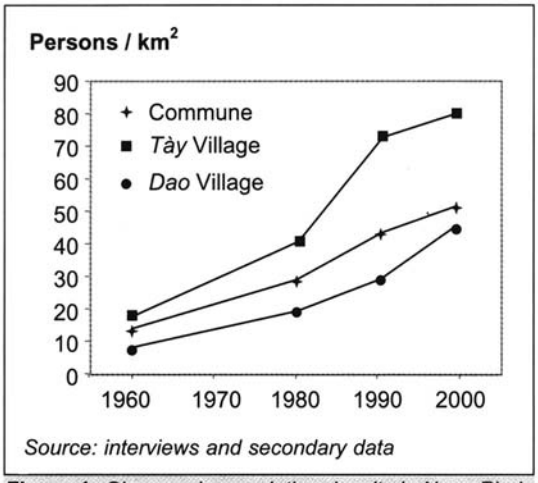


Figure 1: *Changes in population density in Ngoc Phai Commune*

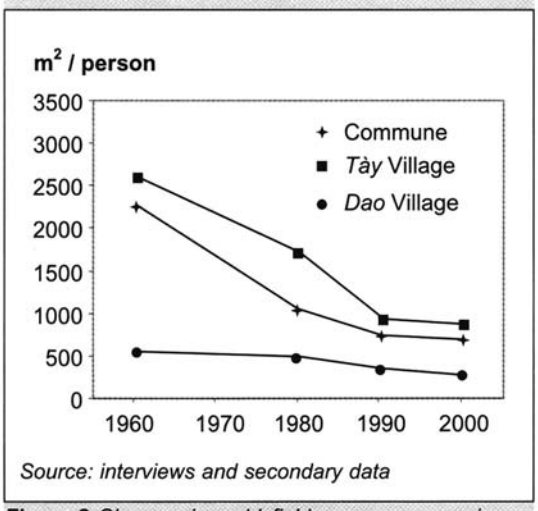


Figure 2: *Changes in paddyfield area per person in Ngoc Phai Commune.*

traditional livelihood systems, the new system was split along ethnic lines: the *Dao* cooperative farmed an average paddyfield area of 550 m^2 per person, compared to 2600 m^2 in the *Tày* cooperative (Figure 2).

As the *Tày* cooperative intensified its rice cultivation systems (by introduction of two rice crops per year, expansion of irrigated area, new photoperiod-insensitive short-cycle varieties, use of chemical inputs, plow innovations, etc.), paddy yields were stagnating and even declining in the *Dao* cooperative (1.7 t/ha compared with more than 5 t/ha in the *Tày* cooperative). Lowland paddyfield production did not meet the food requirements of *Ban Cuon* village, leading the *Dao* cooperative there to turn to the uplands. The remuneration systems differed substantially between lowland and upland cultivation: a large proportion (30%) of lowland production went to the State, whereas the full production of the uplands was shared among cooperative members. Further, swidden fields cleared from primary forests offered higher rice yields: 4 t/ha in swidden fields compared to lowland yields of 1.7 t/ha/year (1 crop cycle; *Dao*) and 5.0 t/ha/year (2 crop cycles; *Tày*), and higher labor productivity: 32,000 VND/day in swidden versus 20,000 VND/day in lowland paddyfields, both in 1999 VN Dongs. With work on swiddens considerably more profitable than on paddyfields, it is not surprising that the *Dao* did not invest in intensifying paddyfield productivity.

As disparities between the cooperatives progressively deepened, new disparities arose among individual households within the *Dao* cooperative. Some households in the *Dao* cooperative developed private swidden fields alongside the collective

swidden fields. The blurred borders between collective and private sloping lands made it easy for households with large labor forces to engage in more-profitable private activities (upland rice, pig raising, forest product extraction, etc.) once they had completed their required collective work.

In contrast, the *Tày* cooperative did not develop private production. They achieved food security through ricefield intensification,and their demanding rice field work schedules did not leave enough time for the cultivation of swidden crops. In summary, a double process of differentiation occurred: (i)between collectives, based on per capita paddyfield area; and (ii) among households within the *Dao* cooperative, based on the ratio between a household's labor force and number of mouths to feed (Sadoulet et al., 2002).

3.4. Crisis in the 1970s

In 1970, the two village cooperatives were merged into one large commune-level cooperative. The new level of management brought bureaucratization and reduced flexibility, leading to a growing lassitude on the part of cooperative members. Chemical input allocations were poorly organized, and yields dropped as low as 2t/ha cycle in spite of the cooperatives' successes with Green Revolution technologies before they merged.

Exacerbating the situation, the commune population had doubled in the preceding twenty years (Figure 1). Population growth exceeded the rate of new paddyfield construction, causing paddyfield area per person to drop by approximately 40% (Figure 2). The return on labor used in paddy production was steadily declining, and cooperative work could no longer meet households' needs. Therefore, farmers of all ethnicities turned to the hillsides, in spite of bans imposed (but not yet enforced) by authorities. Specifically, a 1975 forest-protection law restricted the right to harvest wood to State forestry enterprises, and launched the first forest plantation programs, but was received with general disinterest by the *Ngoc Phai* population. Slash-and-burn practices were made punishable by severe fines, resulting in a food crisis between 1977 and 1980, bringing *Ngoc Phai* to the edge of famine.

3.5. Decree 100, the first step toward decollectivization

In response to similar food crises throughout the country, the State passed Decree 100 in 1981, allocating paddy fields for 4-5 years to households based on the number of family members. Households owed a fixed amount of their production to the cooperative, based on the size and quality of their fields, but were free to retain any surplus for themselves. Families that had not owned cattle before the collective period could now sell some rice and use the income to take advantage of low prices (50% of animals' cooperative-period value).

In *Ngoc Phai*, the new regulations had effects opposite from what was intended. Paddyfield productivity did not increase substantially because of continued problems with cooperative management, for example with allocations of chemical inputs. Labor continued to be more profitable on swiddens than on paddy fields, and hillside cultivation dominated, to the detriment of paddyfield intensification. In 1983, the high profitability of swiddens led to an uncontrolled rash by *Tày* farmers to claim as much forestland as possible. Within five years, swidden cultivation had claimed all of the commune's clearable land. Plots were often so far from the villages that farmers had to live in temporary bamboo shelters during the cultivation season.

The *Tày* and *Dao* villages again turned to divergent land uses. In the Dao villages, sloping lands were used primarily for upland rice. Production exceeded consumption needs, and farmers stored upland rice surpluses in granaries for farm security, but sold surplus irrigated rice. *Tày* farmers likewise used some uplands to grow sticky rice, but treated their upland rice as a cash crop. The *Tày* did not stockpile their rice surpluses; both upland and lowland surpluses were sold. In addition, Thy farmers used some swidden fields to grow maize for pig raising, which was rapidly developing thanks to the introduction of faster-growing hybrid breeds. Hybrid pigs required considerably richer diets than their traditional cousins, hence the increase in land area devoted to maize.

The period following Decree 100 led to significant household differentiation within villages in *Ngoc Phai* Commune (Sadoulet et al., 2002). Paddyfields had been distributed based on the total number of individuals in a household, whether productive (laborers) or non-productive (children, elderly, or invalids). Households with greater proportions of laborers could more quickly complete their mandatory lowland work and engage in more profitable activities such as swidden cultivation. In contrast, households with small proportions of laborers had to struggle to meet their work obligations, and faced penalties when quota were not achieved. Table 2 summarizes the differences in relative land and labor endowment, and resulting strategies, between the two household types that developed during this period.

Table 2: *Land use strategies (types A and B) developed by households after Decree 100*

Household type	A	B
Ratio of laborers to number of mouths to feed per household	+	-
Ricefield area per laborer	-	+
Swidden area per laborer	+	-
Production strategy		
- Cash crops	+	-
- Maize and livestock	+	-
- Land accumulation	+	-
Capital accumulation	+	-

N.B.: The (+) sign represents an increased value and the (-) sign a decreased value of an indicator.

During the Decree 100 period, increasing private production (mostly extensive slash-and-burn agriculture) resulted in (i) better nutrition for farmers, (ii) the beginning of capital accumulation, (iii) a notable deterioration of forest resources, and (iv) differentiation among households.

3.6. Resolution 10, the second step toward decollectivization

The disparities caused by Decree 100 prompted the State to pass Resolution 10 in 1988, bringing about the dismantling of the cooperatives. Farmers gained control of all cropping activities, chemical input allocation, and irrigation. They regained all of the means of production except the land, for which they were granted usage rights by the State. Specifically, paddyfields were redistributed in proportion to the number of laborers in each household. Each household was free to use all the production from their land however they chose. The family farm became the elemental unit of production and a free, private market developed including purchase/sale of rice, fertilizer, equipment such as huskers, and buffalo meat targeted at *Ha Noi* consumers.

The latest in a long series of policy changes, Resolution 10 finally was able to stimulate increased paddyfield production, helped by the declining profitability of slash-and-burn production. Farmers began to invest more time and capital in paddyfields, and yields per crop increased. In addition, a substantial proportion of paddy fields passed from one crop per year to two.

At this time, a group of *Tày* founding families (i.e. historically the first settlers in the area) in neighboring *Cao Bang* Province began a movement to reclaim ancestral lands, a movement that quickly spread through all of *Bac Thai*[1]. Farmers who had not been members of the pre-1954 *Tày* mutual-aid groups were divested of almost all of the lowland plots that they had been farming since the creation of the first cooperatives in 1960. The ownership of rice fields that had been built during the cooperative period was settled in negotiations. Land conflicts occasionally arose but the reallocation process was irreversible, and households in *Ngoc Phai* soon differentiated based on access to paddyfields. After the founding families reclaimed their ancestral lands a dual agrarian system emerged again based on the following two household types:

The *Tày* founding families. By 1991, the founding *Tày* families had claimed almost all paddyfields in *Ngoc Phai*. Most were growing two crops per year, and the increasing availability of chemical inputs along with the use of organic fertilizers (pig and buffalo manure) contributed to a further increase in yields (up to 2.8 t/ha/cycle). For these well-endowed households, the period was marked by the intensification of irrigated cultivation in the lowlands and the progressive

[1] *Bac Kan* Province was created in 1997 from the joining of two districts in *Cao Bang* Province and a part of *BacThai* Province.

abandoning of upland rice. Labor productivity on sloping land (8,000 VND/day) had become considerably lower than on the paddyfields (20,000 VND/day). **The landless**. Regardless of their ethnic heritage, families who were living outside of their native villages were deprived of their paddyyfields. In *Ban Cuon*, the *Dao* community retained only one hectare of their paddyfields, a field that had been built during the cooperative period. The combination of increased demographic pressure and the loss of paddyfields forced the *Dao* to expand their swidden areas, and the search for fertile forestland led them well beyond the borders of the village. But with population density now near 29 people/km^2, forests old enough to provide swidden yields comparable to pre-cooperative times (2t/ha) were difficult to come by (Husson et al., 2001). Farmers increased the number of successive years of cultivation and decreased the length of fallow periods (Castella et al., 2002).

Some families chose at this time to migrate to s outhern *Viet Nam*, drawn by the intensive development of coffee crops on pioneer lands (De Koning, 1999; Alther et al., 2002).Others, mostly of *Kinh* origin, opened small shops along the roads. Poor households turned to the extraction of forest resources, which provided a necessary complement to their income.

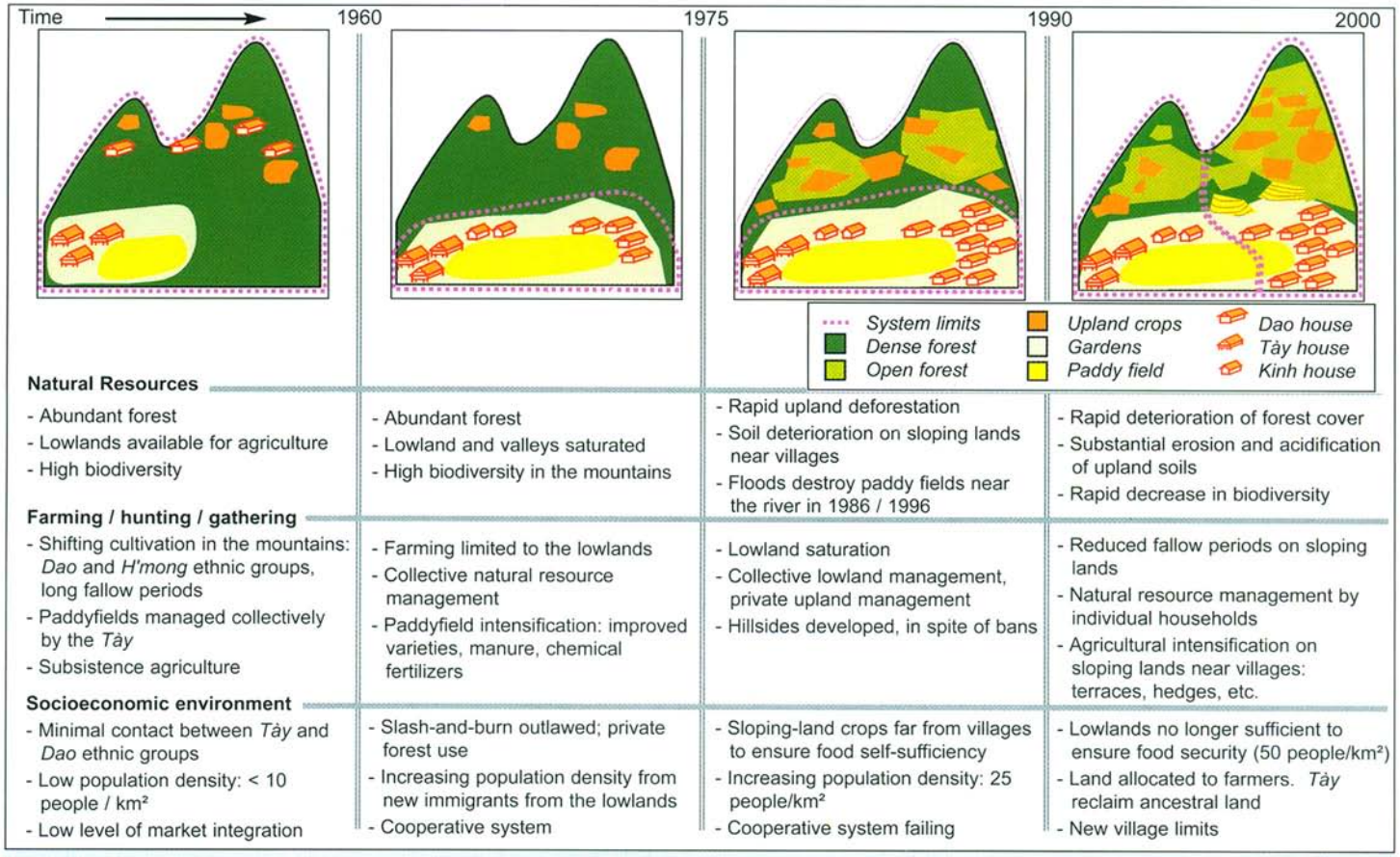
3.7. The 1993 land law

The 1993 land law ratified the land redistribution process that had already begun. Use rights both for flatlands with annual crops (paddy fields) and for aquaculture ponds (fish farms) were allocated for periods of 20 years, whereas use rights for forestland were allocated for periods of 50 years, though all land was still officially owned by the State. Famers could now transfer, sell, buy, rent, and inherit land-use rights.

After almost 10 years of changing land-access rules, clearly defined use right and access to paddyfields and forests caused new production strategies to develop (cf. Section 4). The new rules and the production strategies that they engendered both have remained stable to the present day.

3.8. Agrarian dynamics, landscape transformation, and environmental impact

Figure 3 summarizes the main phases in the evolution of the agrarian systems of the *Dao* village of *Ban Cuon* and the *Tày* village of *Ban Dieu*, in terms of both agrarian dynamics and related socioeconomic transformations. The land use maps in Figure 4 reveal the environmental impact of those agrarian dynamics. Between 1983 and 1989, swidden fields were extended, beginning with the area around the commune's paddyfields, dwellings, and roads. Hillside cultivation was much more important in the *Tày* villages than in the *Dao* village of *Ban Cuon* (Figure 5, north-west of the map). The *Dao* had already been cultivating the hillsides for



	1960	1975	1990	2000
Natural Resources				
	- Abundant forest - Lowlands available for agriculture - High biodiversity	- Abundant forest - Lowland and valleys saturated - High biodiversity in the mountains	- Rapid upland deforestation - Soil deterioration on sloping lands near villages - Floods destroy paddy fields near the river in 1986 / 1996	- Rapid deterioration of forest cover - Substantial erosion and acidification of upland soils - Rapid decrease in biodiversity
Farming / hunting / gathering				
	- Shifting cultivation in the mountains: *Dao* and *H'mong* ethnic groups, long fallow periods - Paddyfields managed collectively by the *Tày* - Subsistence agriculture	- Farming limited to the lowlands - Collective natural resource management - Paddyfield intensification: improved varieties, manure, chemical fertilizers	- Lowland saturation - Collective lowland management, private upland management - Hillsides developed, in spite of bans	- Reduced fallow periods on sloping lands - Natural resource management by individual households - Agricultural intensification on sloping lands near villages: terraces, hedges, etc.
Socioeconomic environment				
	- Minimal contact between *Tày* and *Dao* ethnic groups - Low population density: < 10 people / km² - Low level of market integration	- Slash-and-burn outlawed; private forest use - Increasing population density from new immigrants from the lowlands - Cooperative system	- Sloping-land crops far from villages to ensure food self-sufficiency - Increasing population density: 25 people/km² - Cooperative system failing	- Lowlands no longer sufficient to ensure food security (50 people/km²) - Land allocated to farmers. *Tày* reclaim ancestral land - New village limits

Figure 3: *Agricultural and socioeconomic transformations in Ngoc Phai*

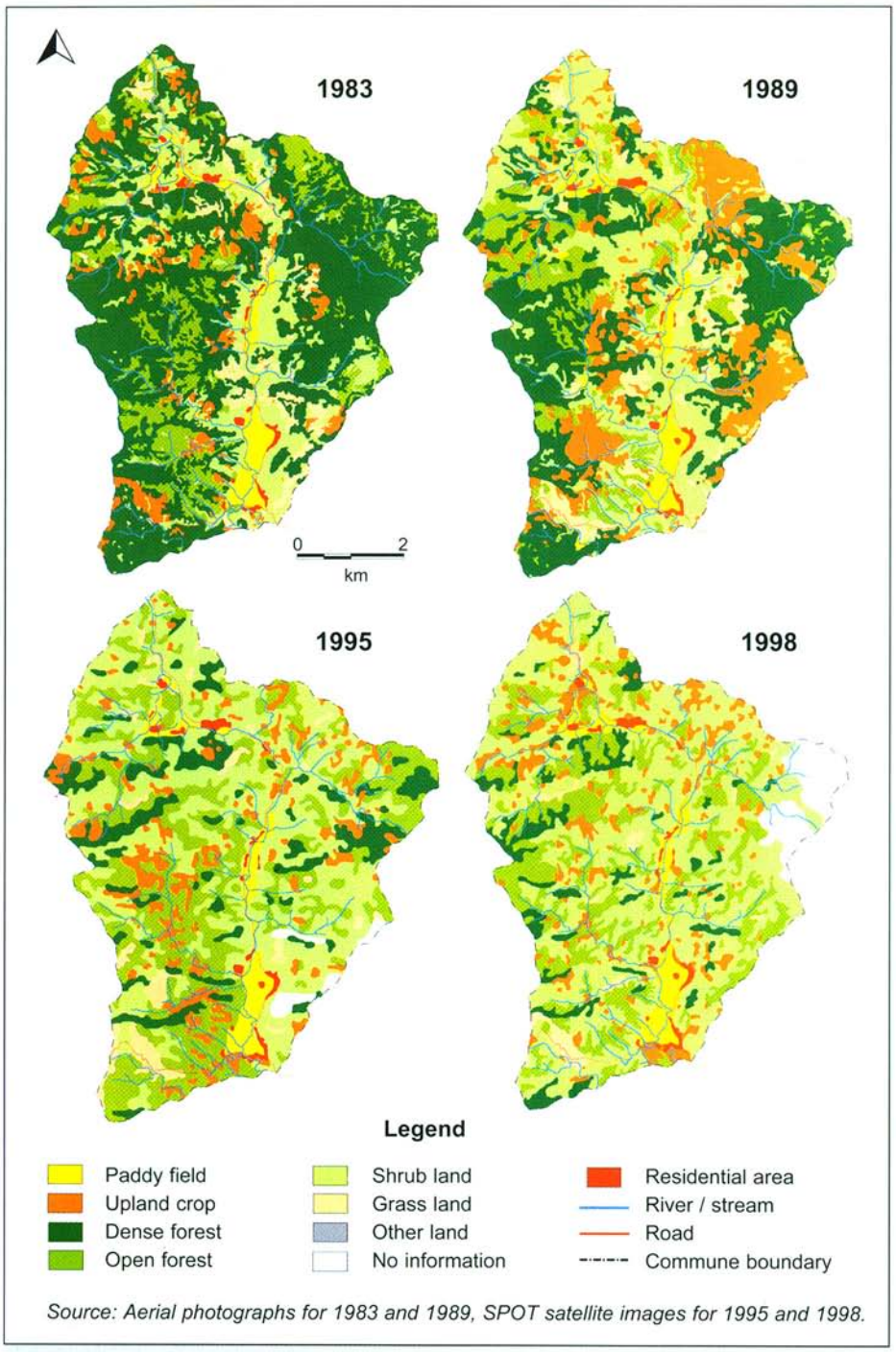


Figure 4: *Land use maps of Ngoc Phai Commune for 1983, 1989, 1995, and 1998.*

years, and cultural norms opposed the clearing of any more land than was necessary. Thus, their practices on the hillsides did not substantially change during the Decree 100 period (1982-1988). Instead, in *Ban Cuon* there was substantial expansion of paddyfield area and a relative regeneration of forestland, characteristic of a slash-and-burn system with a long fallow period. The *Tày* villages, in contrast, had been concentrating on lowland fields for years, so for them the availability and profitability of the hillsides was new - they rushed to clear and claim as much land as possible.

By the end of the 1980s, *Tày* households were cultivating all accessible arable sloping]roads in their villages (Figure 6). Natural forest cover (forest and shrub land from Figure 6-A) reached its lowest level in the history of *Ngoc Phai*. The upland rush naturally ended with the exhaustion of upland forest areas, and was soon followed by the *Tày* movement to reclaim ancestral paddylands, which effectively reversed the *Tày*/*Dao* agrarian dynamics of the 1980s. As the *Tày* in the south of the commune focused on their newly-acquired paddy fields, the forest regenerated. Meanwhile, deprived of their paddyland fields, the *Dao* resorted to increased sloping-land cultivation (Figure 6-B) with shortening fallow periods and more land being cropped continuously.

Recently, farming landscapes in *Tày* villages have reached a sustainable balance, while the environmental degradation around the *Dao* village has been aggravated by a large-scale return to slash-and-burn systems. Such systems, driven by the lack of access to paddylands, are steadily destroying the resource base on which they draw, and local farmers are looking for alternatives (Castella et al., 2002).

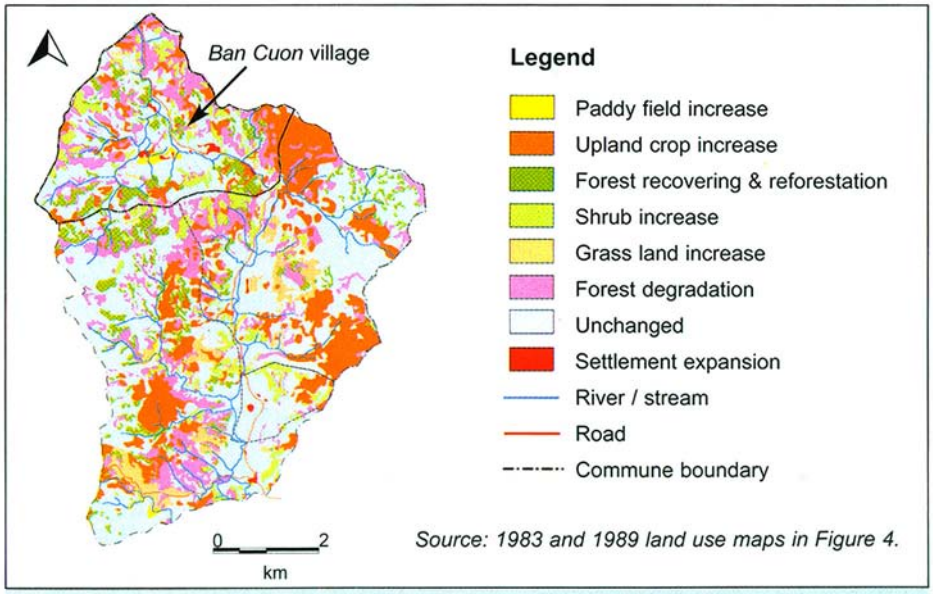


Figure 5: *Land use changes in Ngoc Phai Commune between 1983 and 1989.*

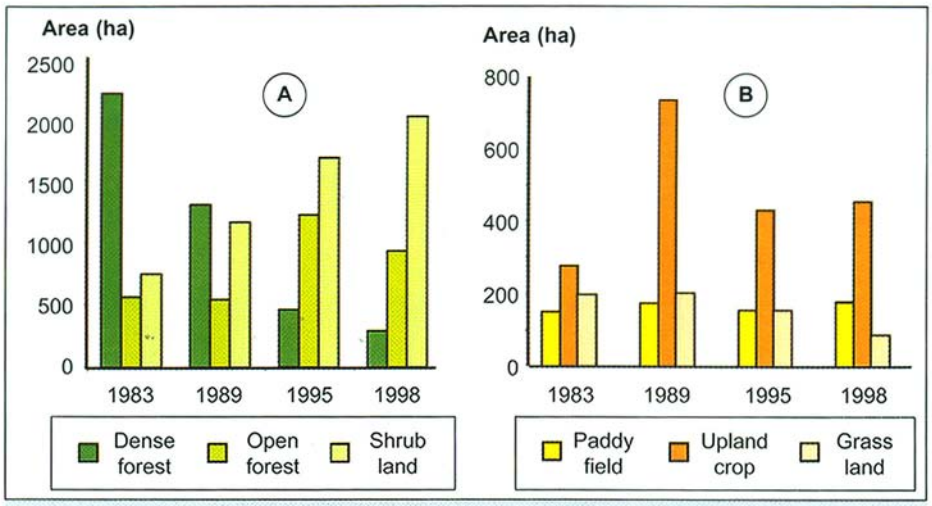


Figure 6: *Land use changes. A: Forest and natural vegetation, B: Farmland*

3.9. The evolution of animal husbandry practices

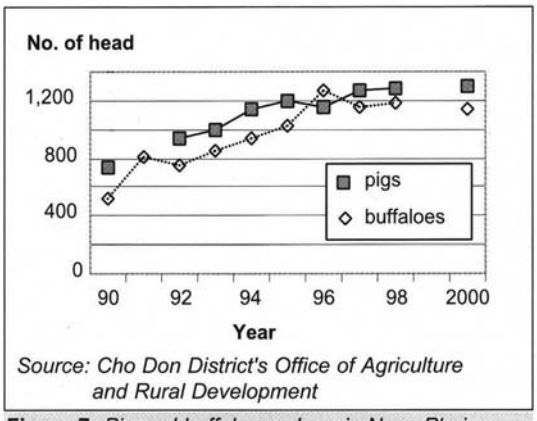
Animal husbandry in the commune expanded both as a means of storing capital for Farmers and as a response to the recent development of the meat market for the delta zones (Figure 7). The steep increase in numbers of large ruminants (buffalo and cattle) has created a threat to sloping lands and forests. The transition from collective herd management to management by individual households has led to free-grazing practices in both the lowlands and hillsides, resulting in an increased number of disputes between farmers (Eguienta et al., 2002). Livestock owners returned to this traditional practice because individual households did not have enough labor force to tend a few head of livestock all year round.

Farmers have developed a number of solutions to the problems caused by roaming animals:

- Building fences (of wood or bamboo) for the short term and then planting hedges and digging trenches around cultivated plots;
- Temporarily (during the crop cycle) establishing shelters close to agricultural plots to better survey crops;
- Growing crops in areas inaccessible to animals.

In *Ban Cuon*, the existing upland crop systems determined the methods of buffalo management. The animals were monitored during the day and stabled in the evenings throughout the whole upland rice-growing season. Given that a specific plot could be planted to upland rice for no more than 4 successive years, and that their areas were often large, *Dao* farmers were not willing to invest in hedges and trenches. In contrast, terraced paddyfields can be cropped permanently. Thus the users often built barriers around their terraced paddyfields.

In the *Tày* villages, swidden crops were systematically protected with hedges and trenches. Animals were rarely monitored, even during the growing season. Sloping land cultivation thus required an increased investment (fence building or planting hedges) if crops were to be protected from roaming animals. *Tày* farmers often chose simply not to cultivate those areas where buffaloes were present in large numbers.



Source: Cho Don District's Office of Agriculture and Rural Development

Figure 7: *Pig and buffalo numbers in Ngoc Phai Commune*

The free-grazing practices of *Tày* fan-hers have not soothed relations between ethnic groups in the region. *Tày* previously had abruptly removed the *Dao* from their paddyfields by the ancestral land reclamation movement, and now *Tày* livestock are causing a major problem for the *Dao*'s upland harvests. Researchers are looking for solutions that will undoubtedly require new spatial arrangements to reconcile crop with livestock management on the hillsides (Castella et al., 2002a).

4. Farm diversity and access to the means of production

The previous section demonstrates that historically, ethnicity has been a major determinant of paddyland access and household differentiation. But in present-day *Bac Kan*, the existing diversity in land use and access cannot be attributed exclusively to ethnicity. At present, the comparative advantage of paddyland rice relative to upland rice has made it the priority for farmers of all ethnicities. Where the possibility has existed, *Dao* farmers have established permanent settlements and purchased paddy fields. Conversely, many *Tày* farmers have been forced to turn to shifting cultivation as a means of survival when their paddyland access was restricted (e.g. sons inheriting from their parents paddy area not sufficient to feed their family). Production systems today are no longer divided along ethnic lines.

4. Means of access to paddyfields

The disputes caused by the unequal distribution of the paddylands dissipated toward the end of the 1990s, as land-deprived farmers took stock of the finality of the 1993 land law. That they did not seek to overturn the law indicates that access to paddyfields had been defined relatively clearly and accepted by this time. There remained several means of access to paddyfields.

Purchase of paddyland

In *Ngoc Phai* Commune, the first land sales took place in 1992. The *Tày* who were relocated to the interior of the commune in the 1962 resettlement were the first to sell off their land, either in part or in its entirety. The first paddyfields sold were of low quality: either terraced or in places with poor soil, insufficient water, or insufficient solar radiation (e.g., deep narrow valleys). In *Ban Cuon*, the majority of the *Tày* chose to sell their ricefields to *Dao* farmers for the following reasons:

- The desire to unite separated families: while parents often continued to live in neighboring *Ban Dieu* village, their children were managing lands in *Ban Cuon*.
- Crop dispersion: farmers owned paddyfields in *Ban Cuon*, and maize fields at *Ban Dieu*. By consolidating all their holdings in a single area, their production could become more efficient (less time wasted travelling between sites).
- Yields at *Ban Cuon* were poor in comparison with the restof the commune (resulting from the recent development of the paddyfields).

The *Tày* founders, after reclaiming their ancestral land, were not interested in reselling it. But between paddyfields and sloping-land swidden crops, they soon found that they had more land than they could make use of with their labor force. Their most practical option was a single annual rice crop on paddy land. In terms of efficiency and production per se, it would have made sense to sell off the upland and focus on paddy intensification. Nonetheless, they did not take that option because by continuing to produce swidden crops, farmers could maintain property rights on the cleared land. Nor did they want to divest themselves of any paddyland. Paddylands were the most important component of the production system, and were held to keep land security for future descendants. Therefore, land sales by descendants of founding families have begun to take place only very recently. The sellers tend to be families with insufficient labor to maintain their paddyfields, and a small number of descendants. The profits from sales of paddyland are generally reinvested in new equipment (huskers, hand tractors), livestock (cattle), and cement houses.

By the year 2000, it had become very difficult to find land to purchase in the *Tày* villages, though land transactions continued to take place in *Ban Cuon*. Between 1992 and 2000, the price of paddyfields rose by a factor of four (Figure 8).

Inheritance of paddy fields

A young married couple could gain access to a paddyfield by inheriting a portion of a parent's land. In the *Tày* communities, land traditionally was passed from father to son, keeping the land in the line of male descent and preventing an outsider from gaining access to land through marriage. The *Dao* only recently adopted this principle, having never before been landowners. With the growing shortage of paddyfields and the *Dao*'s difficulties in obtaining them, they have become very attached to patriarchal land inheritance.

Borrowing and lending of paddy fields

Lending most often takes place within a family, between brothers or between father and son. However, a farmer occasionally will lend land to a farmer in another family, if the lender owned more than he was able to cultivate. The lender generally does not receive any compensation for the loan.

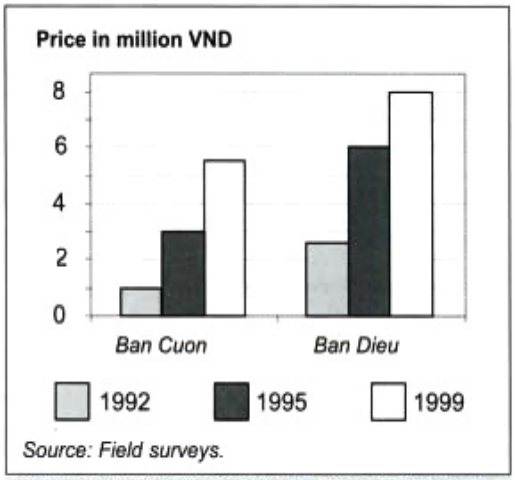


Figure 8: *Paddyfield price changes in two villages in Ngoc Phai.*

N.B.: Average rpice of a 1000 m² paddyfield plot adapted for double-croping in 199 VND.

Tenant farming

Rarely practiced in the commune, but recent examples illustrate the growing interaction between ethnic communities. At *Ban Cuon*, some *Dao* farmers benefited in 1999 from the temporary use of a paddyfield belonging to *Tày* farmers. The *Dao* farmers were allowed to work the land during the spring and reap the harvest. In exchange, they prepared the soil (plowing, harrowing) and provided buffalo manure for the second crop, which was cultivated by the *Tày* landowners.

Renting

We did not observe land renting over the course of our survey, but it existed in the commune between 1993 and 1995. Tenants had to give landowners a sum of money or portion of the harvest in return for the use of the land. According to the former tenants interviewed, this practice did not last long, as landowners preferred to sell their land.

Building new paddyfields

The only households who could engage in the task, particularly in *Ban Cuon*, were those with both many laborers (or enough capital to hire help), and land suitable for development (close enough to a water source for irrigation, few stumps and stones, etc.).

4.2. Means of access to sloping lands

In the early 1990s, forestlands were allocated to households in such a way that most farmers received the rights for whatever lands they were cultivating at the time (Castella et al., 2002). In the swidden expansion of the 1980s, the founding *Tày* families, like the *Dao*, had cleared the sloping lands nearest their settlements.

This forced families arriving later in the collectivization to go farther away (beyond village limits) to find fertile land. Many such households did not claim these lands when forestlands were being allocated in the early 1990s. Some who had the option chose not to act on it, as the land was too far from their residences. There was little benefit in becoming the owner of land that was either unusable or impossible to monitor. Still others were dissuaded by the fear that a tax would be imposed on the new allotments.

Unsanctioned use of common land

In the early 1990', local authorities categorized uplands and specified their uses (Mellac, 1997; Castellaet al., 2002). However, farmers mostly ignored these specified categories. Many farmers continued to cultivate commons supposedly reserved for pastures, protected forests, or zones at the bases of hillsides. Farmers concentrated 'first on common land because (i) they each had signed agreements to protect their allocated upland, whereas the protection of common land was less clearly defined; and (ii) by clearing common land, they hoped that it might one day become theirs. Many farmers realized this hope, as a second allocation in 1997 indeed gave to farmers the common lands that they were cultivating.

Although common land played a relatively small role in *Tày* production, it was essential for the struggling *Dao* households, who relied on upland cultivation. Avoiding cultivation on their allocated lands wherever possible because they had signed protection agreements, *Dao* farmers turned to:

(i) *Communal pasture lands*. In *Ban Cuon*, hill side crops were cultivated intensively in zones initially set aside for animal pasture. In 1999, approximately 60% of households were cultivating upland rice on land officially designated as pasturelands. Local authorities temporarily authorized swidden crops in order to expand the pastureland area. Access to these lands seemed to follow no particular rule: the land could be cultivated even without authorization from the village headman.

(ii) *Land in other villages or communes*. In 1999, ten Dao families from *Ban Cuon* farmed *Tày*-owned land outside of *Ngoc Phai*. Authorities of the neighboring communes eventually put an end to these slash-and-burn practices after several disputes between the *Tày* owners and Dao occupants.

Borrowing and purchase

A few- isolated land transactions did take place between *Ban Cuon* farmers and neighboring villages. One *Dao* farmer "borrowed" a plot of land that had been used in the previous year by another Dao farmer from a neighboring village who had decided to abandon it. We came across only one case of an upland purchase over the course of our research in *Ngoc Phai*. A *Dao* farmer purchased a swidden plot of some 3,000 m^2 for 800,000 VND from a *Tày* farmer of a neighboring commune who had been using the land. This kind of transaction is more

developed in other communes of *Bac Kan* with more severe land scarcity (Alther et al., 2002). Renting and tenant farming do not exist in tile uplands.

Allocated lands covered by forest-protection contracts

Several farming approaches were observed on allocated lands:

(i) A farmer burns a single plot, out of sight from forest wardens (not visible from the road).

(ii) Under the authority of a forest and fruit tree plantation program (e.g., national reforestation program 327, or international development projects), some plots are cleared completely, then planted with seedlings of the desired tree species. This allows several years of planting annual crops between the young trees. Annual cropping ends when the trees grow big enough to block the sunlight.

(iii) A farmer burns wherever he determines that the soil is well adapted to his crop choice, without regard to the forest wardens. In the interest of supporting agriculture, forest wardens keep fines relatively low (Zingerli et al., 2002).

(iv) Since 1999, several poor *Ban Cuon* farmers requested special permission to engage in slash-and-burn practices on their allocated land, as a last resort to feed their households. The commune's forest wardens either granted or denied the farmer this right, based on the quantity and quality of land that he possessed. If the request was granted, the forest wardens then regulated the practice, specifying the area and location of the burn.

4.3. Household typology and livelihood strategies

Based on the access mechanisms described above, several different household types have developed in *Ngoc Phai*, each with it sown particular production strategy. Figure 9 shows the differentiation trajectory that gave rise to each household type. Table 3 identifies the characteristics of the resulting household types and Figure 10 graphically demonstrates their associated production systems. The classification of households permitted us to better understand farmers' current situations and the reasons behind their current livelihood strategies. In this section, we will describe the various production alternatives employed by the various household types

The products of crop and livestock production

At the level of the commune, the main commercial products from crop production were rice, soybeans ,and maize. The owners of the largest paddyfields (households in Types I and II) often sold upland rice surpluses. Naturally, *Ban Cuon* farmers without paddyfields (Type VI) did not sell any upland rice, because they used any upland production for family consumption. All households possessed at least some pigs. Crops with harvests spread across the year, like cassava, were generally grown to feed pigs (all Types) and the sale of animals was

often a significant income source. Depending on the particular husbandry strategy (breeder-fattener or fattener), revenue from pig husbandry could be either immediate or spread out across the year.

In *Ban Cuon*, some Dao farmers (Type IV) were able to raise funds to repurchase paddyfields from founding *Tày* families by selling their buffaloes. Ownership of a substantial number of livestock (5 head or more) at the time when the first paddyfields were being sold by the *Tày* was the major determinant of differentiation in *Ban Cuon*.

The raising of large ruminants (buffaloes and cattle) was an important means of capitalization and long-term saving, whereas pig farming was a medium-term source of income for timely investment needs (expenses related to festivals, chemical input purchases, etc.).

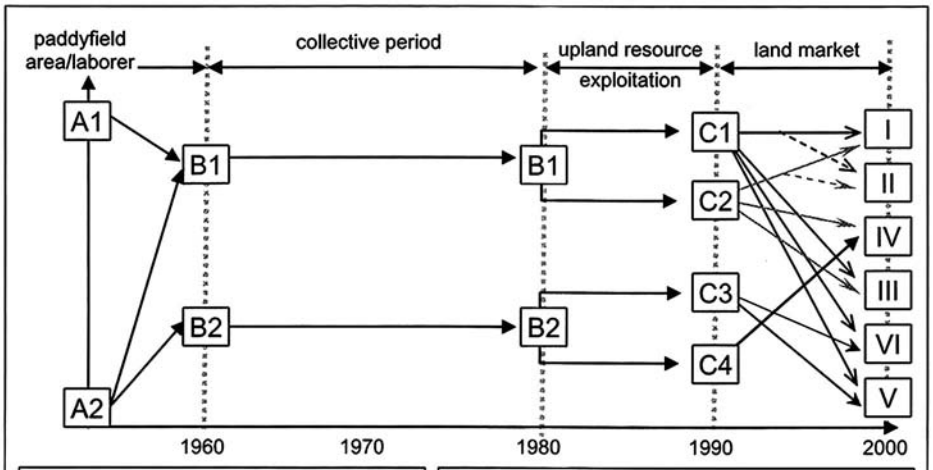


Figure 9: *Household differentiation patterns in Ngoc Phai Commune*

Table 3: *Main characteristics of household types identified in Ngoc Phai*

Farm type	***I***	***II***	***III***	***IV***	***V***	***VI***
Arrival date	founding families	descendants of founding families	founding families	at the beginning of and during the cooperative period		
Family composition	6 to 7 members 3 laborers	4 to 5 members 2 laborers	6 to 7 members 3 laborers	6 to 7 members 3 laborers	4 to 7 members 2 to 3 laborers	5 members 3 laborers
Means of access to paddyfields	reclamation	inheritance	reclamation and purchase	purchase in 1993	no paddyfields	recent purchase
Paddy area / laborer (m^2)	2000-2400	1500-2000	500-700	700-1200	0	500-700
Allocated forest area	3-5 ha	1.5-3 ha	1.5 ha	10-12 ha	*Dao* (Va): 5-10 ha *Tày* (Vb): 1 ha	1.5-3 ha
Rice self-sufficiency	self-sufficient/ surpluses	self-sufficient	shortages	self-sufficient	shortages	shortages
Sale of swidden production	no	maize	no	upland rice	no	maize, upland rice
Annual buffalo sale (no. of heads owned)	yes (6)	no (2)	no (2)	yes (5 – 7)	no (0 - 3)	no (2)
Type of pig raising (no. of heads)	intensive (3 – 6)	intensive (2)	intensive (4)	semi-intensive (8 –12)	light (Va, 1-6) intensive (Vb, 4-6)	intensive (3)
Size of perennial plantations	large	medium	small	large	small	medium
Importance of non-farming activities	unimportant	important	important	important	unimportant (Va) important (Vb)	unimportant
Net revenue / laborer / year (x 1000 VND) (% agric. revenue)	4,820 (100)	4,270 (80)	3,020 (60)	4,050 (75)	2,240 (Va=85, Vb=45)	2,590 (90)

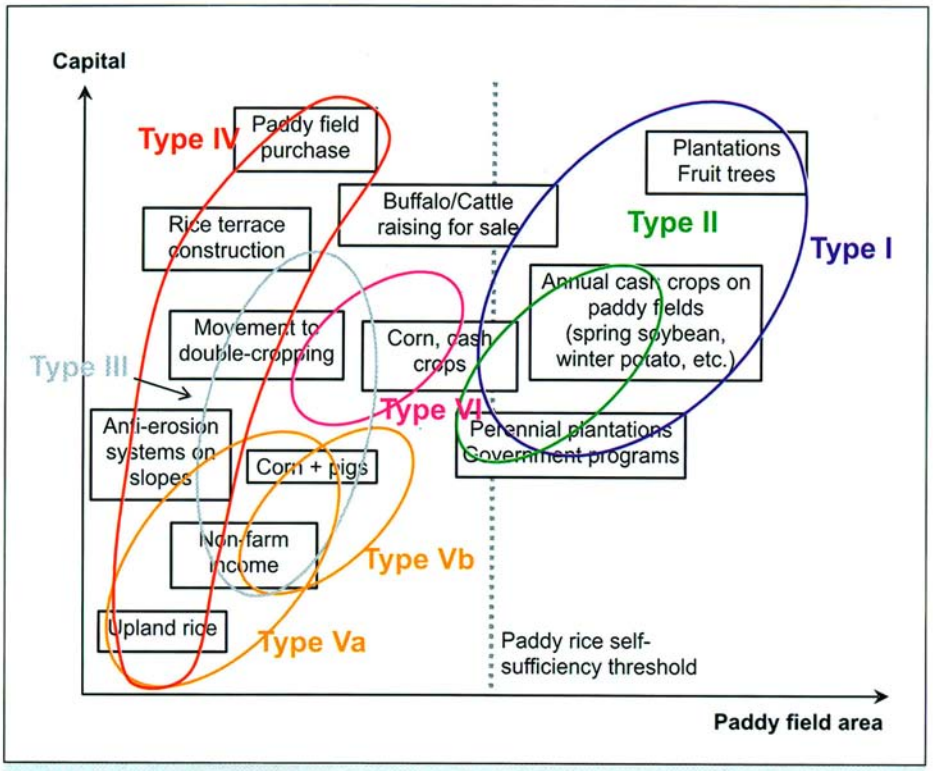


Figure 10: *Options for income generation based on paddyfield area and capital accumulation.*

Non-farm income

In *Ngoc Phai*, the majority of farmers engaged in no-farm activities. The time Given to these activities depended on the household type. The houselhold that Made substantial investments (in time and labor) in non-farm activities were:

(i) households with little or no paddyfield area (Types V and VI),

(ii) households with a high laborer/cultivated area ratio (Types III, IV, V and VI), and

(iii) households with access to forest resources for commercial exploitation.

Principal non-farm activities included:

- *Forest resource use*. The primary non-agricultural activity was the gathering of forest products (Types II, III and IV), including sales of firewood, bamboo, bamboo shoots, rattan, and some kinds of wild animals (snakes, turtles, and rodents).
- *Commerce*. Village shops fell into two categories: (i) households without paddyfields, able to dedicate a large part of their time to commerce (Type Vb); and (ii) households with surplus labor force and sufficient capital to open a shop

while concurrently pursuing their farming activities (Type III). It is often the elderly women who take care of the shop.

- *Other activities*. Non-agricultural revenue also was generated from service provision, such as house construction, brick-making, or motorcycle taxi.

5. Conclusions: strategies based on access to production means, not ethnicity

Historically, the two major ethnic groups populating *Bac Kan* Province inhabited separate tiers of the ecosystem. The sedentary *Tày* cultivated paddy rice in the valley-bottoms, while the nomadic *Dao* harvested rainfed rice on swidden fields in the uplands. The two groups rarely mixed. Historically, the *Tày* received the majority access to lowland fields by privilege of their ancestral rights, and the *Dao* were left to find their livelihoods in the forest.

Since the beginning of Vietnamese independence, several State policies have altered the institutional environment in which mountain people live, and have caused various levels of social differentiation between and within the ethnic groups. At present, both groups follow similar livelihood strategies, basing production decisions on the relative profitability of land and labor dedicated to various activities. These strategies hinge on one crucial factor: access to paddy fields (Castella and Erout, 2002). Where land purchases are possible, we see traditionally-migratory *Dao* farmers willingly taking up sedentary living, to take advantage of the stability of irrigated rice production. Conversely, where traditionally-sedentary *Tày* farmers do not have access to lowland fields, *Tày* farmers have turned to the shifting cultivation systems traditionally practiced by the *Dao*. It is now becoming difficult to draw clear lines between the agricultural practices and lifestyles of these two major ethnic groups in *Bac Kan* Province. Instead of using the traditional criterion of ethnicity, researchers should use households' endowments of land, labor, and natural resources as the key factors for analyzing current circumstances and future rural development actions.

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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 the{r 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

J.C. Castella and Dang Dinh Quang eds. (2002) Doi Moi in the Mountains. Land use changes and farmer's livelihood strategies in Bac Kan Province, Vietnam. The Agricultural Publishing House, Ha Noi, Viet Nam. 73-97.

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 fanning 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 (aspectof 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 fanning 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 farrn management rules*: Quantitative data included family structure, land endowment, main crops mad 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 farmer' assets, objectives, and strategies, identifying five main types of fanning 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 o f *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

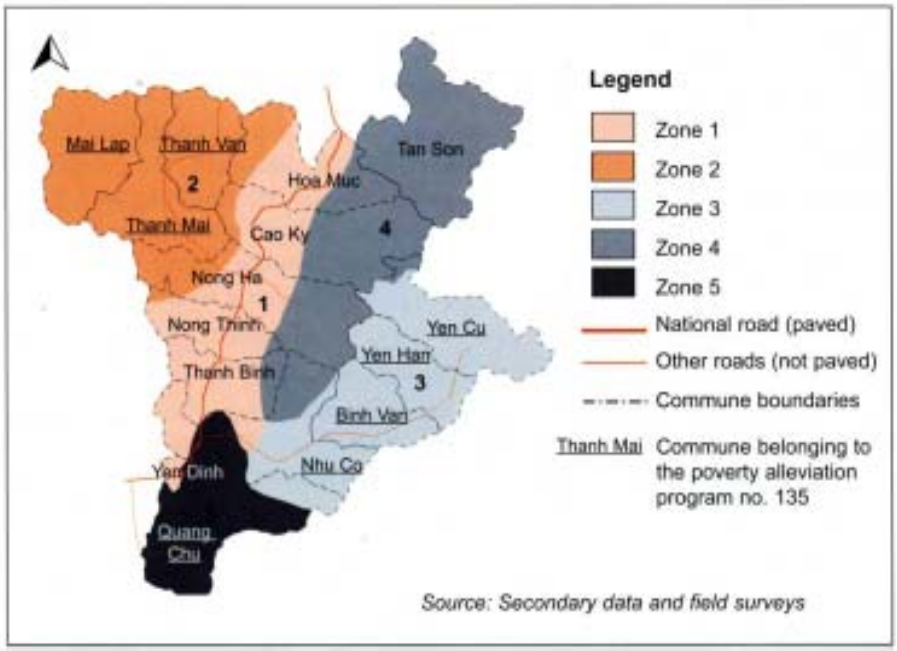
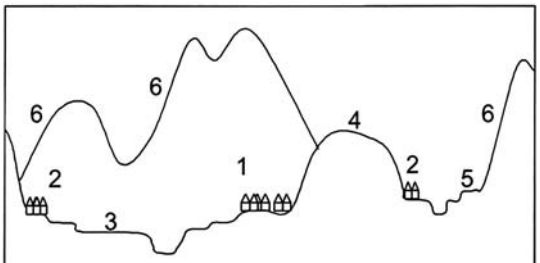


Figure 1: *Agro-ecological zoning of Cho Moi District, Bac Kan Province*

a round 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.



Legend: Most of the dwellings are grouped in villages (1) or hamlets (2) around the main paddyfield area (3). The presence of small rounded hills (4) is particularly noticeable in *Thanh Mai* Commune. Backyard gardens are often located at the bottoms of hills. On the hillsides above the valleys, small terraces (5) are used for single-cropped rice (one rice crop per year). On the steepest hillsides (6), slash-and-burn cultivation is still practiced alongside tree plantations and regenerating natural forest.

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 ah-post 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 agriculture 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 harvest 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.

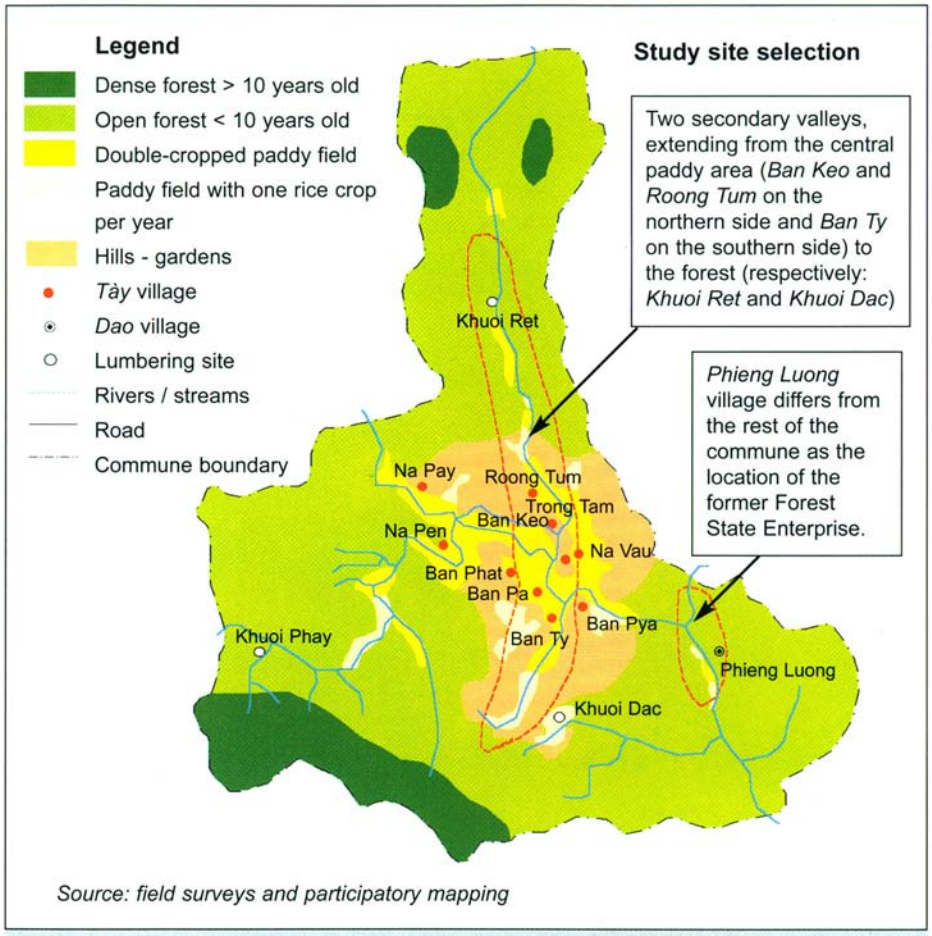


Figure 3: *Land use map of Thanh Mai Commune as of 2000.*

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 m^2. These were the wealthiest families.
- Households with between 500 m^2 and 7000 m^2 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 paddyflelds, 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 months-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 paddyflelds. 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 inproportion 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 fanned it privately. This was the true end of the cooperatives. Across the commune, *Tày* farmers reclaimed the ricefields of their ancestors; their situation rapidly improved and the pressure on hillsides was reduced within a few years. Meanwhile, most K*inh* 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 *Tày* 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 forms as 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 terms 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 die 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 retrained the focus of many farmers to lowland rice, but those farmers left without land, particularly the *Dao*, were forced to turn to the uplands.

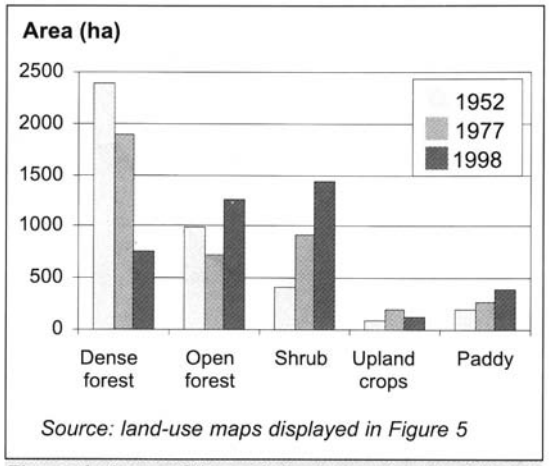


Figure 4: *Areas of the main land-use classes within Thanh Mai Commune in 1952, 1977, and 1998*

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.

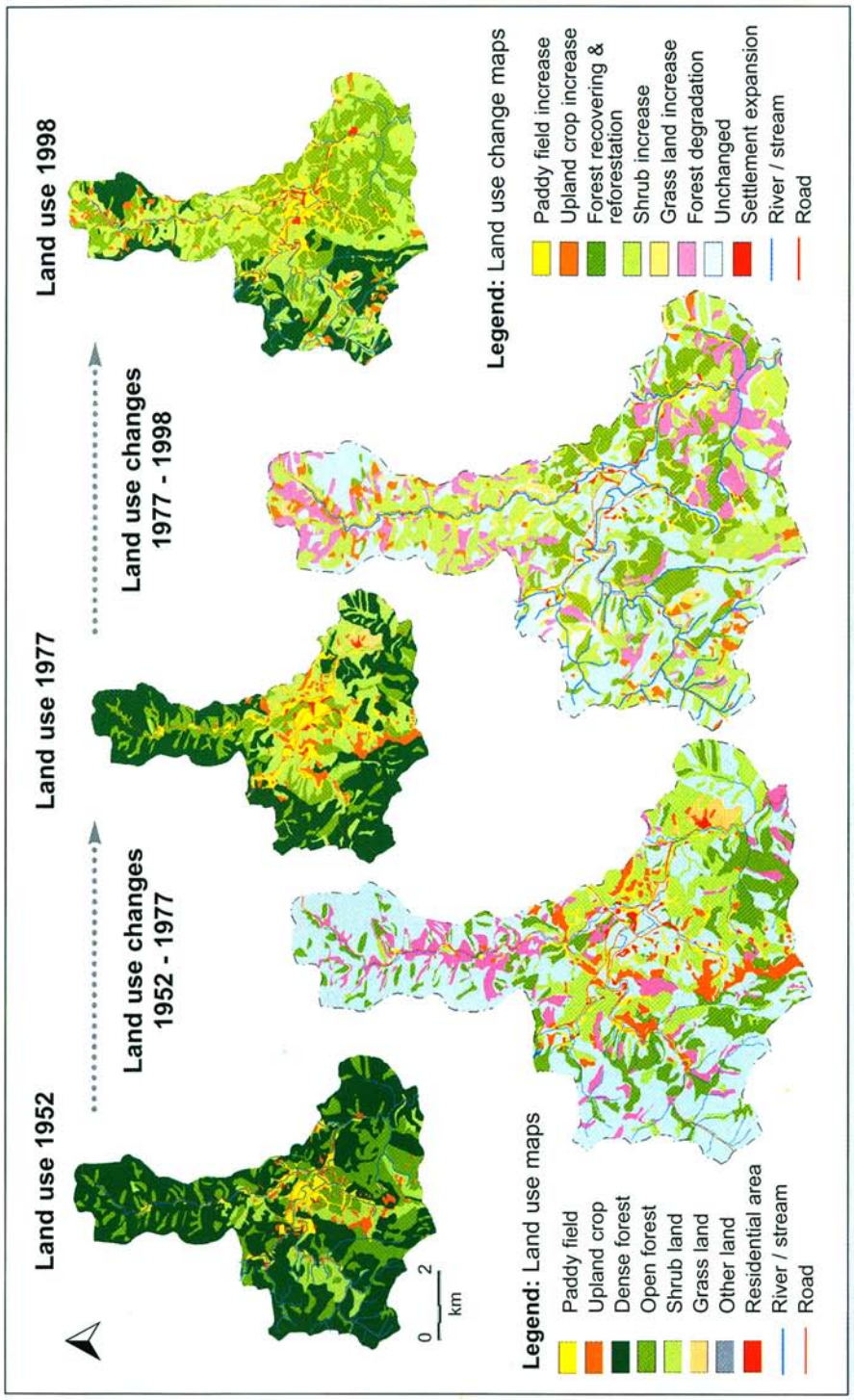


Figure 5: *Land use maps and land use change maps of Thanh Mai Commune as interpreted from aerial pictures.*

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 relocatiny 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 m²	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 m²	-	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		1t (f)-0,5t (d)	20	600 000	30 000
	Apricots	60 trees / 1000 m²	150 000 (4 y without production)	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 m²)	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 m²	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
- large paddy area (~3000 m²/w) - winter cash crops in paddyfields - pig fattening - capital accumulation - hired labor force - village lenders	- medium paddy area (600 - 2500 m² / worker) - forest product gathering and slash -and-burn cultivation	
	- small sloping or forest land area - low-investment animal raising (pigs, fish, goats) - borrow small amounts of money	- 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
- little or no paddyfield area (often converted to fish pond) - minimal capital - rice insufficient - few buffaloes, if any - house near paddyfield	
- young families with high mtf/w - small upland areas - forest product gathering or working as a carpenter	- 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
- 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)		- *Phieng Luong* (lumbering site) households - paddyfields with one rice crop/year plus other annual crops - large plots of forest land - diversified crop and animal husbandry systems - few fish ponds
- sufficient paddy area - established perennial cropping and animal husbandry systems - access to long-term credit	- small paddyfield area - moderate forestland allocations - perennial plantations and animal husbandry systems not yet established - access only to small credit	

Type 2 families own medium paddy areas (600 to 2500 m2/worker), acquired either through inheritance *(Tày)* 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 m^2/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 m^2. 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 m²	500-7000 m²			< 500 m²	
<2	Type l	Type l	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-form 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

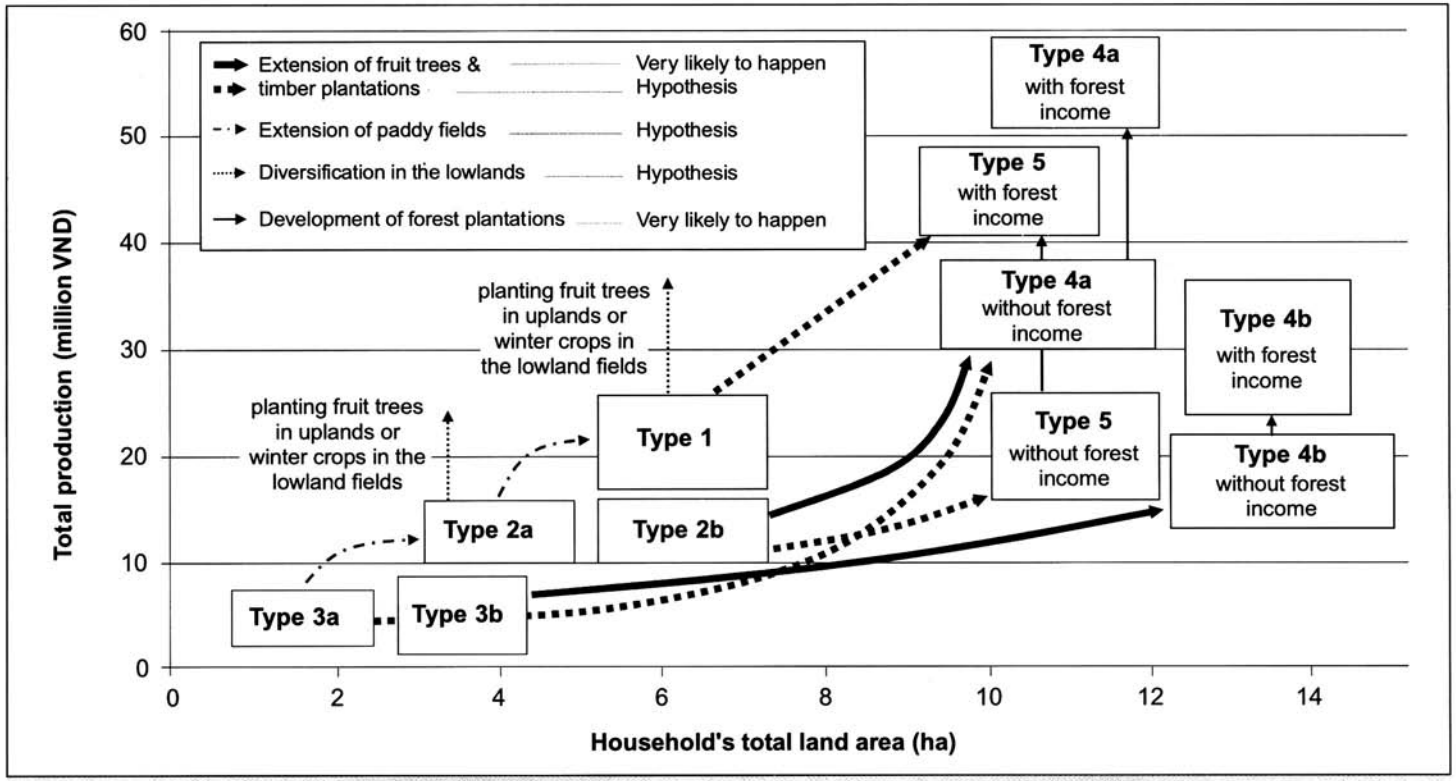


Figure 6: *Evolution of the farming system types from 1990-2000, and projected future evolution.*

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 effortsof 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 offish-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 itfor 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

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Centralized planning and agricultural policy: The role of the State in the agrarian dynamics of *Duc Van* Commune, *Ngan Son* District, *Bac Kan* Province, *Viet Nam*

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Abstract

This monographic study of *Duc Van* Commune contributes to an understanding of the diversity of agrarian systems in the mountainous regions of northern *Viet Nam*, as part of the Mountain Agrarian Systems Program. By examining over 100 small family farms, we identified the major changes in production systems that have occurred over the last 50 years. Access to land, population migration, and individual initiative were the three major factors driving household differentiation. State policies had substantial impacts on all three factors, making the State the key driving force of differentiation. A war with China, a large irrigation project, and the creation of State farms all led to large population migrations. State initiatives to help particular households affected by the migrations created further inequalities. State decisions also regularly reshaped the social relationships of production.

After the latest series of land and market reforms, farmers are faced with increasingly complex communication networks and decision-making processes. After years of central planning, farmers are now free to make their own choices as they interact with their new environment: the market economy. However, many groups that had relied on State initiatives for guidance in the past now lack the enterprising mindset required to participate in the market. Instead, they passively accept State payouts and pensions, waiting to see what project will be placed at their feet next.

In this chapter, we propose institutions that would redefine the relationships among farmers, the State, and the national and international markets. Effective farmers' organizations need to be established to provide farmers with the information and decision-making tools they need to adjust their production to fit the market. Somewhere between

J.C. Castella and Dang Dinh Quang eds. (2002) Doi Moi in the Mountains. Land use changes and farmer's livelihood strategies in Bac Kan Province, Vietnam. The Agricultural Publishing House, Ha Noi, Viet Nam. 99-119.

State control and total independence, community-based natural resource management schemes are needed to ensure that small family farms in the isolated mountainous areas are sustainable in the face of ineluctable macroeconomic changes.

***Keywords**:* mountain agriculture, State intervention, rural development, farming systems, household typology, *Bac Kan, Viet Nam*

1. Introduction

The landscapes of *Duc Van* Commune, like a large part of the *Ngan Son* District to which it belongs, stand out markedly from the rest of *Bac Kan* Province by virtue of their grass-covered hills. This geographic asset clearly has influenced the development of the region, particularly by drawing the attention of the major shaper of regional development: the State. The grassy hills were virtually calling out for State policy to develop them as pastures for animal husbandry.

Since the establishment of the first cooperatives in 1960, the region has witnessed one State intervention after another - State farms, enforced migrations, and remigrations - all intended to maximize the output from this landscape. However, despite all the changes wrought by the State, success has been illusory.

By looking at examples of several different development approaches, we have Tried to identify the influence of changing Government policies on production systems and social differentiation. To this end, we selected two villages with very different histories of State intervention. In the first village, production systems have been largely determined by frequently-changing State policies. Farmers' lack of practice in decision-making resulted in an absence of private initiative. In the second village, local farmers largely have been left to reap the costs and benefits of tbeir own decisions, resulting in more initiative and thus more capacity to participate in the future market economy.

2. Methods

2. 1. Selection of study areas

The selection of the study areas was based on a stepwise process descending from the level of the entire district down to the individually studied villages (Figure 1). We began by acquiring a wide-angle view of the district by identifying major geographical features (lowland types, landforms, watersheds, etc.) and their associated land-use systems through landscape analysis and short interviews with authorities and resource persons in diverse communes. This, together with an analysis of secondary data, allowed us to divide the district into distinct zones based on landscape features, ethnic composition, and crop and livestock production systems. We then tried to identify the commune that would best

represent the whole of the district. In our choice of villages within that commune, we similarly sought to identify a set that would best capture the diversity of systems extant on the scale of the district.

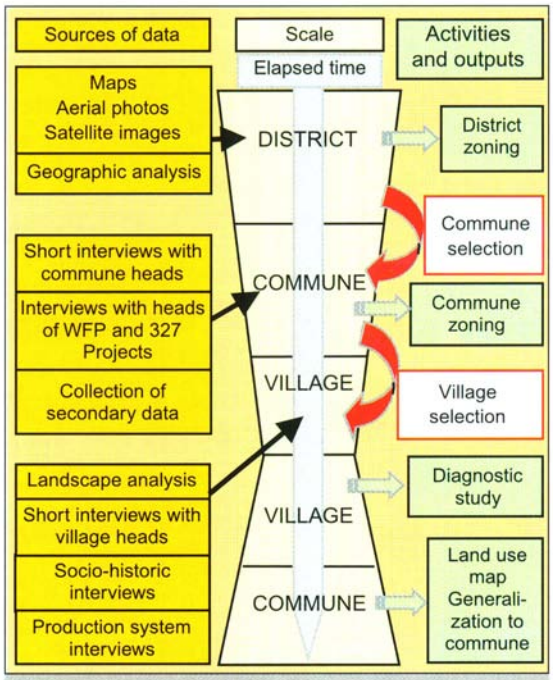

Figure 1: *Study methodology*

Commune selection

Located in the northeastern comer of *Bac Kan* Province, *Ngan Son* District has a wide diversity of ethnicity, ecology, and production systems. The *Tày* , traditional lowland rice farmers, are the dominant ethnic group in the district, followed by the *Nùng*, and then in much smaller numbers, the *Dao*, the *H'mong*, the *Hoa* and the *Kinh*. The district is characterized by econdary forest, mostly deteriorated after years of slash-and-bum agriculture, and rolling hills covered with savannah (Figure 2). Linked to this ecological diversity, three distinct production systems allowed us to subdivide the district into three zones with common features. The three production systems all share an emphasis on animal husbandry primarily the fattening of local or mixed-breed pigs) in association with upland crops of maize, cassava, and sweet potatoes. We divided the district as Follows:

1) **The mid-western part** of *Ngan Son* District is characterized by secondary forest and one-cycle rice. Rice monoculture occupies the lowlands, and is complemented by upland feed crops (mainly maize and cassava). In addition to the pig raising that occurs throughout the district, farmers in the mid-west region raise buffaloes for animal traction and cattle to be sold for cash.
2) **The western part** of the district is characterized by secondary forest and two-cycle rice. Thanks to a dense hydrographic network, this part of the district has moved to rice double-cropping in the lowlands, complemented by an animal husbandry system associated with upland crops. In this area the proportion of the *H'mong* ethnic group is notably higher, although the *Tày* still form the majority.
3) **The eastern part** of the district is characterized by grass-covered hills and tobacco cultivation. The abundance of natural grasses leads this region's

mountains to be widely used as pasture lands, giving the area a comparative advantage for animal husbandry.

The officials of the district were most interested in supporting agricultural development based on animal husbandry. Their interest made the eastern region, with its comparative advantage for livestock pasturing and raising, most appropriate for our study. Within the eastern region, we chose to work in *Duc Van* Commune. Firstly, *Duc Van* Commune encompasses most of the district's major landscape types (Figure 3). In addition, the ethnic composition of this commune reflects that of the district as a whole, as do the crop and livestock production systems. Lastly, *Duc Van* Commune was of particular interest because of the presence of tobacco production. Although tobacco production is not found everywhere in the district, it is one of the unique elements of *Ngan Son* District in *Bac Kan* Province.

Selection of research villages within *Duc Van* Commune

Through surveys and interviews at various scales (Figure 1), we identified the driving forces of land use changes, as well as the current production systems and cropping techniques of each village in the commune, including rice and maize yields and types of livestock. From this information, we selected two villages for our study as exemplifying diverse agricultural and decision-making systems.

Ban Trang: the heart of the grass-covered hills. Ban Trang village is surrounded by grassy hills, and populated primarily by the *Tày* and *Nùng* ethnic groups. The cropping systems of *Ban Trang* are representative of both the commune and district as a whole, with (i) one-cycle rice in the lowlands; (ii) maize, cassava and sweet potatoes in the uplands, to feed pigs; (iii) in some households, specialization in production of perennial fruit trees. *Ban Trang* farmers do not cultivate tobacco, probably because the soil quality is not sufficient. *Ban Trang* serves as a case study of the impact of State intervention on a village. By establishing a cooperative, mandating migrations and remigrations, and centrally planning income generation activities, the State has been a major player in local production systems.

Phieng Nhuong: a tobacco-based system. Populated by the *Dao* ethnic group, the upland village of *Phieng Nhuong* has a cropping system based on tobacco, a cash crop. *Phieng Nhuong* provides a sharp contrast to *BanTrang* as far as State intervention is concerned: this village has seen little direct State intervention, evading even the nation-wide collectivization. Farmers have been the decision-makers for their own production systems, developing private initiatives in response to the perceived market factors of the region.

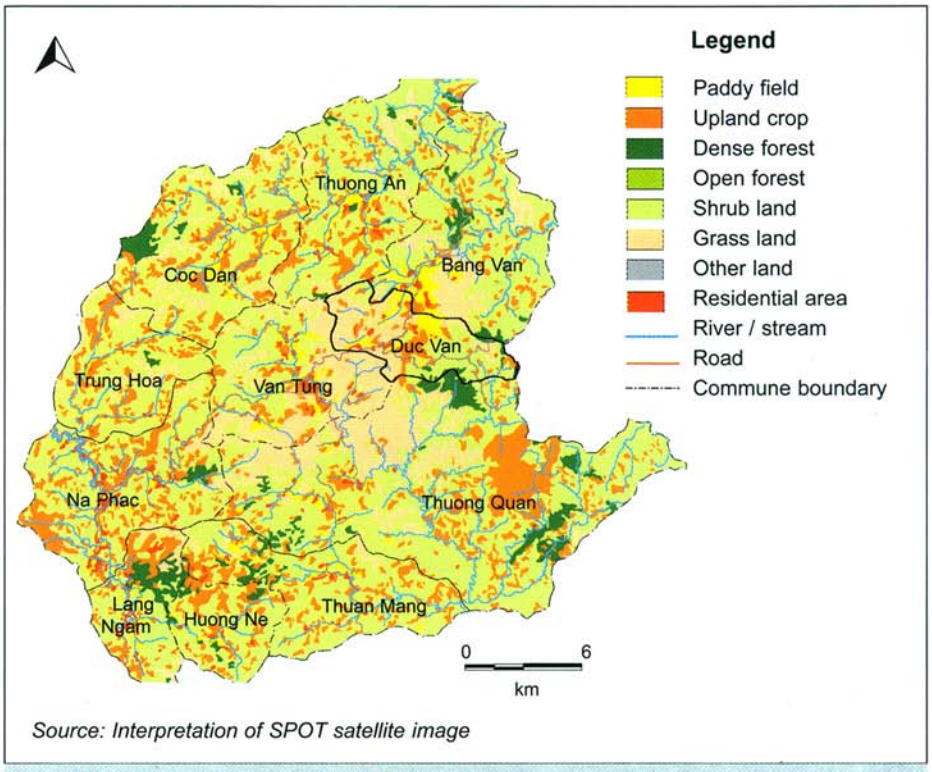

Figure 2: *Land use map of Ngan Son District in 1998.*

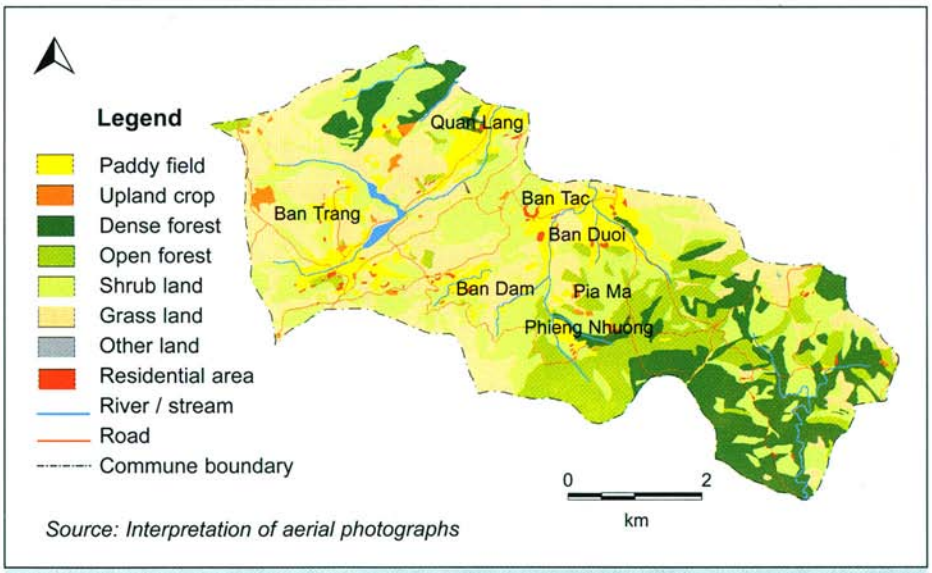

Figure 3: *Land use of Duc Van Commune in 1998.*

2.2. Data collection at village level

Once the research villages were selected, we examined the agrarian histories through interviews with resource persons in each village (village heads, the elderly, etc.). Finally, after a rapid survey of all households in the selected villages we conducted a more-detailed survey of 50 representative households evenly divided between the 2 villages, assessing the following elements:

- household history
- access to land and family organization
- crop and livestock systems (work calendar, equipment, animal and plant production, and other value-adding activities)
- perceptions of the future

The household interviews formed the basis of the agrarian diagnostic study and our typology of production systems.

3. Major production systems in Duc Van Commune

3. 1. Animal husbandry

The grass-covered hills of *Duc Van* Commune have been used as pasture land for years, making animal husbandry the foundation of the area's production systems. Buffaloes are raised primarily for work in the ricefields, while cows are raised to be sold for cash.

Local farmers have acquired an expertise in managing livestock through years of experience and several State farm projects. The greatest impediment to livestock raising in the area is the winter, when temperatures can drop as low as 5°C. Forage becomes scarce, and the cold alone can result in animal deaths. Figure 4 shows the changing numbers of buffaloes and cows since 1991. Both buffalo and cow numbers increased until 1993, after which herd sizes stagnated and even decreased. These changes, wrought by epizootics in recent years, could be indicative of a saturation of available pasture space.

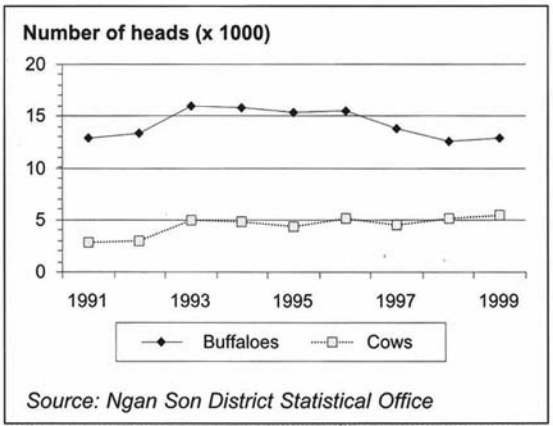

Figure 4: *Recent trends in cow and buffalo numbers in Ngan Son District*

3.2. Tobacco

Tobacco growing is the second distinctive characteristic of *Duc Van* Commune. Tobacco is a paddyland crop, grown in the spring before summer rice. It was first cultivated in the district in 1971 by farmers in *Ban Khau* village, and is a major reason for the relative wealth of that village today. In the following years, tobacco production spread throughout the entire eastern part of the district. In the collective era, cooperatives managed tobacco production, supplying chemical inputs and paying for output in cash. The crop expanded rapidly across the communes because of its high marketability and low opportunity cost, planted as it was on ricefields that would otherwise have been idle at that time of year.
At present, tobacco growing is heavily influenced by the State company Vinataba, which manages all levels of the production process. Vinataba also supplies a package of production recommendations and inputs, including fertilizer, to tobacco producers. To ensure that producers use these inputs for growing tobacco, the company reimburses the cost of the fertilizer to producers only at harvest time. Vinataba's role benefits producers by providing them a guaranteed market for their production, but it also makes them dependent on a company that can fix prices as it wishes. Indeed, price changes caused tensions between Vinataba and the producers during the harvest period of 1999. Total production had grown, but the company classified the 1999 crop as being of a far inferior quality than previous years and therefore paid a considerably lower unit price - average prices were cut almost in half. Farmers reacted strongly - across all communes, the number of households growing tobacco dropped from 80% to 10%.

4. Land use changes and effects of State interventions on the landscape

Our research identified the role of the State as being a major determinant in production system selection, landscape transformation, and social differentiation. Government activities in the region have led to population migrations (and through them, changes in land access)and external revenues for certain households (salaries, pensions). Large State projects in forestry and agriculture also have had substantial impacts on agrarian dynamics in the region. Nonetheless, impacts of State policies have been more intense in some villages than in others, as shown by the following two case studies.

4. 1. Ban Trang: agrarian dynamics driven by State policy

A series of external influences

In 1960, the State established a cooperative system in *Ban Trang* village, along with much of *Duc Van* Commune (Figure 5 1960-1980). Ownership of all

ricefields and uplands was collectivized, and harvests from these lands were distributed to workers according to a labor point system. Cows and buffaloes were collectivized, while pigs remained individually owned. Households focused almost all of their labor on collective activities and private initiatives were discouraged.

In 1979, China declared war against *Viet Nam*, which caused the emigration of the Chinese population of *Ban Khau*, a village not far from *Ban Trang*. The *Ban Khau* cooperative was replaced by a State farm that cultivated the abandoned ricefields and raised animals on the grassy slopes of *Ban Trang*. To better irrigate the ricefields at the *Ban Khau* State farm, the District Agricultural Service built a reservoir at *Ban Trang*, flooding many of the village ricefields. Twenty-six families were dispossessed of collectively-managed ricefields, and had to move their households and work at *Ban Khau* State farm (Figure 5 1980-1987). It was in this context that the decollectivization process began. Land was first distributed to individual households in 1985 in proportion to the number of mouths to feed in each family, and then again in 1988 according to households' land possessions during the pre-cooperative period. Of course, this was of little benefit to those whose ricefields now were underwater. In 1987, after the end of the Sino-Vietnamese conflict, the Chinese returned to *Ban Khau* to reclaim the fleefields now being fanned by the State farm workers and the immigrants from *Ban Trang* (Figure 5 1987-1991). With

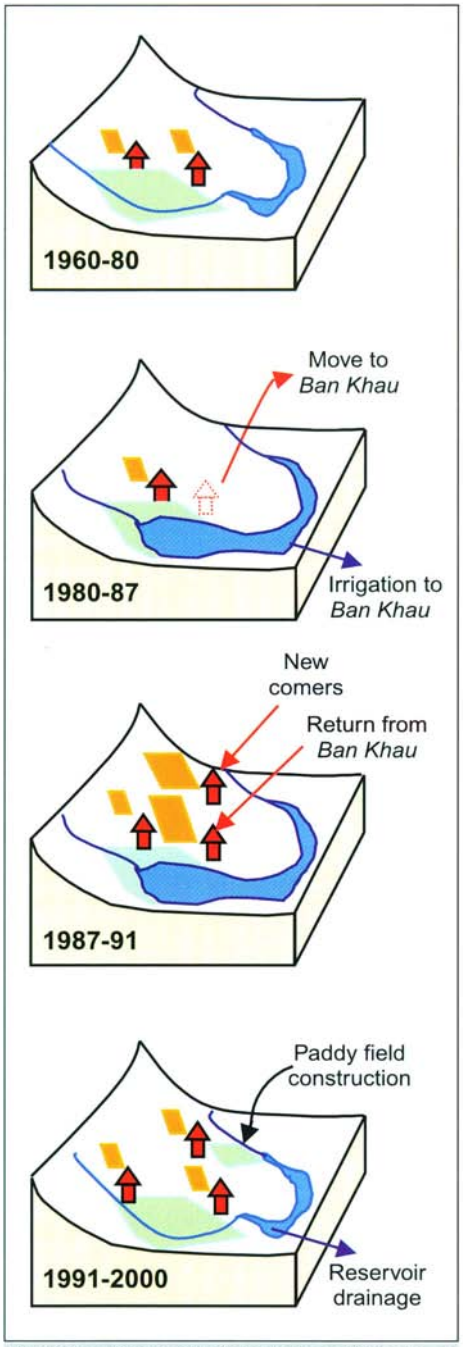

Figure 5: *Diagrammatic representation of landscape transformation in Ban Trang village*

the return of the Chinese, the State farm could no longer operate in *Ban Khau*, so it was moved to *Ban Trang*, where it focused exclusively on animal husbandry. Upon returning, the families that had inhabited *Ban Trang* before reservoir construction reclaimed their former land (though without ricefields), while the workers from the State farm settled in a new area farther upstream. The State assisted the families with the relocation process, supplying a third of the capital required to build a house, labor to build stables, and tax exemptions. But the problem of insufficient ricefields remained,

Consequences to the landscape

There was not enough montane paddyland rice in the region to feed the new population, so the people turned to the uplands. The original inhabitants of *Ban Trang* intensified their upland fields, and the newly arrived farm workers burned and cleared new upland fields. During the next few years, decreasing upland yields and progressive distancing of upland fields from the village were indicators of a system that could not survive long. Under growing pressure from the original inhabitants of *Ban Trang*, the Agricultural Service decided in 1991 to drain the reservoir to increase the availability of lowland ricefields (Figure 5 1991-2000). The draining of the reservoir reduced the pressure on the uplands, and swidden cultivation decreased during the subsequent six years.

While the original inhabitants of the village reclaimed their old ricefields, the new arrivals could acquire ricefields either by building new terraces in the lowlands or purchasing ricefields with their salaries from the State farm. Purchasing was the more common of these two options; buying and selling land had been permitted since 1985, but in *Ban Trang*, few ricefields were purchased until the reservoir was drained in 1991. At the time of writing, in *Ban Trang* it is almost impossible either to find land to develop or to purchase.

Figure 6 shows a hypothetical example of how a *Ban Trang* household could have covered its food needs during the historic periods discussed above. The increase in the relative importance of paddyland production from 1961 to 1970 is explained by the introduction of high-yielding rice varieties and chemical fertilizers by the cooperative (1). A lack of incentives for increased production during the cooperative period led to stagnation of production rates over the next period (2). The first land distribution resulted in an increase in production as farmers gained motivation to intensify production on their own ricefields (3). The pressure caused by the 1987 migration from *Ban Khau* resulted in increased upland use, subsequently dampened by the draining of the reservoir followed by terrace construction and ricefield purchases (4). By 1997, all families owned ricefields and could engage in intensification of rice production through new varieties introduced by the district Agricultural Service (5).

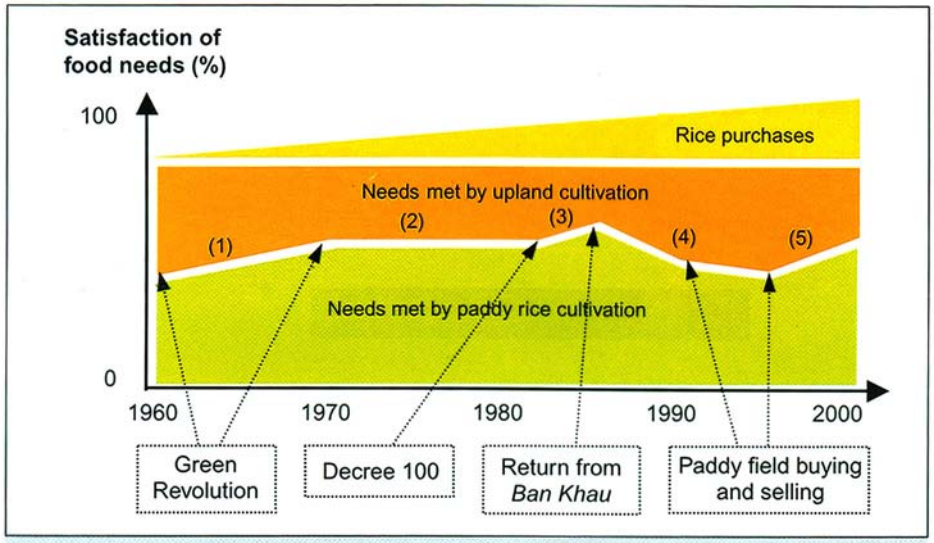

Figure 6: *Changes in land pressure (1960 – 2000)*

N.B. The vertical axis shows a variation between qualitative values, as no ratio can accurately measure this information. Most families achieved 100% of their needs only after (4); during (1) - (3) some of them were going hungry.

Consequences on livestock ownership

The State farm workers were able to develop cattle production faster than the other inhabitants of *Ban Trang*. As payment for their job of taking care of specific herds, they were given half of each year's newborn animals. In addition, the pensions they received allowed them to purchase even more animals.

Forest replanting projects

In 1993, the Government sought to stimulate a more rational use of sloping lands by distributing forestlands to individual households (Castella et al., 2002). The distributions were accompanied by a new profusion of State and foreign projects. The first was Program 327, a part of the 1993 land law. In the case of distributed lands already covered in natural forest, the household to which the land had been distributed received 42,000 VND/ha/year for maintaining the forest. In the case of deteriorated shrub lands, the household received 1,100,000 VND/ha for the first year, in which they would begin reforestation. In the second and third years they would receive 300,000 VND/ha/year, and then 47,000 VND/ha/year from the fourth to eighth year of forest protection.

The forestlands remained the property of the State, but were allocated to farmers for periods of 50 years, with the provincial forest service deciding which areas needed to be replanted. An official from the district forest service would implement the plan in collaboration with the commune authorities. He would

have been transformed into ricefields. In response to the tight land situation, the inhabitants have developed an inheritance system designed to prevent excessive division of family land.

In *Phieng Nhuong's* traditional system, daughters leave to join the families oft heir husbands, whereas sons divide the family land among themselves. In cases where this would result in sons receiving land parcels that were too small to support a family, the eldest son inherits all of the land. The younger sons then can either emigrate from the village or marry into a family that has only daughters, thus gaining access to that family's land. In the latter case, the children (male and female) will take the surname of the mother, thereby keeping the land in the same lineage.

Migration

Sons of *Phieng Nhuong* families who can find no means of accessing land can undertake the long journey to the Government-supported New Economic Zones in the southern part of the country. Three families have made the journey south since the paddyland allocations.

Historically, the other option has been to relocate to the nearby lowlands. Since 1959, it has occasionally become possible for *Phieng Nhuong* families (who are nearly all of *Dao* ethnicity) to purchase lowland fields from the *Tày* ethnic group in the valley bottom. During the cooperative period, faced with the tight land situation in *Phieng Nhuong*, several *Dao* families descended from the hills to farm the lowlands along side the *Tày.* Though the land was collectively managed, newly arrived farmers had to purchase a plot as a kind of entry ticket into the cooperative. The Dao families who farmed valley fields formed a new hamlet, *Pia Ma*, in *Phieng Nhuong* village. They did not resettle their household in the valley. They continued to farm valley fields after the *Tày* cooperative was dismantled. In addition, they bought land from *Tày* families leaving for the South, or who found themselves inheriting or receiving either too much land or land that was too far from their homes.

The rewards of individual initiative

Migration alone has not compensated for the land saturation in *Phieng Nhuong* village, and many enterprising individuals with the right set of attributes (initiative, available labor) have found alternative ways to generate incomes:

- Buyers of lowland fields: we must include the *Dao* described above in this section. The prices they paid for lowland fields are low in comparison with prices at the time of our study, showing the wisdom of their decisions years ago. It is true that the Government provided incentives to make the descent to the lowlands, primarily in the form of large State investment in the cooperatives. Nonetheless, the shifting of households and production systems required considerable initiative.

- Volunteers for upland allocation: upland allocations were based on farmers filling out request forms for specific tracts of forestland. In the early years of this new policy, farmers tended to be uninterested in acquiring this land, for fear of future taxation. Government officials finally put pressure on certain influential families to take the initiative and claim large tracts of land as an example to their neighbors. This resulted in a few of *Phieng Nhuong* families each being allocated nearly fifty hectares of forestland, on which they now make large profits with a minimal labor investment.
- Tobacco cultivators: farmers who responded to the double call of the market and the State have intensified production on their ricefields with a spring tobacco crop, resulting in additional income. Profiting from tobacco requires farmers to acquire a new set of technical knowledge, from the use of chemical fertilizers to various steps in the drying process.
- Fruit tree planters: acting only on private initiative, the first farmers to plant fruit trees had the benefit of being the first to the market and have profited from large market demand. At present, all households have planted fruit trees, and the market grows tighter each year.

State policies affected the differentiation process, but not the range of possible outcomes. Although State policies affected the differentiation process more intensely in *Ban Trang* than in *Phieng Nhuong*, households in all villages within *Duc Van* tended to differentiate into the same 5 household types described in the following section.

5. Current diversity in household livelihood strategies

5.1. Determinants of household differentiation

In studying the historical trajectories and current production systems in *Phieng Nhuong* and *Ban Trang*, we identified five different types of household livelihood systems. This categorization of households brought to light potential trajectories for each household type, as well as the various blockages that exist in the current evolution of livelihood systems. Figure 7 presents the differentiation patterns and livelihood systems typology. In developing the household typology, we identified two major determinants of household differentiation: access to paddylands and capacity to seize upon opportunities. Box 1 provides a detailed explanation of each household type based on its strategic orientations (Rousseau and Gevraise, 2000).

Access to paddylands

The main determinant of differentiation among households is access to flatlands Suitable for flooded ricefields. Paddy rice remains the cornerstone of all

production systems, and the first priority of all families who are not rice self-sufficient is to purchase or develop paddy fields (Castella and Erout, 2002).

Households who are not rice self-sufficient cannot generate the capital needed to invest in diversifying their production systems. They often must sell labor for several months of the year to make enough money to buy rice. Households with the smallest paddy fields may sometimes directly consume upland crops that most households use only as animal feed.

Lack of access to paddy fields is doubly crippling, as it can hamper access to credit. As a pre-requisite for granting a loan, the Bank for the Poor requires borrowers to pledge a certain sum of assets or paddy land as collateral. Thus the poorest of the poor often cannot qualify for credit.

Capacity to seize opportunity

Once families have become self-sufficient in rice, they can begin to diversify their production and seek out other income generation activities. Livestock offers a means of capital accumulation, primarily in the form of pigs and buffaloes. This highlights the second major determinant of differentiation: individual capacity to seek out and seize opportunities for income generation. A household's capacity to seize opportunities depends on its structural attributes (e.g., relative availability of labor and capital) and on factors that influence decisions (e.g., access to information, level of integration to market, level of individual initiatives, etc.).

Individuals who seized upon State initiatives(State farms, tobacco, forestland allocations, sales of paddyland as part of the policy to settle swidden farmers, etc.) were often able to make substantial profits. Those households that made file first move on fruit plantations were able to benefit the most from the new market.

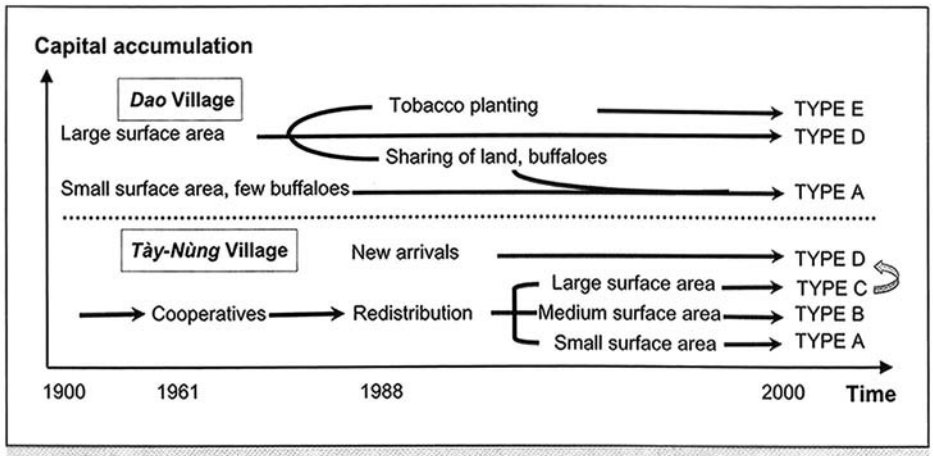

Figure 7: *Production systems, social differentiation and household typology*

Box 1: *Farm household typology in Duc Van commune*

Type A: survivors. The defining element of the Type A. household is the possession of very little land, both paddyland and upland. Households cannot attain rice self-sufficiency. The average period of rice deficit is five months, but in some households can last up to nine months. In many such households, the husband leaves to work off the farm for several months of the year, gaining enough income to buy rice for the family. The primary external employment in *Duc Van* commune is found at the gold mine. In other cases, upland crops (which other household types use only to feed livestock) are directly consumed.

The barriers to capital accumulation are many The lack of buffaloes translates to an absence of capital. Despite its name, at the Bank for the Poor access to credit is conditional on owning a certain amount of fixed assets, which means that these poorest of the poor cannot borrow money to finance income-generating activities. Some farmers have begun to plant fruit trees, but with a rapidly saturating market, the potential for profit is questionable.

Type B: agroforestors. This type comprises households in *Ban Trang* village who have inherited medium-sized ricefields. Owning one or two buffaloes, they have begun the process of accumulation. Owning more sloping upland than Type A households, these families can begin to raise mixed-breed pigs and grow soybeans either for consumption or sale. Revenues from forest replanting projects allows the purchasing of rice to fill the deficit period (two and a half months, on average).This household type tends not to earn any off-farm income.

The future for Type B likely holds intensification of paddyland productivity and increased use of sloping land crops to raise pigs. Of all the types, these households have the lowest rice yields and use sloping lands the least, which means they potentially have the most to gain in these area& Fruit trees also offer potential gains in the future, though the market demand is unreliable.

Type C: diversifiers. This type consists of *Ban Trang* natives who inherited large paddyland and sloping land areas, as well as new arrivals from the State farm who were able to purchase or develop large paddyland areas. Such purchases were made possible by State farm salaries and pensions. This household type generally possesses a number of buffaloes, acquired in the same manner as the paddyland, Pigs continue to provide the largest agricultural income for this group. Pensions make up a substantial part of family income for both *Ban Trang* natives and the new arrivals. Type C households are likely to diversify their production as they accumulate capital, continuing to raise pigs but complementing this investment with cows and perennial plantations.

Type D: cattle breeders. This type comprises two kinds of households: (i) Dao families who have preserved capital(land and buffaloes) through inheritance; and (ii) new arrivals to Ban Trang, who were able to use their salaries and benefits to invest in livestock. These were Primarily State farm workers who accumulated cattle from their State farm service. These households have similar amounts of land and labor as Type C, but are distinguished by their capacity to seize opportunity. Experience gained on the State farm and an enterprising disposition are two likely factors explaining the success of farmers in this category. These were the first households to take part in perennial plantations, and they currently are profiting from a wide-open market for their production. This type also sells vegetables from private gardens, primarily cabbage and cauliflower. As Type D accumulates capital, we expect to see continued investment in the livestock and fruit tree initiatives described above, particularly investment in cows.

Type E: paddyland intensifiers. This type comprises those farmers from *Phieng Nhuong* and *Pia Ma* with large paddyland areas, a large labor force, and a number of buffaloes. This group already has intensified production on their paddyland, adding gains from a spring tobacco crop to increased summer rice yields. These households have reached the limits of paddyland intensification, so their only future possibility is to extend their range of activities, likely through the raising of cattle and buffalo. The variability of tobacco yields and market prices make this kind of diversification important for income stability.

5. 2. The effects of State intervention

The major determinants of social differentiation within and between *Ban Trang* and *Phieng Nhuong* were land access and individual capacity to seize upon opportunities. However, we also discovered that the State, through frequent interventions, was and remains a major driving force behind both of these determining factors.

State effects on land access

In the 1960s, the State created the cooperatives, reorganizing land access rules throughout the country. Later State interventions took such forms as policies for settling swidden farmers, the creation of State farms, and large infrastructure projects such as the flooding of the *Ban Trang* ricefields. These successive changes resulted in several migrations, land dispossessions, and land reacquisitions for the inhabitants of *Ban Trang*.

The current diversity in land access that now appears in *Ban Trang* is due primarily to the effects of local implementation of the land distribution policy. Those farmers who received the largest paddy areas following decollectivization were transformed into those with the greatest potential for income generation and accumulation. Farmers who were allocated large plots of forestland also have benefited from higher incomes in the form of their annual maintenance salaries. In addition, State farm workers have been able to grow wealthier than their neighbors because of the subsidies and help that they received.

State effects on capacity to seize opportunity

The differences between *Ban Trang* and *Phieng Nhuong* in individual capacity for seizing opportunities is directly related to the levels of State intervention in each village. In *Ban Trang*, the establishment of the cooperatives removed all decision-making power from individual farmers. The capacity to seize upon opportunities had little value in a system that methodically sought to eliminate any gain that might be made from private initiatives. During and after the collective period, both frequent changes in land policy and external circumstances (migrations, State projects) made private initiative unlikely; farmers could hardly make long-term plans in a system that so regularly restructured all of its most basic elements.

The recent forest replanting projects were developed both to protect the forest resource base and provide opportunities for agricultural production (Castella et al., 2002) but they have done little to stimulate individual initiative. As long as farmers are being paid annual sums, they are content to, “sit back and watch the forest grow,” in the words of one. Farmers’ motivation to maintain forests is not motivated by any long-term perspective of the market economy and the fature demand for forest products. Rather, farmers are waiting for the next State intervention; waiting to be told what to do with the forest that they have been maintaining. These results, derived from farmers’ surveys, were confirmed by a

participatory analysis of local livelihood systems that we applied in *Duc Van* in 2001 (Bousquet et al., 2001).

Phieng Nhuong offers the contrasting example of a village that has seen relatively little State intervention. The village never became a cooperative and the few State interventions that reached the village (the tobacco company and forest plantations) were offered as opportunities rather than as obligatory policies. In fact, it was often those farmers who seized upon these opportunities who attained the greatest potential for accumulation. Other farmers have improved their lot through privately initiated fruit tree plantations. In either case, the individual profits made by *Phieng Nhuong* farmers have arisen only from their own production decisions and strategies.

6. Recommendations for an effective institutional setting

At the beginning of the 1980s, the State responded to nationwide crises in the cooperatives with mass deregulation and encouragement of the market economy. The crucial elements of the new system were land allocation to individual households and the freedom of choice over production systems. After twenty years of directed production, farmers were subjected to a new set of rules, initially defined by the national economy but yearly becoming more influenced by the international economy. Figure 8 provides a schematic representation of the changes in the institutional environment within which farmers have developed their livelihood strategies.

Thrown again into a new context, farmers do not have the knowledge or experience, or even a reference point, for making decisions about their production systems. This is evident in *Ban Trang*, where individuals have initiated fruit tree plantations because of having seen their neighbors' successes. The new plantations will not begin to produce for several years, and the market for fruit production already is narrowing rapidly. These farmers certainly will not reap the same benefits as their pioneering neighbors, and might not reap any benefits at all. Having depended for years on instructions from the State regarding their production decisions, *Ban Trang* farmers have not developed an effective communication network for the diffusion of innovations and effective production strategies. *Phieng Nhuong* village has a better community-based information dissemination system (Hoang Lan Anh et al., 2002), but nonetheless suffers from a lack of access to market information.

Farmers cannot be expected to know intuitively the national market demand for their production. During the transition to a market economy, remote villages that were producing agricultural products were obliged to organize by themselves the first components of the marketing channels that would link them to the bigger traders and processors. Some farmers became informal middlemen during the short harvest period. They began to build information networks among producers,

starting with relatives, then neighbors and then expanding outwards. But these very limited and poorly structured communication channels could not prevent production "crazes" in which many farmers switched to producing some fashionable product (e.g., apricots or cinnamon) that subsequently saturated the market after a few years. Today, all stakeholders involved in these emerging producers' networks see a clear need to develop a new system to better integrate farmers with an increasingly complex market.

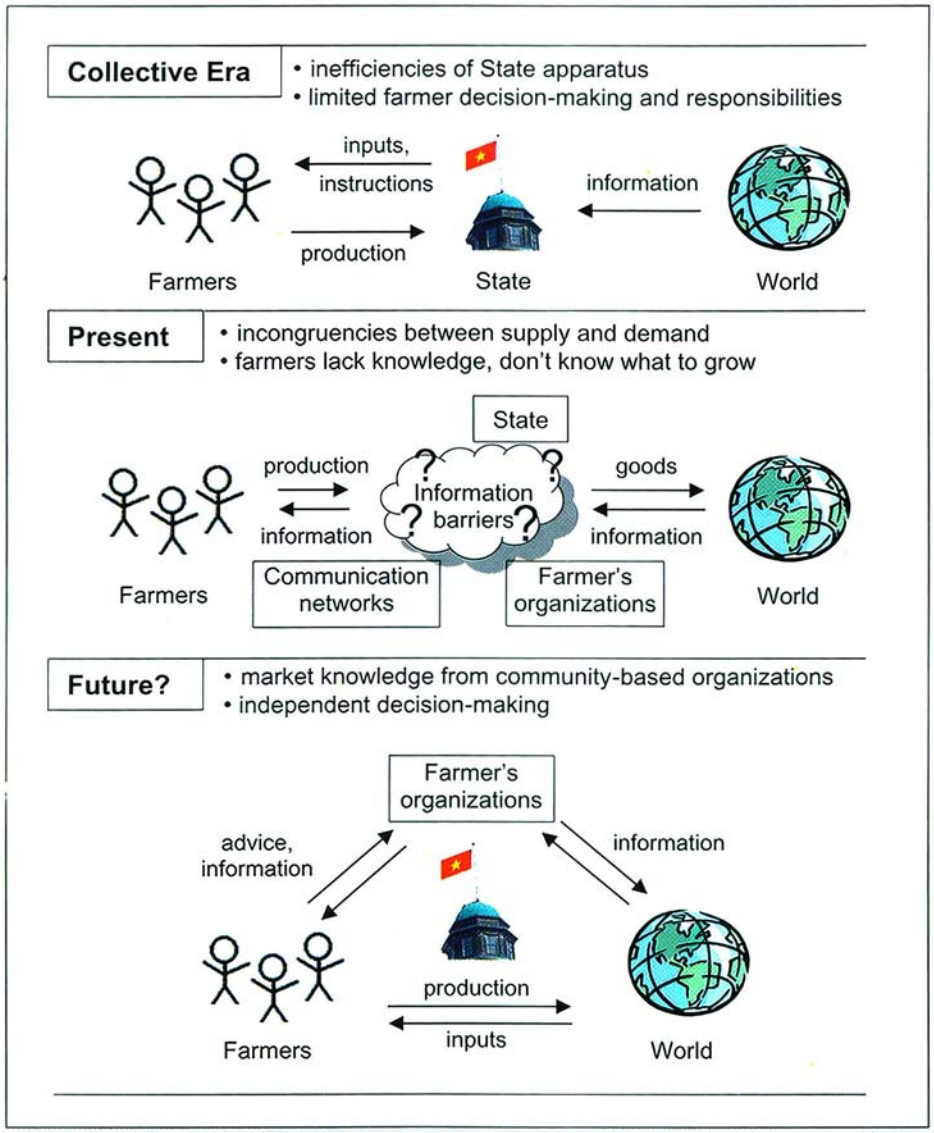

Figure 8: *Changing decision-making spheres*

The framework already exists for the kind of social organization that needs to be developed. Since the cooperative era and in some cases earlier, farmers have engaged in mutual help and exchanges of labor and equipment, both with and without reciprocity. In some villages of *Duc Van* other than those surveyed in detail, local communication networks have developed, resulting in a rapid dissemination of information and innovations. Our surveys have shown that in *Ban Tac* village, near *Ban Trang*,such a network exists, based upon long-established family networks. The village network allows all individuals to profit from each other's knowledge and experiences. The result is readily apparent: *Ban Tac* has a wealth and standard of life that is clearly higher than that of *Ban Trang.*
The benefits of communication networks can also be seen by comparing the dissemination of the fruit tree idea in *Ban Trang* versus *Phieng Nhuong*. The latter village, not having undergone the frenzied changes of the former, has a more firmly established information network, which perhaps is responsible for the rapid introduction of perennial fruit tree plantations. *Phieng Nhuong* families are already making substantial profits from their plantations while *Ban Trang* inhabitants are only just beginning the planting process.
To scale up and institutionalize the promising trends outlined above, the State needs to change its role from that of a prescriber to that of a facilitator of economic and social transformations. Based on our empirical results, in our opinion there are three directions that the State should prioritize to enable family farms to integrate into the market economy, namely:

(i) Increasing opportunities for improved marketing and off-farm income by improving local market structure and infrastructures; marketing channels; and local initiatives to create new jobs in agro-processing, trade, and micro-industries.
(ii) Facilitating circulation of knowledge and innovations, and
(iii) Enhancing not only individual, but also collective capacity to seize opportunity by reinforcing community-based management of resources, developing farmers' organizations, and empowering farmer groups in their negotiations with other stakeholders in the marketing process.

Along side the existing State institutions that support farmers (e.g. Extension Centers, Farmers' Association, Bank for Agriculture, Bank for the Poor), a new kind of farmers' organization needs to play the role of a broker between individual farmers, State institutions, and the market (Figure 8). Today, the question remains how to build new community, based organizations on existing local social structures to revive farmers' initiative and their entrepreneurial spirit.

7. Conclusions

In the past, mountainous areas received less attention and benefits from government research and extension services than the lowland areas because of their remoteness mad the complexity of their agricultural systems. Today, the State needs to give high priority to strengthening the capacity of agricultural support services to develop more holistic, integrated forms of research and extension. It is also widely recognized that members of small farm households need to increase their knowledge base and capacity to respond to both changing agricultural requirements and off-farm income opportunities. Between the research and extension system and the individual farmers there is a place for a new kind of institution that could strengthen the weak links among the farmers, the State, and the market as displayed in Figure 8. A number of projects have already shown that it is possible to support the emergence of efficient organizations of producers that can become a key driving force of local development (VASI-GRET, 2000). However, most of those projects were limited in their geographic and thematic scopes. Therefore, the next challenge is to scale up the best practices and lessons from projects and incorporate them into the official extension system to achieve a broader and more sustained impact on farmers' livelihoods.

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Impact of accessibility on the range of livelihood options available to farm households in mountainous areas of northern *Viet Nam*

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Abstract

The comparison of two sets of rural villages in the province of *Bac Kan* that differ in accessibility allowed the examination of the influence of roads on livelihood systems of farming households. Villages far from roads still depend heavily on agriculture. With little influence from outside, the farmers in these villages must develop their own initiatives to secure their livelihoods. In contrast, farmers in villages that are close to roads can more easily take advantage of non-farm opportunities for income generation. Ease of transport and access to the marketplace are the most important assets of these villages in the view of the inhabitants. Government and non-government agencies adapt their activities in rural development according to the accessibility of the target populations. However, farmers are critical of most projects that were not based on their perceived needs. To smooth the transition to accessibility, government services need to support participatory locally-driven initiatives.

Keywords: accessibility, rural development, development projects, household economy, local initiatives, northern *Viet Nam*

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1. Introduction

Bac Kan is one of the poorest provinces in *Viet Nam* (General Statistical Office, 1999). More than 30% of its 122 communes are registered as poor or very poor [1] and 21% of its households live on less than 5 USD per person per month. Their critical situation arises largely from the agro-ecological and socioeconomic constraints specific to mountainous environments (Donovan, 1997; Jamieson et al., 1998). The biophysical limitations to agricultural productivity in *Viet Nam's* mountains are well documented. They include (i) the limited availability of flatland area suitable for intensive rice-based cropping systems, and (ii) the unsustainability of shifting cultivation systems on the hillsides due to increasing population pressure and environmental degradation (Hill, 1985; Hirsch, 1997; Pandey and Dang Van Minn, 1998). There are also socioeconomic constraints common to most mountainous areas, including: (i) cultural differences among ethnic groups; (ii) limited formal education; (iii) high rates of population growth, particularly in remote areas; and (iv) varied interpretations of national policies resulting, for example, in unclear land-use rights (Kerkvliet 1995). State policies are developed on a national level but administered locally, and subject to numerous re-interpretations along the way.

Throughout this paper, by "accessibility", we mean the speed and reliability of transportation for people and goods. In general, areas with paved roads are most accessible (because rapid transport even by truck is reliable even during the rainy season), whereas areas with only footpaths are least accessible. We define social accessibility as openness of a village and its inhabitants towards people from outside and the ability of villagers to communicate with self-confidence with people from outside. Economic accessibility is defined as the degree of monetary relations as well as the degree of market economy established in a village. It is generally agreed that accessibility is a key factor by which the biophysical constraints interact with the socioeconomic aspects of development in mountainous areas (Prescott and Litvac, 1995; Fforde and Sénèque, 1995). However, the mechanisms that link accessibility, livelihood strategies, and poverty are not well documented. In this paper, we hope to fill this gap by examining villages in three communes that were subject to the same nationally-administered policies but found themselves with dramatically different opportunities because of their differences in accessibility.

By contrasting villages that differ in terms of their accessibility while having comparable resource endowments, we will analyze the various dimensions of

[1] In rural areas, the government classifies a commune as poor if more than 30% of the households have a monthly income lower than 80,000VND per person and very poor if lower than 45,000VND per person. In urban areas the poverty threshold is 120,000VND per person per month. The exchange rate in 2002 is 1US$ = 15,040VND.

accessibility (i.e., spatial, social, and economic) that are intricately interwoven and show their effects on farmers' livelihood strategies. Then, we will examine how improving accessibility can increase the range of income-generating options available to farm households and therefore achieve the objective of poverty alleviation.

2. Methodology

2.1. Site selection

This chapter draws on two studies of farmers' livelihood strategies that were conducted independently from each other but used the same guiding principles and methods. As shown in Table 1, the four sites within these studies represent all four of the possible combinations between two levels of accessibility (high or low) and two agricultural systems (paddy rice or shifting hillside cultivation).
The first field study was conducted from 1996 to 1999 in two villages of *Van Tung* and *Thinh Vuong* communes. Both villages are characterized by high accessibility because they are located close to either paved roads or district administrative centers. However, the two villages differ in their major agricultural systems (paddy rice in *Van Tung* versus shifting hillside cultivation in *Thinh Vuong*). The second field study was conducted in 2000 in *Nghien Loan*, a commune of *Ba Be* District in the north of *Bac Kan* Province, that is characterized by low accessibility. Within this commune, as in the first study, we focused on two villages that differ in their agricultural systems. Specifically, *Ban Dinh* village (like *Van Tung*) is organized around a large flatland area cultivated with paddy rice

Table 1: Main characteristics of the, four, study sites

Study sites	Accessibility	Dominant agricultural system	Population density (persons / km 2)	Dominant ethnic group
Van Tung village of *Van Tung* Commune	+	Paddy rice on flatlands	55	*Tày*
Thinh Fuong village of Thinh Vuong Commune	+	Shifting cultivation on hillsides	11	*Dao*
Ban Dinh village of Nghien Loan Commune	-	Paddy rice on flatlands	68	*Tày*
Khuoi Un village of *Nghien Loan* Commune	-	Shifting cultivation on hillsides	112	*Dao*

by farmers from the *Tày* ethnic group, whereas the *Dao* farmers of *Khuoi Un* village (like those in *Thinh Vuong*) rely on shifting cultivation on sloping land for their staple food production. Table 1 summarizes the human and natural environments of the studied villages.

The hypothesis underlying our site selection procedure is that the diversity of local development patterns, and of farmers' capacities to seize upon income-generation opportunities, is caused by two factors:

(i) the accessibility of the open market economy to inhabitants of a region, and (ii) the impacts of government policies and development projects.

These two factors in turn depend on the constraints to their effective implementation: accessibility, primarily in its spatial and social dimensions.

2.2. Survey method and data analysis

Each study consisted of (i) an analysis of land use changes based on aerial Photographs from 1952 and 1998; (ii) participatory observations, with the researcher living in the village and developing a relationship of trust with the interviewed people; (iii) in-depth interviews of key informants; and (iv) household surveys to elicit quantitative and qualitative information through semi-structured interviews with the help of a translator.

We selected villages that were representative of the commune diversity in terms of wealth and livelihood strategies. In the first study, we surveyed 54 households in *Van Tung* Commune, and 65 households in *Thinh Vuong* Commune. In the second study, we surveyed 51 households in *Nghien Loan* Commune (25 and 26 households for *Ban Dinh* village and *Khuoi Un* village respectively). The survey methods are described in more detail in Alther (1999; 2000) and Rousseau and Gevraise (2000). We analyzed land-use changes over the last 50 years in an effort to identify their main driving Forces. The land-use and land-use-change maps were used to quantify the impact of land-use changes on agricultural landscapes and assess the natural resource base on which today's households must base their livelihood strategies. We then categorized farm households according to their livelihood strategies and identified the specific constraints to improving their welfare. This led us to the identification of intervention points to assist these farmers in adapting their livelihood strategies to their changing environment.

3. The case studies

3.1.Van Tung and Thinh Vuong - a case study in accessibility

Van Tung research site is situated in a broad river valley bordered by rolling hills covered with shrubs and grasses. During the summer season, the river provides

enough water to irrigate rice fields and most terraces, but in winter there is only enough water for domestic use. *Van Tung* village is linked to the district capital town of *Ngan Son* only by a three-kilometer footpath that is not passable by any wheeled vehicle. However, *Ngan Son* itself is highly accessible, because it is located along the paved national highway No. 3 that runs from *Ha Noi* to the provincial capitals of *Bac Kan* and *Cao Bang*. Therefore, the nearby villages (including *Van Tung*) are considered to have good accessibility. *Van Tung* is often visited by extension officers, and benefits from frequent Government and foreign-sponsored rural development projects.

The wide river valley in *Van Tung* allows farmers to base their production systems upon paddy rice. However, most households are highly diversified. For example, 53% of households have some non-farm sources of income, such as wages from formal and informal employment, income from trade (buying and then re-selling goods produced by others), or sale of forest products. Some participate in development projects for farm sources of income such as sales of upland crops, vegetables, livestock, and poultry in the *Ngan Son* marketplace. Farmers in *Van Tung* attain a high degree of food self-sufficiency of 90%. Historically, slash-and-burn cultivation was practiced on the surrounding hillsides, but these have been deforested for over one hundred years (Doudoux, 1891). The hillsides have regenerated substantially, mainly in the form of shrubs and small trees, likely permitted by farmers' focus on the lowland areas (Figure l-A). However, the trees' regrowth remains checked by extensive livestock grazing.

Van Tung is inhabited primarily by the *Tày-Nùng* ethnic groups (54%), followed by the *Dao* (36%) and the *Kinh* (10%). *Van Tung* shows remarkably good relations among ethnic groups; for example, 30% of households are ethnically mixed. All groups have similar production strategies and have the possibility of serving in the local administration.

Population movements have played a major role in the recent development of *Van Tung*, though official data on this delicate subject is not easily obtained. *Van Tung* Commune exhibits a substantially lower population density (55 people/km^2) than most mountainous regions of *Viet Nam* (TranThi Que et al., 1996), largely because of mass emigrations to the New Economic Zones in the south of the country (personal communication from the head of *Van Tung* Commune). The low population density has reduced land scarcity and improved farmers' prospects in the commune.

To widen the scope of our study, we also investigated the case of *Thinh Vuong*, a highly accessible village with minimal access to flatland fields in *Cao Bang* Province. *Thinh Vuong* is a predominantly *Dao* village stretched out on a mountain ridge along the paved national highway No. 3 midway between *Ngan Son* and *Cao Bang* Province. Inhabitants of *Thinh Vuong* rely on a small number of terraces, most of which cannot be irrigated, to grow most of their staple crops. They

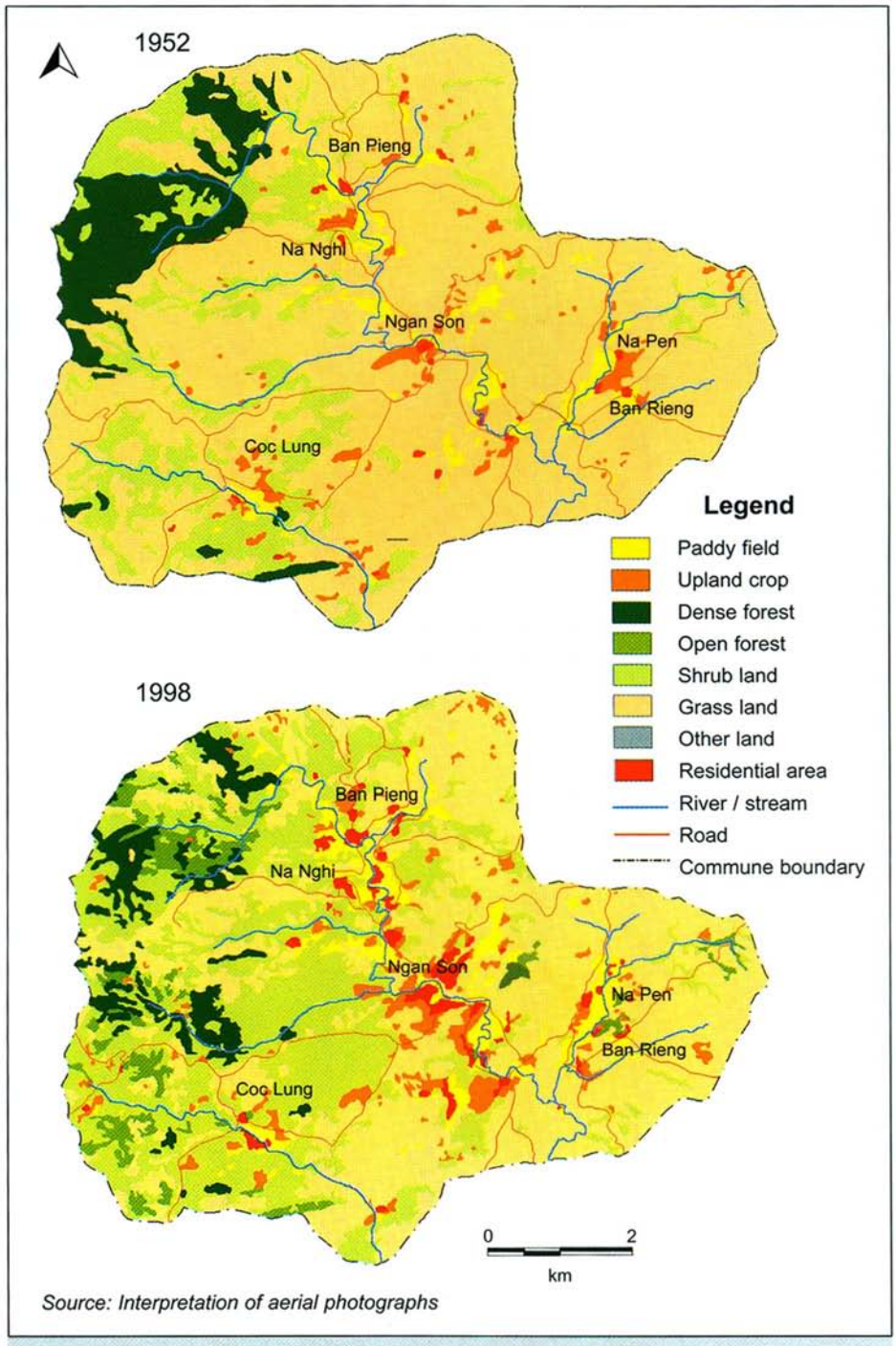

Figure 1-A: *Land use maps of Van Tung Commune, 1952 and 1998.*

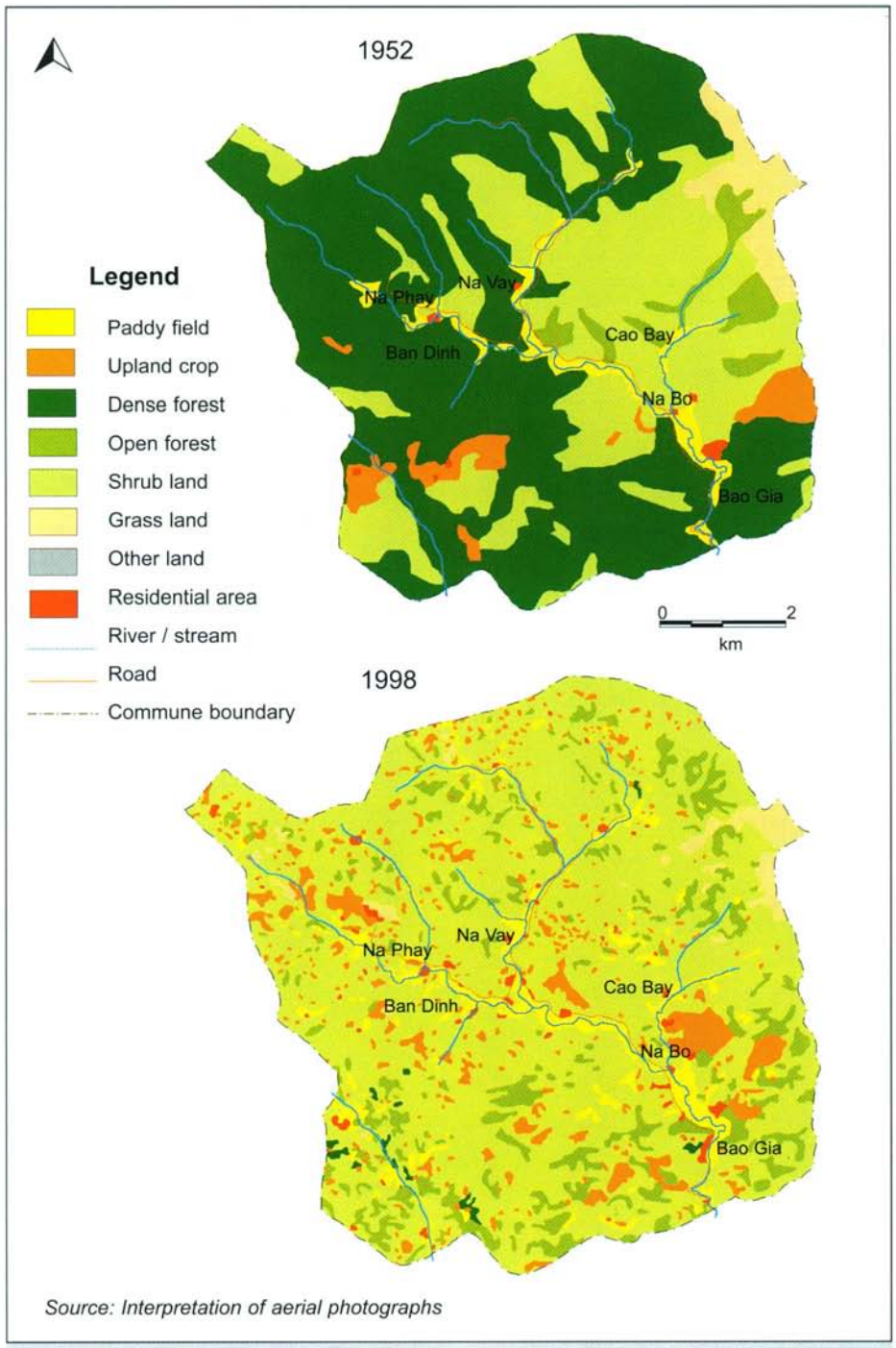

Figure 1-B: *Land use maps of Nghien Loan Commune, 1952 and 1998.*

formerly practiced extensive swidden cultivation, but this technique was outlawed in the early 1990's. Since then, the sale of forest products and other non-farm activities has become an important component of household income. As in *Van Tung*, the *Thinh Vuong* landscape has regenerated in recent years, likely due to the recent ban on slash-and-burn cultivation.

The age pyramids of both villages are typical of developing countries, with many children and fewer elderly people (Alther, 2000). However, the relatively low number of children below ten years of age suggests a stabilizing population. This is a result of the national family planning campaigns to limit families to one or two children.

3.2. Nghien Loan Commune - a case study in inaccessibility

Nghien Loan Commune, in the far northern part of *Bac Kan* Province, is characterized by low accessibility. A rugged landscape and few roads have kept this commune isolated. Major marketplaces are distant indeed for farmers here.

Production systems in both studied villages are subsistence-oriented. *Ban Dinh* farmers, mostly of *Tày* ethnicity, focus on flatland paddy rice production, and complement this with terraces and slash-and-burn cultivation on the hillsides and small-scale animal husbandry. *Khuoi Un* farmers, mostly *Dao*, focus production on the hill sides, where they combine extensive terracing with slash-and-burn cultivation. Buffalo and cow raising is developing in the commune, spurred on since 1999 by the existence of a new livestock marketplace in *Ban Dinh*.

Of all the areas studied by the SAM Program, *Nghien Loan* Commune has shown the sharpest separation of ethnicities. Here, ethnic groups inhabit clearly-distinct tiers of the ecosystem, with *Tày* farmers cultivating the valley-bottoms; *Dao* on midland hillsides and terraces; and *H'mon*g farmers subsisting almost exclusively on the steepest slopes using slash-and-burn cultivation of upland rice, maize, and cassava. This rigid tiering of the ecosystem is likely a result of high population density (68 people/km^2 in *Ban Dinh* village and 112 people/km^2 in *Khuoi Un* village), poverty, and intrinsic scarcity of flatland. Unlike the farmers studied in the comparatively wealthy and accessible villages described above, farmers in *Nghien Loan* do not have the luxury of sharing their land and social spheres with outsiders (i.e., people outside their ethnic group or immigrants).

Since the cooperative period, *Nghien Loan* Commune has received an influx of immigrants, particularly of *H'mong* from *Cao Bang* Province, first fleeing the 1979 war with China and later pushed out by new land allocation policies. Thirty-three families inhabited *Khuoi Un* in 1990, the year that paddy land was allocated to individual households. Today there are more than 200 households in the village. Over the years, this growing population has dramatically impacted the landscape as displayed on the land use maps in Figure l-B, and current practices are not sustainable. Fallow periods on the hillsides are decreasing, yields are dropping,

weeds are gaining predominance, and pasturelands are not regenerating as quickly as they are being grazed.

The prospects for *Nghien Loan* are not entirely bleak. Faced with a growing population subsisting on a shrinking resource base, *Khuoi Un* locals have built on their social capital to implement a set of livestock-management rules that permit them to produce more from their limited land. The ability to develop community-based resource management rules is of substantial benefit to a village facing scarcity. In the last year, a road from *Cho Ra*, the district administrative center, has been built through the commune, making *Nghien Loan* more accessible to the rest of the district and increasing farmers' options for diversification. Some already are considering the option of planting fruit trees.

4. Effects of accessibility on income generation strategies

Figure 2 displays a conceptual model of how roads influence four elements of farmer's income generation strategies. Apart from their rice-based subsistence agriculture, households in the study area have four main options to generate income. Each of these four options is largely influenced by accessibility:

(i) participation in State programs and in development projects (State and other),
(ii) marketing of agricultural and forest products,
(iii) other, mostly non-agricultural employment alternatives, and
(iv) migration.

These four elements of farmers' income generation strategies are listed in light blue in the middle of Figure 2. Positive influences on the household economy are shown in green on the left of the figure, whereas negative influences are shown in red on the right side.

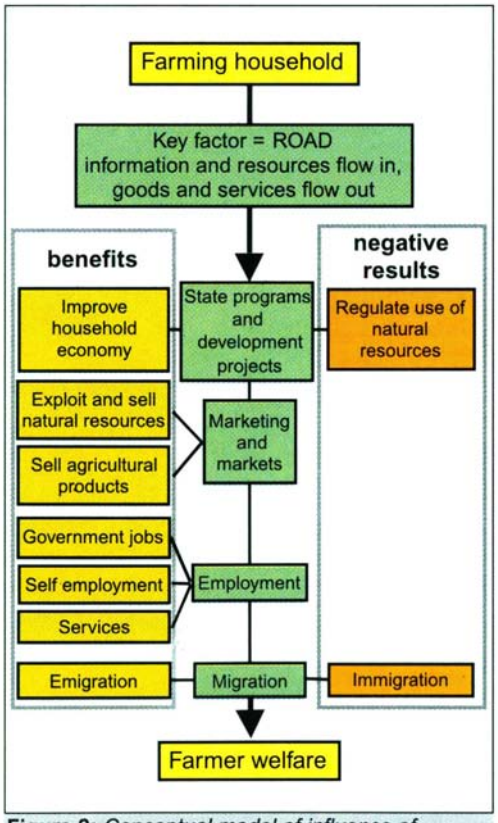

Figure 2: *Conceptual model of influence of accessibility on farmers' income generation strategies*

Castella et al. (2002a) showed strong relationships among accessibility, land use systems, ethnicity, and poverty indicators in villages within *Cho Don* District of *Bac Kan* Province. In the next sections of this paper we will move beyond the statistical description of these relationships, by applying the conceptual model introduced in Figure 2 and investigating the mechanisms linking these variables.

4.1. Effects of accessibility on relationship with the State

The State has a substantial influence on livelihood strategies in the uplands of Northern *Viet Nam*. From the establishment of the cooperatives in 1960 to the decollectivization processes of the 1980s and the land allocations of the 1990s, State policies have had major impacts on social organization and the relationships of production in the studied region. In each case, State policy was developed at a national level and then passed down through provinces, districts, communes, and villages. At the village level, village leaders and farmers tailored each policy to fit their own local circumstances as well as possible. One region might follow a given policy to the letter, while another region might virtually ignore it. Although on paper policies may be all-encompassing and have national scope, in practice the influence of the State is limited by the accessibility of the targeted regions. *Van Tung*, by virtue of its accessibility, has been a close partner of the State organizations in implementing State policy. This has both helped and hindered farmers. On the one hand, *Van Tung* has received one State project after another, and many farmers benefited from governmental support. On the other hand, the close scrutiny by district authorities has restricted farmers' ability to reinterpret State policy to make it fit their particular circumstances.

The villages of *Nghien Loan*, meanwhile, have had tenuous relationships with the State. The same policies implemented in *Van Tung* likewise arrived in *Nghien Loan*, but in *Nghien Loan* authorities have not had the capability to enforce any policies seen as undesirable by the local population. Nor has *Nghien Loan* been privileged by the same influx of funding as *Van Tung*. *Nghien Loan* is out of reach of Government projects. So far, only a few activities from the resettlement program for ethnic minorities have reached this remote area, limited to the distribution of blankets and kitchenware to poor households. The vast majority of projectsin *Ba Be* District where *Nghien Loan* is located have focused on the readily accessible lakeshore region, supporting the National Park management board in tackling biodiversity conservation issues (Zingerli et al., 2002).

The implementation of the cooperatives

In 1960, the State established the cooperative system in similar form in all of the studied villages. Almost all land and most livestock was collectively owned, and laborers were remunerated according to a labor point system. The cooperative system had the twin goals of equalizing the economic status of individuals and organizing agricultural production on a national scale.

In *Van Tung*, the implementation of the collectivist system from 1961 to 1969 was continually resisted. Farmers lacked motivation to put any more effort than was necessary into cooperative tasks, as their share of the collective production was being minimized by rice exports to the delta region of the Red River, where famine was raging. These exports led to hunger in villages such as *Van Tung* that otherwise would have covered their staple food needs. Making matters worse, newly arrived families, mostly of *Kinh* ethnicity, could join the cooperative without contributing either cattle or land, leading to tensions among members.

In the early 1970s, innovative farmers focused their attention on private agricultural activities, either appropriating parts of collectively managed fields or building new terraces. Farmers who withdrew from the cooperative to concentrate on individual production were stigmatized initially, but once it was clear that they had become more successful, other farmers soon copied them. By the time the 1988 *doi moi* reforms arrived to dismantle the *Van Tung* cooperative, farmers already had developed an open market economy, and the new policy was little more than a formalization of what already existed.

In contrast to *Van Tung*, *Nghien Loan* farmers did not experience major problems with rice exports to the lowland regions. *Nghien Loan* was part of the same national system of cooperatives as *Van Tung*, but its relative inaccessibility made it an inconvenient source for rice exports. That said, farmers in the *Nghien Loan* cooperative nonetheless faced difficulties with the allocation of production drawn from a very limited paddy field area. As the population of the commune grew, the proportion of rice production available to each household decreased. With time, households faced longer and longer periods of rice shortage, and had to rely more and more on private cultivation of the uplands for their survival.

Forestland allocation and protection policy

Beginning in the mid-1990s, the State began to allocate forestlands to individuals across the nation, with the intention of increasing farmers' sense of ownership of forestlands and putting an end to the extensive deforestation that was taking place. In 1997, a World Food Programme (WFP) reforestation project was accompanied by further allocation of forestland. Local authorities stipulated the permissible uses of specific upland areas, and allocated them to individual households. Associated with the allocation was a protection policy that restricted the exploitation of certain forest areas and outlawed slash-and-burn cultivation. Farmers who received areas classified for reforestation or forest protection would receive annual payments for watching over the land and protecting it from being cleared or cultivated.

In *Van Tung*, farmers' reaction to the forestland allocation policy was general disinterest. 75% of families did not want to become responsible for protecting forests. To meet the demands of the provincial Department of Agriculture and Rural Development (DARD), village leaders decided that all farmers would

jointly protect the surfaces that could not be allocated to individuals, and the remuneration would be equally distributed among them. In spite of the campaigns of the extension officers, only 20 ha of forest were allocated to individuals. The remunerations offered for forest protection were too small to be worthwhile to farmers, and the forests that needed to be protected were too far from the village. Instead, farmers pursued better income-generation opportunities such as agricultural intensification, formal and informal employment, and small-scale trade. Nonetheless, as we will discuss later, the pressure from the forest protection policy stimulated some farmers to seek more favorable living conditions in the south of the country.

Forest protection policy in *Van Tung* met with resistance, but nonetheless was implemented, driving some farmers out of the region. In contrast, in the *Dao* and *H'mong* villages of *Nghien Loan*, the policy was virtually ignored. In the mid-1990's, a large number of *H'mong* arrived in the *Nghien Loan* region. Most had been driven out of the *Cao Bang* area by forestland allocation and restrictions on slash-and-bum cultivation. *Nghien Loan* was subject to the same policies, but was inaccessible enough that authorities could not enforce the bans. At present, slash-and-bum techniques in an environment of high population pressure are rapidly diminishing the resource base. But with few other choices, *Nghien Loan* farmers continue to engage in the only activity that can feed their households.

Thinh Vuong farmers, like those from *Nghien Loan*, rely on the forest for survival, but ignoring forest protection policy was not an option for them. The village lies along the highway, making newly-cleared fields highly visible to local authorities. Thus, farmers feared the repercussions of disobeying the law. Low population density allowed each household to receive a large amount of forestland for protection, and thus a correspondingly large annual payment. With few agricultural alternatives, farmers willingly became guardians of the forests... as long as they were being paid for it. Forest cover improved remarkably in the late 1990s, and in the past few years very few upland fields have been burned. It is the high accessibility and visibility of the village that has made forest protection policy effective.

4.2. Effects of accessibility on access to projects

Development assistance projects do not necessarily target the individuals who are in greatest need. Inaccessible communities can be passed over in the selection process because of the added cost of working in difficult regions. Further, regions with better infrastructures may have greater potential to capitalize on the assistance offered by projects. Thus, projects may be able to achieve more rapid progress in comparatively accessible regions, even if there are greater needs elsewhere. Indeed, some projects simply may have nothing to offer to a region that is too remote. For example, *Nghien Loan's* inaccessibility and lack of marketing

channels makes it a very ineffective target for a fruit tree plantation project. All these reasons can result in a distribution of projects that marginalizes the regions that are the least accessible, and often the most in need of support.

We have already discussed *Nghien Loan's* Commune lack of access even to the district extension service, and the resultant clustering of projects in other communes of *Ba Be* District. In contrast, some but not all of *Nghien Loan's* villages benefited from the WFP reforestation project. In particular, the *Tày* village of *Ban Dinh* as well as most of the *Tày-Nung* villages within *Nghien Loan* Commune participated in the WFP project. However, the *Dao* village of *Khuoi Un* did not. It was virtually impossible for individual households of the *Dao* and *H'mong* villages to participate in such a project because their very limited land was dedicated exclusively to annual crops. They could not afford to dedicate a piece of land for such a delayed return on investment.

Van Tung, in contrast ,has benefited from a comparative abundance of projects. Unfortunately, this abundant assistance has not always translated into benefits for farmers. In this section, we will examine several projects that have been implemented in *Van Tung* in recent years, and attempt to identify how these projects have contributed to the current skepticism of farmers toward development assistance.

Table 2 summarizes some of the projects that have been implemented in *Van Tung* and *Thinh Vuong* in the last decade. In the early 1990s, local authorities provided fruit tree seedlings (mostly plums) to farmers to give them an opportunity for additional income generation. When the seedlings were distributed, there was not a lot of fruit on the market, and prices were high. But because the same project had been implemented in many villages in the area, by the time the trees bore fruit, the market was flooded with plums and prices had dropped sharply. As the project did not offer a means of processing the fruit or a feasible way to bring it to larger markets in the lowlands, the fruit tree project failed to deliver on its promise of increased income.

Following the forest protection project mentioned earlier, in which few *Van Tung* farmers participated, the government proposed a reforestation project in cooperation with the WFP The areas chosen for reforestation were close to the villages, and the payments offered were substantial enough to attract the attention of farmers (1.5 million Dong per replanted hectare, as opposed to the 50,000 Dong offered by the previous forest protection program). Most of the farmers in *Van Tung* were interested in participating in the project, for the following reasons:

- The remuneration was substantial enough to make participation worthwhile.
- Although labor requirements were high, farmers could organize the timing for their labor input as they chose.
- The seedlings were offered free of cost, but the forest would be the farmers' to exploit in the future. People were getting something for nothing.

Table 2: *Some of the many State-implemented projects in Van Tung and Thinh Vuong Communes*

Project	% of village households participating in projects		Purpose	Result
	Van Tung	*Thinh Vuong*		
Fruit tree plantation project (early 1990s - 1998)			Offer income-generation opportunities through sale of fruit on an open market.	Market flooded with fruit, small potential for profit.
Forest protection (1993 - about 2000)	25	95	Give farmers incentives to protect forests from slash-and-burn cultivation and deforestation	Overall disinterest, insufficient opportunity for profit
Reforestation 327 / WFP projects (1993 - about 2000)	64	39	Give farmers incentives to replant areas close to the village with pine trees.	Farmers planted the trees but did not care for them - they received the remunerations, but the trees died.
State promotion of tobacco growing project (1998 - present)	71	-	Create opportunity to generate income through tobacco crops, bring production to Vinataba.	Farmers grow tobacco, at the expense of the forest and goals of previous projects.
Livestock project	-	58	Generate income and capital for peasants in *Thinh Vuong*	Increased income for wealthier households, harmful to forests.
Honey making project	-	26	Generate income from bee keeping and producing honey in forested areas	Success, where forests are available and honey can be marketed in stalls on the road.

This approach to reforestation was more effective than the previous State program at attracting the attention of farmers, but nonetheless it is difficult to rule it a success. The "*cay nha nuoc*", the "Government tree", as the locals call it, was widely planted but poorly maintained due to a lack of both farmer knowledge and interest. Farmers claimed that the soil was not sufficiently fertile and water sources were too far away, but observation suggests that farmers were fulfilling only the minimal requirements to qualify for support. Only a small fraction of replanted areas have developed well.

In the second half of the 1990s, a joint initiative by DARD and the *Ha Noi* Vinataba Company brought tobacco production to *Van Tung*.The Vinataba tobacco company offered an input package to farmers consisting of seedlings, fertilizers and, if necessary, pesticides. Extension officers introduced tobacco cultivation techniques to a group of farmers, who then disseminated their knowledge throughout the village. Agricultural extension workers and agronomists from Vinataba visited regularly and monitored the progress of the crop. Farmers were obliged to sell the tobacco to the company, but the price was not fixed.

The tobacco project offered additional income to farmers, though there were both financial and social costs. Tobacco cultivation substantially reduced the time available for visits and social events, the traditional pastimes of the winter season. Further, children who previously would have gone to school now had to spend the Winter season tending grazing cattle to prevent them from damaging tobacco fields. Nonetheless, the majority of farmers (71% in *Van Tung* village) chose to cultivate tobacco on at least a portion of their rice fields.

Although most farmers seized upon the tobacco-growing project for its income-generation potential, it did little to improve local opinions about the State's ability to bring worthwhile projects to the region. The tobacco leaves sold to the State company first had to be dried in large wood-burning ovens. The high timber requirements of tobacco drying placed this new project in conflict with earlier reforestation and protection projects. The local authorities wanted farmers to preserve and regenerate the forest in the area, but were at the same time implicitly sponsoring timber exploitation. District agricultural officials were aware of the conflicting nature of the project, but argued that they themselves were not in a position to question broader development plans issued by superior offices.

The tendency of farmers is to follow the most profitable of several conflicting directives, so tobacco growing currently takes priority over forest protection. But the protection policy packaged by the State has never been very popular. Farmers remain concerned that what few forests remain will soon disappear if tobacco cultivation and drying continues, but no plans have been made to prevent this eventuality.

Given the large number of projects that have graced the region without producing substantial benefits, it is not surprising that farmers react with skepticism to new projects. The State has not established a reputation for creating effective income generation opportunities in the region, and large-scale projects are unpleasantly reminiscent of the failed cooperatives. When a new project arrives, local farmers assess it only in terms of the immediate profit it can bring them. Farmers thus draw income from the reforestation project, but are not concerned with the survival of the trees. Likewise, they draw income from tobacco growing regardless of conflicts with previous State policies and forest quality.

The frequency of projects in *Van Tung* also has created expectations among local farmers. Our interviews suggested that farmers expect to see at least one income generation project per year in their area. They showed little initiative in making long term plans, preferring instead to wait and see what gets offered to them.

4.3. Effects of accessibility on relationships among households and on relationships with the market

Apart from their degree of access to extension services and income-generation projects, *Nghien Loan* and *Van Tung* are highly differentiated in their access to broader markets for their production.

Nghien Loan's isolation means that farmers use their agricultural production almost entirely for household consumption. Buffaloes are mostly used as a means of traction, while fowl are raised for household consumption. Capital in the form of cows and buffaloes is being saved primarily for the future purchase of rice fields. In short, farmers' perspectives of the future are limited: farmers' primary livelihood strategies are focused on just trying to attain rice self-sufficiency through intensification and extensification of paddy fields. In part, this perspective is justified, because opportunities for diversification are limited. One exception is the rapidly developing *Ban Dinh* livestock (buffalo-cow) market. It offers an income generation opportunity, but is mostly exploited by the wealthier *Tày-Nùng* households. They can concentrate on this new activity because their ability to hire labor frees them from personal involvement in rice growing activities. But the general lack of possibilities for diversification, and the diminishing resource base in *Nghien Loan*, are pushing most *Dao* and *H'mong* farmers into a situation of imminent crisis.

Meanwhile, *Van Tung* enjoys relative prosperity, in part because of its proximity to *Ngan Son*, which provides the village an outlet for its agricultural production. The effects of the nearby market are visible in the diversification strategies of *Van Tung* and *Thinh Vuong* farmers as compared to the *Nghien Loan* farmers (Figure 3). Non-farm activities contribute 45% of *Van Tung's* total household production. About half of this contribution is earned at the *Ngan Son* market in the form of trade, employment, and sale of forest products. Even in *Van Tung*, fully 55% of the total household production is in the form of agricultural produce (primarily paddy rice followed by maize, vegetables, meat, and eggs). However, *Van Tung* farmers sell much of this produce for cash. Of *Van Tung's* total annual household production, only 30% is in the form of agricultural produce that is consumed by the household. In contrast, in remote *Nghien Loan* Commune this figure is 68%. Non-agricultural activities play a major role in the *Van Tung* household economy, and contribute to the income of every second household. Non-agricultural income sources include Government work that is mainly of an administrative kind, informal employment, day labor, and trade (Alther,1999). Government work in

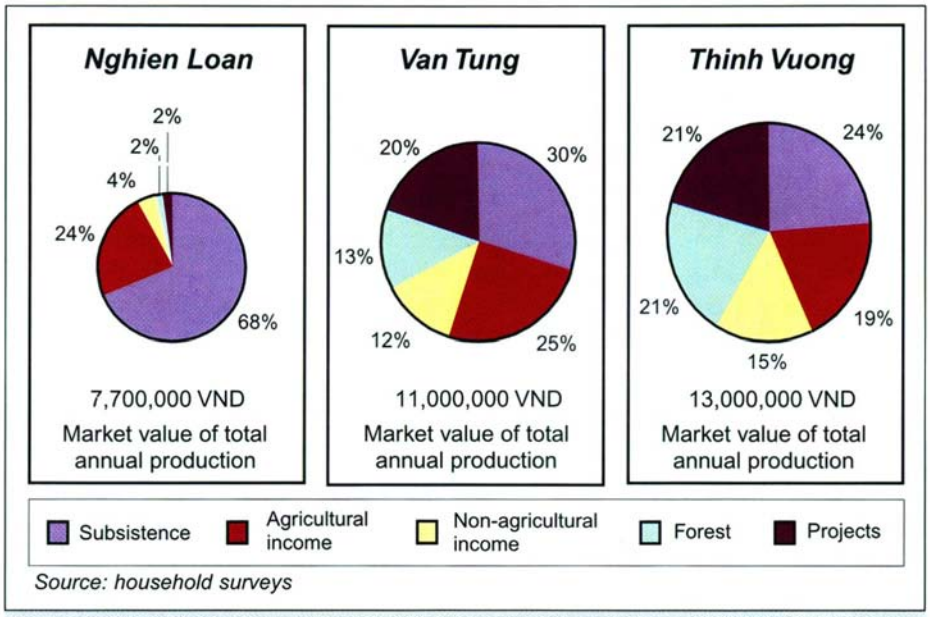

Figure 3: *Comparison of average composition of annual household production in the study areas in 1999.*

particular allows individuals to develop their social networks, helping them to stay informed of economic developments and new laws and policies. Trade is another means of building social capital, as it reinforces relationships with people outside of the village. Most families who engage in trade do so with the help of relatives in other towns or villages.

In the other high-accessibility study area, *Thinh Vuong*, non-agricultural activities make up 57% of the total household production, mainly because agriculture is restricted by natural conditions and environmental laws while trade and government work, including road maintenance, have become important for income generation. In contrast, in low-accessibility *Nghien Loan* Commune, non-agricultural activities make up less than 8% (against 45% and 57% in *Van Tung* and *Thinh Vuong*, respectively) of total household production. If the one-time benefits of the WFP reforestation program are excluded, this figure drops to 5% (Rousseau and Gevraise, 2000).

Van Tung benefits further from its proximity to a source of external information about the market and national policy environment. With the advent of the *doi moi* reforms, farmers are finding themselves more and more responsible for creating their own production strategies, and information on marketing channels is a crucial input for the production decisions they must make. Upon our arrival in *Van Tung*, we found that farmers were much more interested in any information we could provide about the market than in whatever project we were associated with.

4.4. Effects of accessibility on migration

An additional particularity of *Van Tung* uncovered by our survey was the mass emigration that occurred in the mid-1990s. The development projects that were intended to bring prosperity to the region threatened certain farmers' livelihood systems, mainly due to the fundamental changes in land use policy: common land became private, and crops that traditionally were grown under swidden production were banned. In contrast with many regions of *Viet Nam*, where farmers with economic difficulties are drawn to larger population centers, farmers in the studied region were drawn to the rural New Economic Zones in the south of the country (Alther, 1998).

For many farmers, the South is thought of as a land with fertile soils and a better climate. Many farmers have relatives who had already moved there. In the early 1990s, newly opened areas in *Dak Lak*, *Binh Phuoc* and *Lam Dong* Provinces had very low population densities, a further drawing factor for people in comparatively densely populated *Bac Kan* Province. Information from those who already had made the move suggested that education levels in *Bac Kan* Province were higher than in *DakLak*, *Binh Phuoc*, and *Lam Dong* provinces, and that immigrants could very quickly find themselves better off than the southern local inhabitants. Less stringent environmental laws also meant that shifting cultivation would again be a possibility, and it seemed that there was plenty of land with which to work.

In contrast to *Van Tung*, in low-accessibility *Nghien Loan* we heard very little about migrations. The difference could well be explained by accessibility, both to information and to the necessary infrastructure to engage in such a relocation. In *Van Tung*, farmers get letters from their emigrant relatives. They watch TV programs about migrations and can get newspapers at the market. On the National highway there are direct bus services to the provinces in the southern Central Highlands. But far from the district capital, *Nghien Loan* farmers receive little information about the New Economic Zones, and in any case a move would have been rather hard to imagine without family connections in the South.

4.5. Effects of accessibility on social conditions

Social consequences of low accessibility are visible in *Nghien Loan*, where *Dao* and *H'mong* villages are characterized by a higher level of illiteracy than other villages in the commune. Low education has direct consequences on farmer livelihood. The capacity to seize upon innovations tends to be less. As we will address later, selection of project participants often results in the exclusion of less-educated farmers. Families in very remote areas tend to be larger than in more accessible villages. The low-accessibility villages of *Ban Dinh* and *Khuoi Un* averaged 5.4 and 6.8 persons/household, respectively. In contrast, the high-accessibility villages of *Van Tung* and *Thinh Vuong* had smaller households, averaging 5.0 and 5.3 persons/household, respectively. Low-accessibility villages

have larger households both because of fewer contacts with family planning services and because family labor force remains the most important asset in situations of poor integration into the market. Accessibility, with the non-agricultural opportunities it brings, is thus a force for demographic transition.

5. Discussion: perspectives on the future

At the provincial level, remoteness and poor accessibility can be obstacles to the development of rural employment and non-agricultural income generation activities. In *Bac Kan*, trading opportunities are limited compared with those in other northern provinces that share borders with China or that border the Red River Delta. *Bac Kan's* inadequate transportation network, in spite of recent upgrading efforts, remains a major constraint to industrialization and attraction of investments from outside of the province. Within the province, non-agricultural activities are mostly limited to a few small mines and services in the small urban centers. Income generation primarily consists of small-scale agriculture and the now strictly-regulated exploitation of forest resources. Only in a few places that are easily accessible has non-agricultural income become important. This unequal accessibility within the province brings about substantial disparities in income generation opportunities and people's chances to lift themselves out of poverty.
In the future, substantial investments by the State will bring roads to many remote regions. For example, beginning in 2002 the State will use over $110 million in World Bank loans to build infrastructure, including roads, in 6 northern mountainous provinces. We have seen in the studied villages that improved accessibility can have a definite positive impact on economic situation. However, roads alone are not the all-purpose solution for rural development.

5. 1. Helping farmers take advantage of increasing levels of accessibility

Building on local initiatives

The decision by *Khuoi Un* farmers to enforce a livestock management regulation Themselves was unparalleled in any of the other studied villages. Faced with increasingly severe constraints of land scarcity and population growth, the shifting cultivators of *Khuoi Un* decided that their system could no longer sustain free grazing livestock. In 1999, the village collectively decided to implement a two-year-old district livestock management law that until then had gone ignored. Under the new law, farmers would be responsible for the surveillance of their livestock at all hours, and would have to pay for any damage to others' fields. The adoption of this law by the village was driven by need, and stands in contrast with the general disinterest towards projects and regulations displayed by the other villages. We believe that locally-driven initiatives are most likely to respond to local needs.

Van Tung has seen a multitude of projects, but has rarely displayed the kind of collective initiative shown by *Khuoi Un*. At the beginning of our investigation, farmers and village leaders repeatedly said that it was impossible to set up a grazing management scheme to keep the cattle from part of the fields during winter season in order to plant a second crop there. However, when the Vinataba Tobacco company initiated tobacco cultivation in the village, local leaders agreed to establish a grazing management scheme. In part because of the absence of land scarcity, and in part because of negative memories of the collective period, *Van Tung* farmers have not been willing to rely on anything except individual initiatives. Those projects that did meet with any measure of success did so only because locals saw potential for individual profit in them; *Van Tung* did not take to heart the grander ideals and visions of the projects. *Khuoi Un* farmers likewise adopted the livestock law not for its "grander ideals and visions", but because it was in their individual interests. Can the projects in *Van Tung* be termed successes because a number of farmers participated and gained income from them?

Participants believe that if the projects had not arrived, farmers would have created their own initiatives and earned similar profits. This view is contradicted by emigrant farmers who feel a lack of governmental support at their new homes in the South and find it very hard to improve their economic situation there. In Figure 3, the pie charts show that in the high-accessibility villages development projects contribute about 20% of the household production. *Van Tung* and *Thinh Vuong* farmers seem not to be aware of this anymore, perhaps because this support has flowed regularly into the villages for the past five years. In addition, the state of the forest has definitely improved since the implementation of the reforestation and forest protection projects; this gain in natural capital has been one clear and concrete benefit of projects in the area. Without the external financial incentive, i.e. by building only on local initiatives, such a project would not have been possible. Other case studies in *Ba Be* and *Ngan Son* Districts offer more evidence of the key role of local authorities and local mass organizations for implementing State environmental projects (Castella et al., 2002; Zingerli et al., 2002).

State projects in *Viet Nam* are often implemented on a national scale, disregarding all-important local peculiarities .Local peculiarities are particularly difficult to assess in the highly heterogeneous natural and human environments of the mountainous areas of *Viet Nam*. However, thanks to long-term contacts with authorities implementing projects, farmers have learnt about the mechanisms of project implementation and how to manipulate these projects to their benefit. For example, *Thinh Vuong* farmers put pressure on the local department responsible for forest protection when the promised payments were delayed. The farmers said that they were unable to help protect the forests without remuneration and instead would have to cultivate rice on slopes again in order not to go hungry. The payments were made shortly thereafter. After a very low yield in 1998, farmers in

Thinh Vuong were surprisingly relaxed. They planned to send a delegation to *Cao Bang* to ask for State food support. For this village, the government is a safety net. The lesson from *Khuoi Un* is that if a project is to be genuinely owned by the local people, then it needs to respond to their needs, regardless of the dreams and visions of policy-makers and extension staff. If a project is ignorant of local needs as perceived by the farmers themselves, it will be used by those farmers as little more than a short-term source of free income. On the other hand, when communities are involved from the beginning, they will be more likely to accept responsibility for project implementation. When they have identified themselves with a project in this way, the project stands a better chance of surviving even after the outside inputs are removed.

Re-thinking local extension systems

Roads play an essential role in providing access for extension staff. Extension staff prefer to work in villages close to a road, giving farmers in these villages much better opportunities to participate in development projects than farmers living in more remote villages. The village selection process plays an instrumental role in determining whether or not development will be equitable.

Extension staff and authorities have vested interests in seeing projects succeed, but for most government agencies the quantity of the impact is often more important than its quality, i.e. how many ha of forest land are declared to be reforested land rather than the number of trees surviving after three years. Judged by farmer participation, the *Van Tung* tobacco project was a success, regardless of the fact that it is exacerbating the deforestation problem and standing in opposition to forest protection and regrowth projects. The goal of the creators and implementers of projects needs to shift towards facilitating local changes, instead of trying to direct them by continually injecting subsidies. Instead of trying to artificially create economic incentives for farmers, rural development authorities need to consider what incentives already exist and what kind of initiatives the farmers themselves are interested in pursuing.

In *Van Tung*, all our interviews suggested that farmers feel a need for information about the market and feel constrained by limited access to sources of information beyond economic programs on local radio. Instead of trying to dictate what farmers should grow (a technique that often has failed to improve living conditions because of inadequate market understanding, e.g. the plum and apricot trees), the extension service could work to develop information-sharing mechanisms to better connect farmers with potential buyers of their production.

Developing rural employment opportunities

Roads are an important factor in creating employment opportunities. Roads create opportunity for development projects, and where development projects are being implemented, Government agencies will need local people to mediate between

villages and authorities. People located close to the road will be able to join the administration, securing a regular source of income. A variety of spontaneous self-help projects by farmers with good access show the potential of self-help projects under condition of good accessibility. During the past years, five families in *Thinh Vuong* set up small shops along the national highway. These stalls are not gold mines yet but farmers feel it's a worthwhile strategy of diversification. The local products sold to drivers, and processed goods sold to villagers and people from more remote villages, contribute 20% to these households' production. The shopkeepers also sell products from other villagers such as forest products and local specialties (e.g. honey or a special kind of rice wine). These products often bring a high price, because the buyers consider them as novel products, made by ethnic minorities and thus something special that can be sold profitably in *Ha Noi*. We expect that the volume of products sold by such stalls along the road will increase. However, there will be increasing competition among shop owners and some of them will be ousted. Such local channels of marketing increase diversification. For example, some farmers in *Thinh Vuong* started fruit plantations, selling fresh fruit right from the field.

However, new roads will also become springboards for further migrations. The migrations to the New Economic Zones in the South have largely ended, as the conditions of low population and thriving industry in the South have ended. In the future, the rural-rural migrations of the 1990s risk being replaced by rural-urban migrations, which the population centers of *Viet Nam* may not be able to support. Currently, migration to urban regions is not yet an option to *Van Tung* and *Thinh Vuong* farmers because they feel that they would not be able to compete with urban people for employment.

Rural employment generation can begin in agriculture through diversification as many areas have already reached the limits of intensification and extensification. In addition, the State has announced plans to promote the development of rural industries in coming years. As with other income generation opportunities, people with better access to information and better education will have a greater chance to benefit from new rural industries. It is unlikely that rural job creation can completely stem the tide of migration, but it can certainly play an important role. Although most families' dreams are for their children to get a good education and find work outside of agriculture, both farmers and their children have strong attachments to their traditional homelands. A survey among students in the accessible villages, aged between 12 and 16 years of age, showed that most students are dreaming of a job as teacher, nurse, policeman, soldier or mechanic but few are willing to live and work outside of their district. Children in remote villages are less aware of non-agricultural job opportunities. Thus, local support for rural industry certainly exists.

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Part II:
Thematic Studies

Landscape changes in *Cho Don* District during the *doi moi* era (1990-2000) and their implications for sustainable natural resource management in *Viet Nam's* mountainous provinces

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Abstract

The mountainous zones of northern *Viet Nam* have been mostly bypassed by the remarkable economic growth that delta regions have enjoyed in recent decades. The extreme diversity within these remote mountainous zones causes national policies to have vastly different outcomes in different areas, even within the same province or district. In this chapter, we examine the relationships between the biophysical and socioeconomic factors that shape peoples' livelihood strategies and, ultimately, their standards of living.

We combine a broad district-level geographic approach with localized monographic studies to assess the effect of geographic conditions on rural development. After identifying the village as the elementary unit of natural resource management, we demonstrate that biophysical' characteristics (landscape, relief, climate) are the defining factors behind village production systems. Villages that have production systems based on wide valley bottoms cropped with irrigated rice tend to be compact and accessible. In contrast, villages in steeply-sloped forested areas tend to be spread out and inaccessible. The *doi moi* reforms of the 1980s and 1990s have mostly benefited the former type of villages, populated mostly by the *Tày* and *Kinh* ethnic groups, while leaving behind the latter type, mostly *Dao* and *H'mong*. The geographic approach offers researchers a mechanism for classifying and identifying the villages in greatest need of technical assistance without the need for exhaustive monographic studies.

Keywords: land use changes, resource use, mountain agriculture, accessibility, *Viet Nam*

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1. Introduction

1.1. Poverty and natural resource management in the mountains of northern Viet Nam

The mountainous regions of northern *Viet Nam* are today receiving particular attention from the national government, as they have thus far missed out on the impressive economic development that has blessed the rest of the country since the *doi moi* reforms that began in the late 1980s (Jamieson et al., 1998; *Dao* The Tuan, 2000). Today, about fifteen years into the reform process, the national poverty level has dropped from 58% to 37%, but remains at 60% in the northern mountains (Poverty Task Force, 1999). In the relatively inaccessible mountainous provinces, many village economies are based exclusively on subsistence agriculture and depend directly on the availability of natural resources to farmers. The mountainous regions are characterized by great ecological diversity, which can lead to substantial disparities in resource availability within even a small area. Low availability of natural resources is a major criterion for the State in identifying disadvantaged areas (CEMMA, 1997). Further, poverty reduction programs often target villages based on their isolation, their weak infrastructures, and their level of environmental degradation (Minot and Baulch, 2002). Underlying these criteria is an implicit relationship between poverty and the environment that is rarely documented in the literature (Le Trong Cuc and Rambo, 2001). In this chapter, we will examine this relationship and evaluate the relative roles of biophysical and socioeconomic factors in the recent agricultural changes that have visited the mountainous regions.

Near the end of the 1980s, some researchers predicted major environmental destruction in the northern mountains including *Bac Kan* Province (Dang Dinh Quang, 1991; Piquet and Puvilland, 1992; *Dao* The Anh and Jesus, 1993). Several years later, however, new- land policies and the prohibition of slash-and-burn systems resulted in a visible improvement in forest cover (Sadoulet et al., 2002; Castella et al., 2002b). Land allocation to individual households had stabilized the livelihoods of most farmers in the region by creating incentives for paddyland cultivation and agroforestry. But some farmers slipped through the cracks. Those who did not receive paddyfields in the land allocation were forced to return to unsustainable slash-and-burn systems on the hillsides (Castella et al.,2002). Rural development in *Bac Kan* Province needs to focus on reaching the most marginalized groups who thus far have been neglected by the development process. Geography has played an important role in keeping these poorest of farmers on the periphery of development and needs to be considered in identifying intervention points to assist them. In this chapter, we will demonstrate the role that geography has played, and show bow researchers can use broad geographic techniques to identify priority areas for future development interventions.

1.2. Land use changes and the complex human and natural environment

In examining the natural resources of a region, it is important to consider both biophysical characteristics that remain unchanged over long periods (geology, soil types, climate, etc.) and the comparatively rapid-changing (on the order of several years) ways in which communities use resources. Our research rests on the understanding that there is no equilibrium state of an agricultural landscape, but rather, evolution patterns that may be positive or negative in terms of long-term ecosystem sustainability. The resource situation at any given date is in a state of flux, and is the result of past land-use changes and natural resource management approaches.

The evolution of land use and of natural resource management approaches is shaped by State policy. A single agricultural policy applied broadly to the heterogeneous mountain zones, where one valley can differ markedly from the next, can result in a diversity of localized effects. For example, the land allocation policies of the reform period were reinterpreted mad adapted in a wide variety of ways across the mountains (Castella et al., 2001). The successive reforms of *Doi moi*, each interpreted and then reinterpreted at various levels, further contributed to the present complexity. As a result, the simple criteria (i.e., ethnicity, rich/average/poor households) used by State institutions to classify communes and villages are no longer sufficient (Minot and Baulch, 2002). To guide development activities, the present diversity needs to be understood both in terms of its present-day spatial characteristics and projected evolution patterns in the future. Landscapes and their natural resources are shaped by the land uses of the populations that base their livelihoods on those resources. Completing the circle, farmers develop their production strategies based on the way they perceive their environment, and their social and economic conditions are often determined by resource access.

With remote sensing technology, we can follow the evolution of landscapes, thereby gaining insight into local biophysical and socioeconomic processes. In this research, our first objective was to characterize the diversity of landscapes in *Cho Don* District of *Bac Kan* Province in terms of biophysical parameters, and then to describe the landscapes' evolution based on a chronological series of land-use maps. Moving down to the village scale, our second objective was to associate the key biophysical parameters with farmers' practices and the socioeconomic variables that affect those practices. The third objective was to analyze the interactions between these static (biophysical) and dynamic (human) variables, to create a typology of villages in *Cho Don* District. From this typology, we can classify local circumstances and recent evolution patterns, bringing to light the most crucial intervention points for development.

2. Methods

2.1. Theoretical framework

Our methodology was guided by the hypothesis that landscape changes are the Result of interactions among (i) spatial organization of natural resources, (ii) quality or condition of natural resources, and (iii) local rules for natural resource management. Figure 1 demonstrates the functional relationships between these biophysical and socioeconomic parameters.

With the goal of encompassing the whole of *Cho Don* District in our survey, we developed a geographic information system (GIS) with information at the highest level of detail available (described in section 2.2). This GIS included two kinds of data: (i) static data, which have not substantially changed in the last ten years: hydrology, soil types, geomorphology, etc.; and (ii) data for dynamic variables: land use, population, accessibility, etc.. The joining of these variables in the GIS allowed a broad characterization of natural landscapes.

After examining the structural and functional relationships among landscapes and the other layers of the GIS, we tried to relate these relationships to local land uses and stakeholders' decision-making processes. With the active participation of local informants, we associated data from monographic surveys with information from a chronological series of aerial photographs, helping us to understand local rules for natural resource management and their impact on the environment. We focused particularly on local stakeholders' perceptions of the resources available to them, and the ways in which these perceptions influenced stakeholders' final decisions about production strategies. This participatory approach had to be limited in its spatial coverage, and did not go beyond the village level, but was undertaken in a number of villages that were deemed to be representative of the entire province. With the help of the GIS, we selected a group of research sites that encompassed the provincial diversity of agro-ecological systems and levels of accessibility.

Monographic studies conducted in *Cho Don* District proved that the village, corresponding to a micro-watershed in geographic terms, was the elementary unit of natural resource management (Mellac, 2000; Castella et al., 2002a and 2002d). At the village level, we examined the impact of both internal and external factors on the already-identified landscape changes. We studied the statistical relationships between socioeconomic and geographic variables through principal component analyses. The monographic studies then helped us to interpret the statistical results and formulate hypotheses about natural resource management rules in the different types of villages that we identified. The study culminated in a typology of village agro-ecosystems, which allows us to target recommendations to match the kinds of problems encountered in each kind of village.

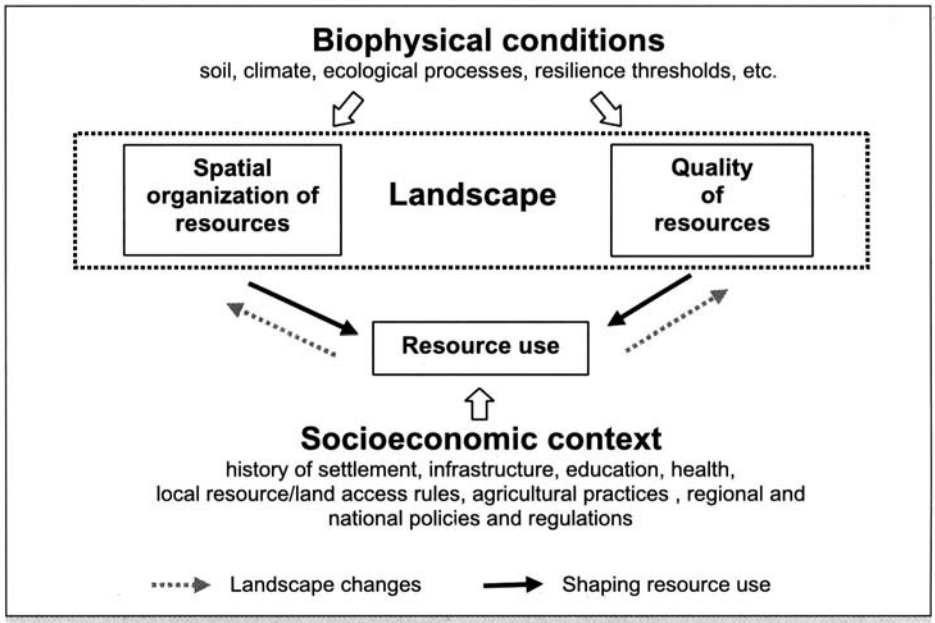


Figure 1: *Interactions to consider when analyzing landscape changes*

2.2 Data sources

Quantitative geographic data

Static biophysical characteristics. The maps representing the main biophysical variables were drawn from a provincial database of information from various institutions and projects (Brabant et al., 1999). The soil map of the district was created by Raunet (1999).

Land use maps. *Cho Don* District has been the subject of several research programs (Bal et al., 1997; Brabant et al., 1999; Mellac, 2000), and several land use maps were available. However, we used them as ancillary data because they were not available at the same resolution, did not all describe the same information, and did not have consistent legends. We developed a consistent series of land use maps at the maximum resolution available from the SPOT satellite images for three successive dates: 1990, 1995, and 1998.

Socioeconomic survey of Cho Don villages. In 2000, we surveyed all the villages in the district, evaluating their access to different kind of facilities (markets, schools, and health services). In each of the twenty-two communes, we organized meetings attended by all of the commune's village heads. In each meeting, we presented a topographic commune map on which the village heads traced their village boundaries. The commune is the smallest administrative entity recognized by the State (and the lowest level at which statistics are available), but it was

important to identify village boundaries if we were to evaluate the state of available resources at the village scale.

We then asked the village heads to draw existing roads and paths on the maps and identify travel times on routes of varying qualities. We processed travel times from villages to different locations (facilities, main towns, other villages, etc.) with the GIS tools FlowMap® (Zwakhals et al., 2000) and ArcView® (Ormsby et al., 1998) to generate accessibility indicators (e.g. isolation, remoteness). This information was merged with socioeconomic data for each of the 231 villages in the district, including population, proportion of households of each ethnicity, illiteracy rates, poverty levels, date of access to electricity, schools, presence of markets, health services, modes of access to information (number of televisions, radios, telephones), and type of animal husbandry (buffaloes, cows, pigs).

Qualitative geographic data

Monographic Studies were undertaken by university students over a ten-year period in several communes of *Cho Don* (Dang Dinh Quang, 1991; Piquet et Puvilland, 1992; Mellac, 2000; Castella et al.,2002c; Eguienta et al.,2002), resulting in a large database of information on diverse sites that represented the diversity of the district (e.g. agrarian history, natural resource use by the various ethnic groups, production strategies, etc.). In 1999 and 2000, a monographic study conducted in *Ngoc Phai* Commune (Castella et al.,2002c) confirmed that the factors influencing the agrarian history of *Cho Don* District were also at play in other districts of *Bac Kan* Province (Sadoulet et al., 2002; Castella et al., 2002b; Fatoux et al., 2002; Alther et al., 2002). Moreover, we used a chronological series of land use maps to characterize the evolution of the landscape in the studied communes over the last five decades (1950-2000). We then used the monographic studies to help explain the observed changes in land use.

Analysis of village-level resource use. We addressed the spatial dimension of resource use in *Phieng Lieng* village, *Ngoc Phai* Commune, where agrarian history was representative of a large number of *Tày* villages in the district (Castella et al., 2002d, Eguienta et al., 2002). Using a visual relief model of the village, we discussed with local farmers the seasonality and locations of agricultural activities (cropping, animal husbandry) and forest product gathering. This mix of interdisciplinary scientific data (maps derived from aerial photos, biomass measurements, etc.) with local understanding and perceptions allowed us, together with the villagers, to evaluate the impact of various production practices on the natural resource base (Castella et al., 2002a; 2002d).

The qualitative data made it possible to analyze the functional relationships among the quantitative variables introduced earlier: static biophysical characteristics; village-level socioeconomic data from a single date, 2000; and the succession of landscapes from the 1990, 1995, and 1998 land use maps.

3. The landscapes of *Cho Don* District

3.1. Biophysical characteristics and distribution of natural resources

North-South biophysical diversity

Approximately 900 km 2 in size, *Cho Don* District is in a transition zone between the Red River Delta and the northern mountain chain. The district spans altitudes from 200m to 1500m (Figure 2-A), although more than half of it is below 400m. The district can be subdivided into three main geomorphologic zones that lie along a north-south geomorphologic gradient (Figure 2-B).

- The **southern zone** of the district is composed of gentle hills (20 to 60m in height), surrounded by a network of rivers and small valleys with flatland areas suitable for wet-rice cultivation.. The soils in this zone are thick (100-200 cm), resting on a substrate of quartzite and schist.
- The altitude of the southern zone rises toward the north, leading to the **central zone**, made up of high hills. Reaching to 700m in altitude, the high, steeply sloping hills average about 80-200m in altitude. Like the southern zone, this zone rest on schist and quartzite. The relief makes for clearly defined watersheds (Mellac, 2000).
- Further north, past the district administrative center of *Bang Lung*, the landscape becomes mountainous. In this **northern zone** the relief is strikingly marked by sharp crests, steep slopes, and boxed-in valleys, making for very clearly defined watersheds (Raunet, 1999). Two massifs rise above 1000m in the northern end of the district. Climate is cooler at the higher altitudes, with average temperatures 4°C colder than in the southern zone (Brabant et al., 1999). In this schist-dominated zone, granite and limestone outcroppings make up the highest mountains. Soil depth varies widely (0-100 cm).

These three geomorphologic zones are scored by alluvial valleys, the largest of which have deep soils and are often marked by high terraces. These terraces dominate the valleys, and are composed of ancient alluvia lying on schist and covered by colluvium from the surrounding slopes. Five major rivers wind through these valleys, defining the major watersheds of the district (Figure 2-C). Of particular interest are the *Song Pho Day* and *Khuoi Vao* valleys, which make up the major transport corridor in the north of the district.

Distribution of natural resources

The *Cho Don* land-use map is composed of six land classes:

- *Cultivated land:* **paddyfields** are located in the valley-bottoms and on terraces. **Upland crops** is used on our land use maps both for bare soil and for hillsides covered with non-woody vegetation(crops, crop residues). **Lower hillside**

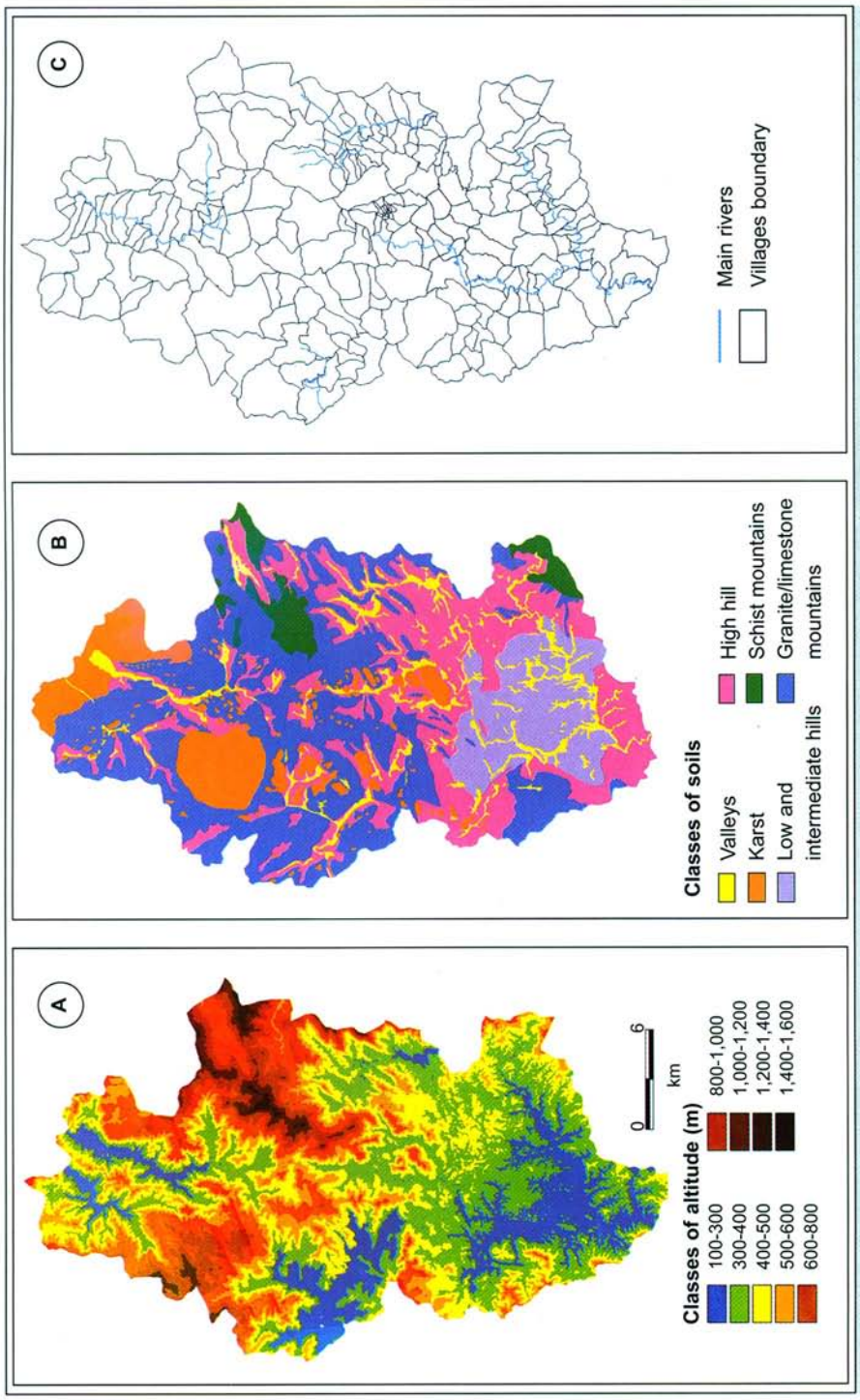


Figure 2: *Maps of Cho Don District. A: topography, B: geomorphology, C: hydrology and village boundaries.*

mosaics are intensive mixed cropping located near houses and paddyfields in the intermediate zone between upland and lowland crops.

- *Uncultivated land*: **shrubland** corresponds to areas covered by woody plants less than 5m high with medium to high densities, and may have an herbaceous stratum. The difference between shrubland and open forest can be hazy, and a given area could change classes depending on the season in which the satellite image was taken (October in 1990, December in 1995, and September in 1998). We used a single class **forest** for all forests to account for seasonal variations that could affect our forest cover statistics (e.g. trees losing leaves).Our definition of a forest is therefore rather broad, covering any trees higher than 5m, with medium to high densities.
- *Residential zones*: **residential areas** were delimited with the help of aerial photographs.

The 1998 *Cho Don* land-use map (Figure 5) shows a distribution of natural resources at the district level that varies with the toposequence (lowland, hillside, hilltops).

Paddyfields are concentrated in the wide, flat lowlands of 'three river valleys to the north and east, and nestled between the low hills of the southern zone. In the north of the district, the lower hillside mosaics are found mostly at the bottom of the colluvium slopes and on the edges of large lowland paddyfield areas. In the southern zone, the area of lower hillside mosaic is more limited, concentrated around the smaller paddyfields and at the bottoms of steeper slopes. The hillsides are the setting for a variety of crops and plants representing a series of stages of forest regeneration in the slash-and-burn cultivation process. Cropped fields on the hillsides are most often cleared from forested areas, and then abandoned when soil fertility declines. Years of fallow allow secondary forest to grow. Shrubland is an intermediate phase in the cultivation process, often marked by bamboo competing with mixed woody species. Bamboo is classified as a pioneer species after forest fire, often indicative of forest deterioration (Mellac, 2000).

Secondary forests are found on the highest summits and steepest slopes, particularly on the two northern massifs, the least accessible of areas. Their specific ecological conditions (limestone substrate, high altitude, and harsh climate) have selected particular plant species. These summits are covered by evergreen forest, also found in the far north of the district on limestone soils. Lower altitudes are populated by semi-deciduous forests or in some locations covered by bamboo forest (Mellac, 2000).

The spatial variability of natural resources in the district is thus determined by the north-south geomorphologic gradient. We can summarize this variability as follows:

(i) in the north, mosaic-covered hillsides extending between two unchanging land-cover classes: paddyfields on lowlands, and forests on top of high summits and

steep slopes; and
(ii) in the south, a landscape with intermingled land-cover classes.

3.2. The agro-ecological diversity of Cho Don villages

The territory of a village is most often defined by a small watershed that drains rainfall into streams that run into a river at the bottom of the valley, where paddyfields are often located. The intensity of land use increases as one progresses from the mountains at the top of the watershed toward the houses and paddyfields at the bottom. Houses tend to be strung along a road or path that runs past the central paddyfields. Gardens and orchards are found close to the houses on colluvium at the bottoms of hillsides. Above the gardens, intensive upland crops are grown on the lower hillsides (mostly maize and cassava for feeding pigs and fowl), characterized by shortfallow- periods and use of chemical inputs. Orchards also extend into these lower hillsides as they are protected against theft by the proximity of houses. On file higher hillsides of the watershed, far from houses, is a combination of cropped fields and areas of natural plants. Long fallow periods here take the place of fertilizers in restoring soil fertility. The fallow fields in this zone are the most common place forgrazing ruminants (buffaloes and cows). It is also in the upper levels of the watershed that farmers gather forest products (timber for heating and construction, bamboo shoots, edible leaves, mushrooms, and medicinal plants).

Biophysical conditions vary across the district, and a village's location largely determines the principal land use of that village. To classify village agro-ecosystems, we extracted statistical variables (area and number of polygons of each land use class, average distance of each land use type, etc.) from the maps presented above and entered data for 231 villages into a non-geographic database. We then used 222 of these villages for a statistical analysis. The nine excluded villages were residential sections of *Bang Lung* town, the district administrative center, whose small sizes made it impossible to generate geographic data at the level of detail required for our analysis.

A principal component analysis (PCA) of 1998 data on land use, soil classes, slope inclinations, and altitude variations allowed us to distinguish the various classes of villages in *Cho Don* District. The PCA revealed (not surprisingly) that villages with gentle slope inclinations tend to be based on paddy production, whereas villages with steep gradients tend to be based on upland cultivation and agroforestry. The PCA also showed that the latter villages have surface areas much larger than the former, highlighting the importance of paddyland in structuring village space (Figure 3).

The PCA made it possible to identify four main classes of village spatial organization. Figure 4 shows the land classes of an average village in each defined class. Types I and IV represent only a small proportion of villages (7%

and 3%, respectively), whereas types II and III respectively encompass 60% and 30% of the village in the district. Type I villages are characterized by their very small surface area and the high proportion covered by the residential zone; these are urbanized village on the periphery of *Bang Lung*. Type IV village have a

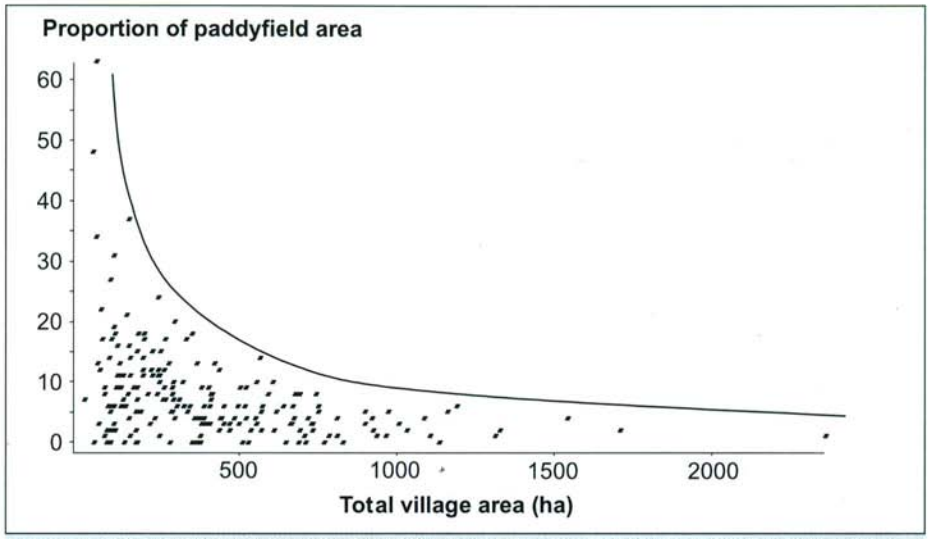


Figure 3: *Relationship between Cho Don village surface area and the proportion of that area covered with paddyfields*

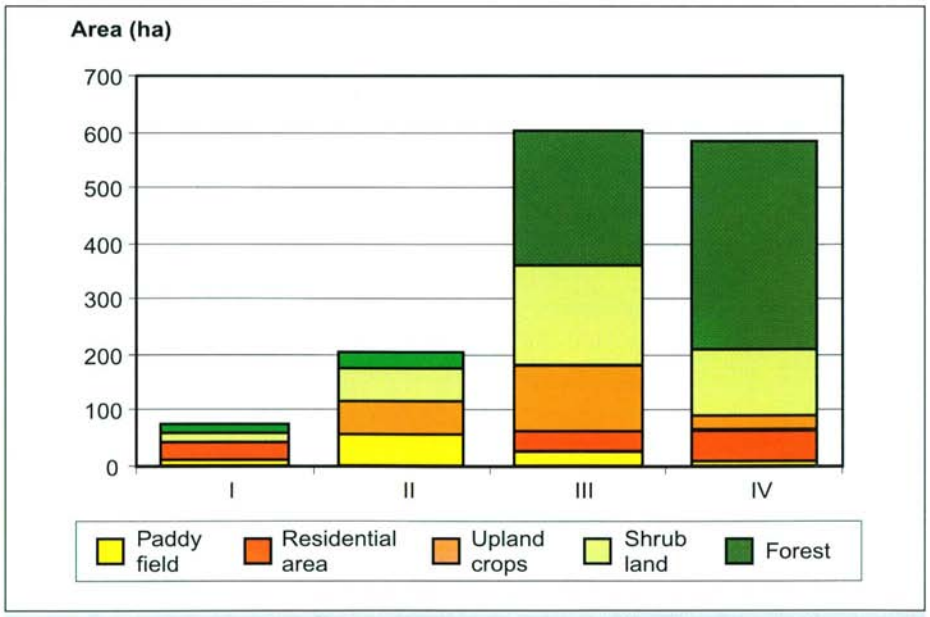


Figure 4: *Graphic representation of the four types of village spatial organization*

very small amount of agricultural land, and large residential and natural-vegetation areas; these villages are in a military zone and an area near a mine, where inhabitants do not rely on natural resources. Type II villages are small but enjoy high proportions of paddyland, whereas Type III villages are considerably larger and rely on extensive hillside cultivation. Our study focuses on these two village types and their very dissimilar spatial organizations.

4. Landscape changes and natural resource use

Following twenty-five years of collectivization, the land policies of the 1990's marked the beginning of a period of changing access to natural resources. We placed 1998 land use into historical perspective by comparing it with land use at previous dates in the same decade. We sought to explain the landscape of 1998 by analyzing changes in plant cover from *Cho Don* land-use maps from 1990 and 1995 (Figure 5). 1995 was the year that all forestlands were allocated to individuals in *Cho Don*, making it an interesting middle date for this analysis. In our analysis, we did not include the land classes that remained nearly constant at the district level over this period, these classes mainly being paddyfields, lower hillside mosaics, and residential areas, Simple variables allowed us to follow land cover change: (i) the proportions of land-use classes from 1990, 1995 and 1998 (Figure 6); (ii) the average area and number of upland crops fields (Figure 7); (iii) the proportions of each major class that remained stable across all three dates (Figure 8); and (iv) the changes in those classes across the three dates (Figure 9). Although the **1990** land use maps show as much forest as the **1998** maps (Figure 6), in 1990 that forest was substantially fragmented by upland crops, which occupied 13% of the district. Extensive shrub zones in the north covered wide clearings (15 ha on average), whereas shrubland in the South was in clearings that were smaller (average 10 ha) and less numerous (Figure 7). In 1990, the total area occupied by crops (including paddyfields, mosaics, and upland crops) was equal to that covered by shrubs (23%).

In **1995**, district forest cover attained what would be its lowest level in ten years, 39% of district area, even though upland crop area had slightly decreased since 1990, a decrease that continued in 1998 (Figure 6).In 1995, the average size of a cropped upland field was only half as large as in 1990. However, the number of fields had nearly doubled, and they continued to occupy 12% of district area (Figure 7). These fields were scattered over the hillsides, concentrated to some degree in the north but much more spread out than they had been in 1990. There was more shrubland in this period (30%) than in either 1990 or 1998 (Figure 6). in 1995, shrubland was primarily land regenerating after having been cropped in 1990, but also included several large areas of recently cleared forest. Between 1990 and 1995, we can therefore see that new fields were cleared from forests

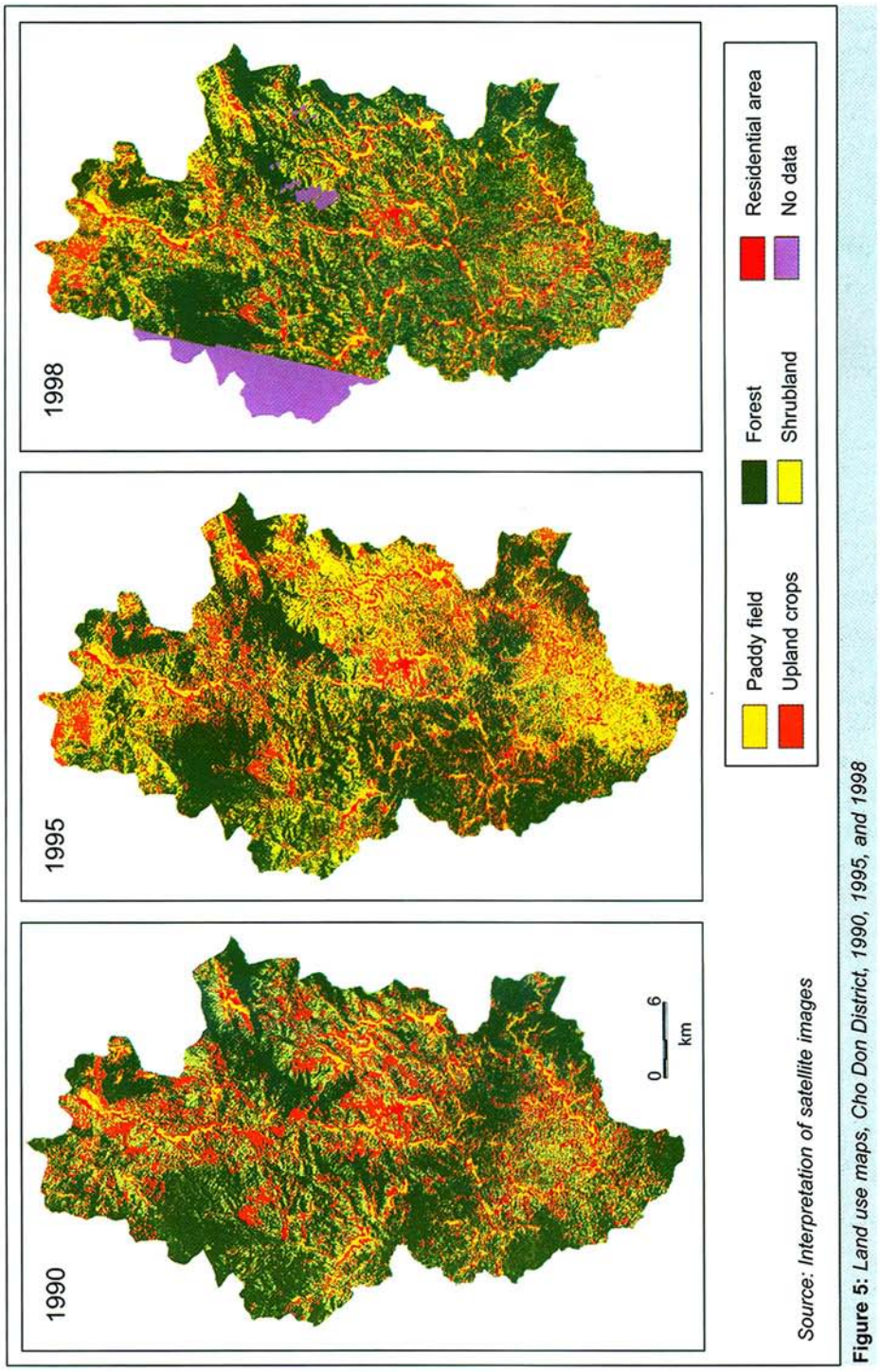


Figure 5: *Land use maps, Cho Don District, 1990, 1995, and 1998*

(41% of the total area of upland crops), but also some from shrubland (Figure 9-A).

In **1998**, forest cover had returned to 1990 levels (Figure 6). In spite of its fluctuations, the forest is the most stable land class (Figure 8), particularly in the inaccessible zones of the northern massifs and high hills in the center and the west. The surface area of upland crops continued to decline, reaching its lowest level in eight years (8%). Since 1995, these fields had decreased in number but increased in average size and moved nearer to the valley-bottoms.

The evolution of the land that was covered by upland crops in 1990 clearly shows the regeneration process and regular relocation of upland crops, because by 1998, 76% of that land was classified ether as forest or shrubland (Figure 9-B). Shrubland remained abundant in 1998 (27%), even if it had declined somewhat since 1995 (Figure 6). Shrubland usually represents land that is regenerating after having been cultivated, but the dynamin view reveals a more complex picture. Figure 8 shows that shrubland is Fairly stable (45% uchanged Over the eight years), which Suggests that this land class may Be the final degenerated state of Plant cover; i.e. it may never Regenerate into forest. Crops

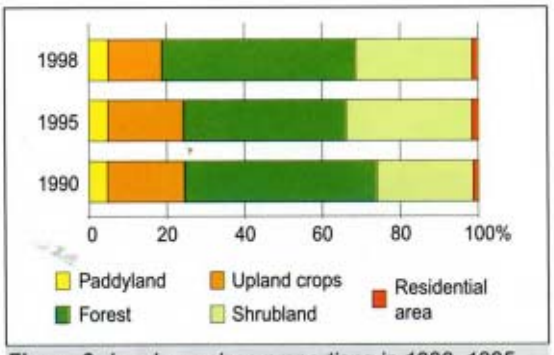


Figure 6: *Land-use class proportions in 1990, 1995, and 1998*

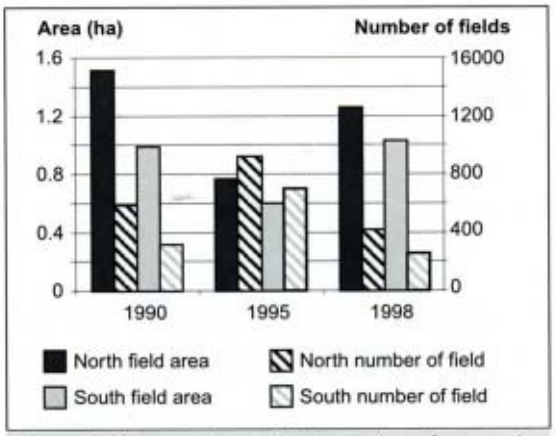


Figure 7: *Average size and total number of cropped upland fields in 1990, 1995, and 1998*

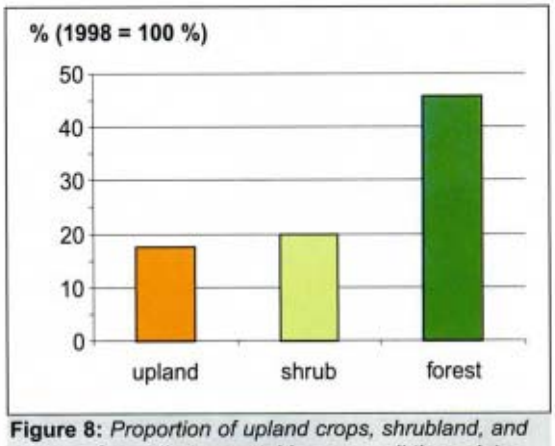


Figure 8: *Proportion of upland crops, shrubland, and forest that was stable across all three dates (1998=100%)*

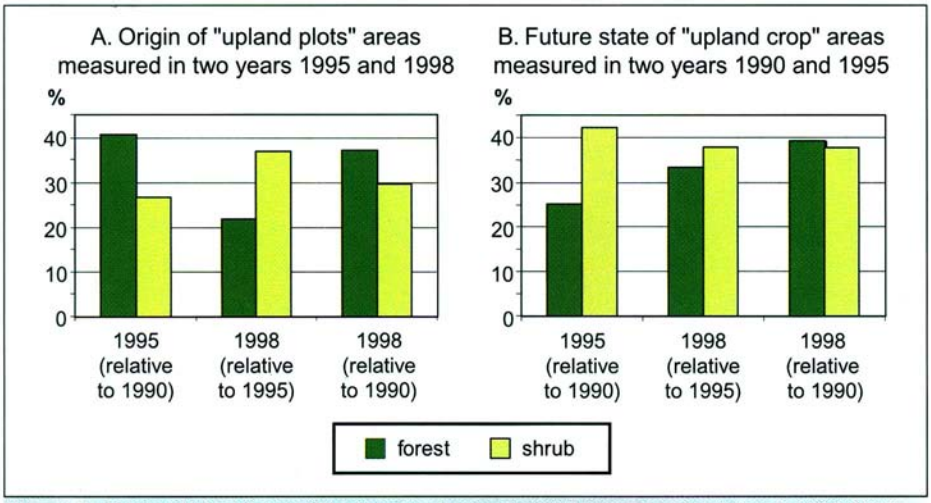


Figure 9: *Origin (A) and future (B) of cropped upland plots between sets of dates, 1990-1995, 1995-1998, 1990-1998*

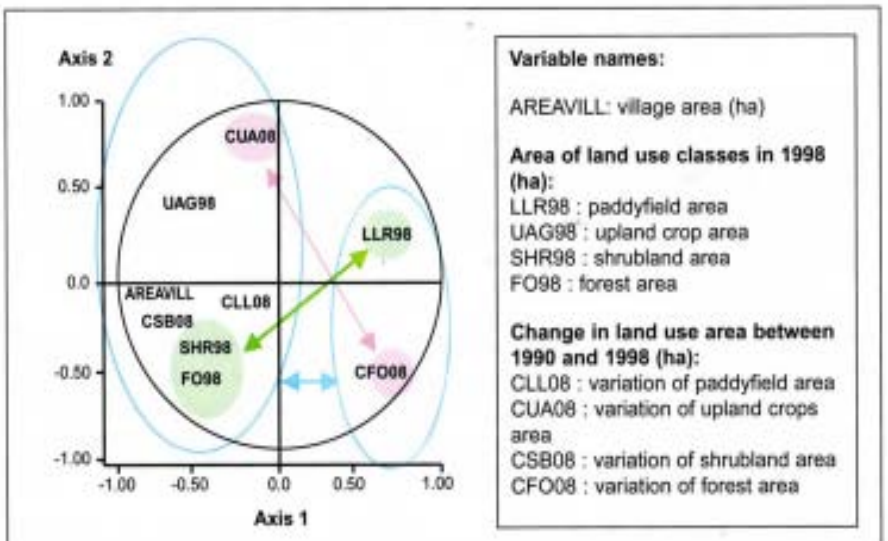
N.B.: Reading example for graph A: Of all the area covered by "upland crop" land class in 1995, 41% had been "forest" in 1990 and 26% had been "shrubland" in 1990. For graph B: Of all the area covered by "upland crop" land use class in 1990, 25% became "forest" in 1995 and 42% became "shrubland" in 1995,

planted on cleared fields can sometimes cause an irremediable loss of fertility, particularly in areas of steep slopes and shallow soils in the north of the district. In these areas, the forest may never grow back. It is also possible that these shrublands are not regenerating because of bamboo harvesting. Shrubland can also represent cleared forest (a deterioration in quality) caused by wood harvesting.

The landscape dynamics were characterized at the village level through PCA analysis. Using data extracted from the three land-use maps (Figure 5), we calculated the land-use changes for each land class in every village for every pair of dates (90-95, 95-98, 90-98), thus obtaining new variables describing the positive or negative change in the area of forest, shrubland, paddyfield and upland crops. We then integrated these variables with the static land-use data for 1998 in a new PCA. The PCA results presented Figure 10 and Figure l 1 show that the new allocation policy had an immediate impact on land use, one that was statistically significant even in a span of only three years (1995-1998). However, the effects of the allocation on forest clearing were substantially different across different villages. Before 1995, the expansion of upland crops took the form of large clusters of fields cleared in the free-access forestland managed collectively by several families. This characteristic forest-clearing pattern took place primarily in villages based on irrigated ricefields. After 1995, the upland fields became smaller and more dispersed within the now-fragmented forest, especially in

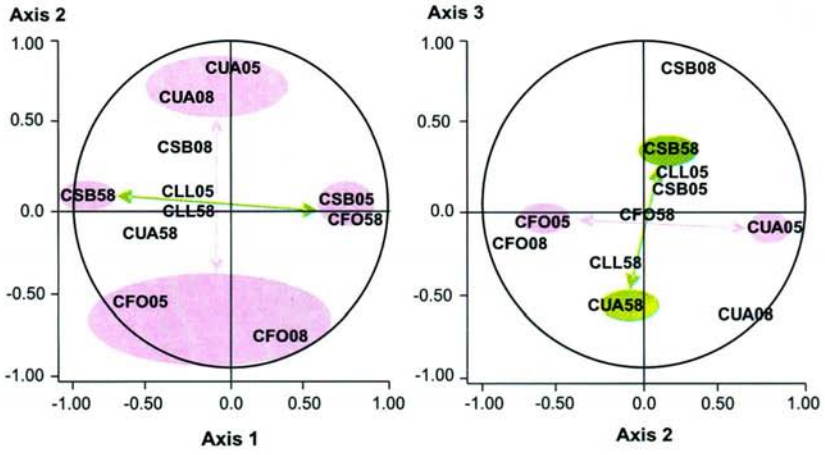
forest/upland-based villages. After the 1995 land allocation, we can see increases in forest cover in villages of the former group, but forest decreases in the latter group. This observation is consistent with results obtained from monographic studies that examined the relationships between rice-growers and swidden cultivators and their natural environments (Castella et al., 2002b and 2002d).

As we have seen, the purely spatial approach allows us to observe the changes in land use and resource organization in the district over a period of time. However, because land use is shaped by the natural resource management practices of local populations, better comprehension requires the study of the underlying practices.



The first two axes account for 47% of total variance, and are composed of the land-use variables. The first axis (28% of total variability) opposes villages whose forest cover increased from 1990-98 (variable CFO08) against villages whose shrubland increased (CSB08). Also on this axis, we find high 1998 paddyfield proportions (LLR98) associated with the former group of villages, and extensive hillside cultivation (UAG98) and shrubland (SHR98) in 1998 associated with the latter, supporting the arguments made in section 3.2 above. The second axis (19%) contrasts variations in forest area against variations in hillside cultivation area, revealing the inverse relationship between these variables.

Figure 10: *Relating land use changes to 1998 land use: axes 1 and 2 of a principal components analysis*



Variable names: change in land use area (ha)

between 1990 and 1995	**between 1995 and 1998**	**between 1990 and 1998**
CLL05: paddyfield area	CLL58: paddyfield area	CLL08: paddyfield area
CUA05: upland crop area	CUA58: upland area	CUA08: upland crop area
CSB05: shrubland area	CSB58: shrubland area	CSB08: shrubland area
CFO05: forest area	CFO58: forest area	CFO08: forest area

The first of the three axes deepens our analysis of the relationships among land uses in the studied periods. We can see very different land use evolution in the two studied periods, 1990-95 and 1995-98. In 1995, hillsides and forestlands were all allocated to individuals, whereas before they had been available to all in a free-access system. This change transformed local natural resource management (Castella et al., 2002b).

- The first three axes of the PCA together account for 70% of total variance. The first axis (31%) shows the inverse relationship between changes in forest cover (CFO58) and shrubland (CSB58) between 1995 and 1998, suggesting that shrublands were regrowing into taller forests. An association between forest cover expansion during the second period (CFO58) and shrubland expansion during the first period (CSB05) shows that forest regeneration followed a period of intensive clearing.
- The second axis (22%) demonstrates the opposition between upland crop expansion during 1990-95 (CUA05) and forest expansion during the same period (CFO05). This axis also shows a connection between changes in both upland crops and forests during 1990-98 (CFO08, CUA08), and changes during 1990-95 (CFO05, CUA05), demonstrating that most changes observed over the period 1990-98 actually happened during 1990-95, before the upland allocation that seemed to have a rapid impact on the diminution of upland crop areas.
- On the third axis (17%), we see upland crop expansion during 1990-95 (CUA05) in opposition to forest cover increases during the same period, suggesting that upland crops were developed at the expense of the forest during 1990-95 (CFO05) before the upland allocation, but at the expense of shrublands following the upland allocation, after 1995 (CSB58).

Figure 11: *Principal components analysis of changes in land use, 1990-95, 1995-98, 1990-98*

5. Determinants of land use changes

The next phase of our study was to bring the socioeconomic context into the picture, to explain the land-use changes described above.

Historically, the availability of natural resources has been a reason for the colonization of new areas by various ethnic groups (Mellac, 2000; Castella et al., 2002c). Areas where irrigated paddyfields could be built were settled by the *Tày*, whereas areas rich in forest were settled by the nomadic *Dao* and *H'mong*. This distinction between *Tày* and *Dao* villages in *Cho Don* remains clear today. Although ethnicity is no longer a determining factor of the goals of farmers, its historical role has helped determine farmers' access to resources today. In *Ngoc Phai* Commune of *Cho Don* District, Castella et al. (2002c) documented the way in which the past role of ethnicity, determining which families settled which areas, has shaped villages' present-day circumstances.

In addition to proximity to natural resources, the relative accessibility of an area also has a substantial impact on the implementation of land policy. Alther et al. (2002) demonstrated that accessible sites offer development opportunities unavailable to remote or isolated areas. In particular, accessible areas benefit from marketing channels for agricultural produce and access to development aid projects. Based on data about access to markets, health services, news sources, and the national electricity network, we calculated accessibility indicators for villages in *Cho Don* as shown in Figure 12. We then integrated these indicators with socioeconomic data from each village such as population, ethnicity proportions, poverty rates, and literacy rates. The statistical analyses resulting from this integration are shown in Figure 13.

The first PCA in Figure 13 relates landscape dynamics with variables that describe accessibility and ethnicity. On the first axis, the *Tày* (TAY) and *Kinh* (KINH) are associated with high paddyfield areas (LLR98), good accessibility (ACCESSIBILITY) and forest regeneration during 1990-98 (CFO08). On the other side of the axis are the *Dao* and *H'mong* groups (DAO-HMONG), who are associated with remoteness (REMOTENESS), high upland crop areas (UAG98), and large tracts of shrubland (SHR98). These villages (type III from Figure 4) have shown decreasing forest cover and increasing shrubland over the studied period (1990-2000).

It is also worth emphasizing the direct relationship between accessibility and the presence of irrigated paddyfields. The ancient arrival of the *Tày* and more recent arrival of the *Kinh* in the irrigated lowlands explain the relationships between the variables on the positive side of axis 1 in Figure 13 (Castella et al., 2002c).The allocation first of lowlands and then of uplands secured the right of the *Tày* to retain possession of the irrigated paddyfields, allowing them to concentrate their activities there. This reduced pressure on the hillsides, evidenced by the recent

forest regeneration in *Tày* communities. Meanwhile, the *Dao* and *H'mong*, marginalized both by their remoteness and by the most-recent land policies, continue to engage in slash-and-burn cultivation despite knowing that it is only a short-term way to feed their households (Castella et al., 2002 and 2002c). Finally, some *Kinh*, dispossessed of the paddyfields they had farmed during the cooperative period, have developed non-agricultural activities by building upon their social networks, access to marketing channels, and the road system. Non-agricultural activities provide them with a of their substantial portion 0 6 household income, and have enabled some of them to purchase paddyfields.

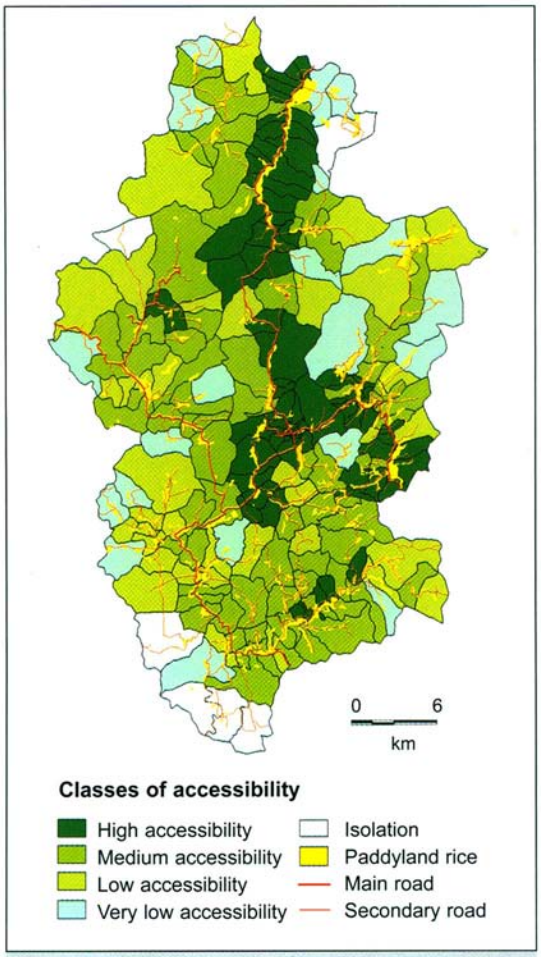


Figure 12: *Relationships between accessibility, road and irrigated ricefields*

N.B.: Accessibility indicator was calculated based on the quality of the transportation networks roads).

The second axis in Figure 13 reveals the oppositions between the *Tày* and *Kinh* ethnicities. *Tày* villages (TAY) are associated with large forest areas (FO98) and forest regeneration (CFO08), whereas *Kinh* villages (KINH) are characterized by a temporary increase in upland cultivation (CUA08). From our monographic studies (Sadoulet et al., 2002; Castella et al., 2002b), we have learned that some *Kinh*, after losing possession of their paddyfields in 1990, turned to slash-and-burn cultivation from 1990-95.

The second PCA in Figure 13 shows that *Kinh* villages have the best access to the national electricity network (association of the variables KINH and ELECTRIC). Meanwhile, *Tày* villages (TAY) rely on microturbines (TURBINE), using the streams and rivers that irrigate their fields as a source of electricity where the national power network is unavailable. On the other side of the first axis are the

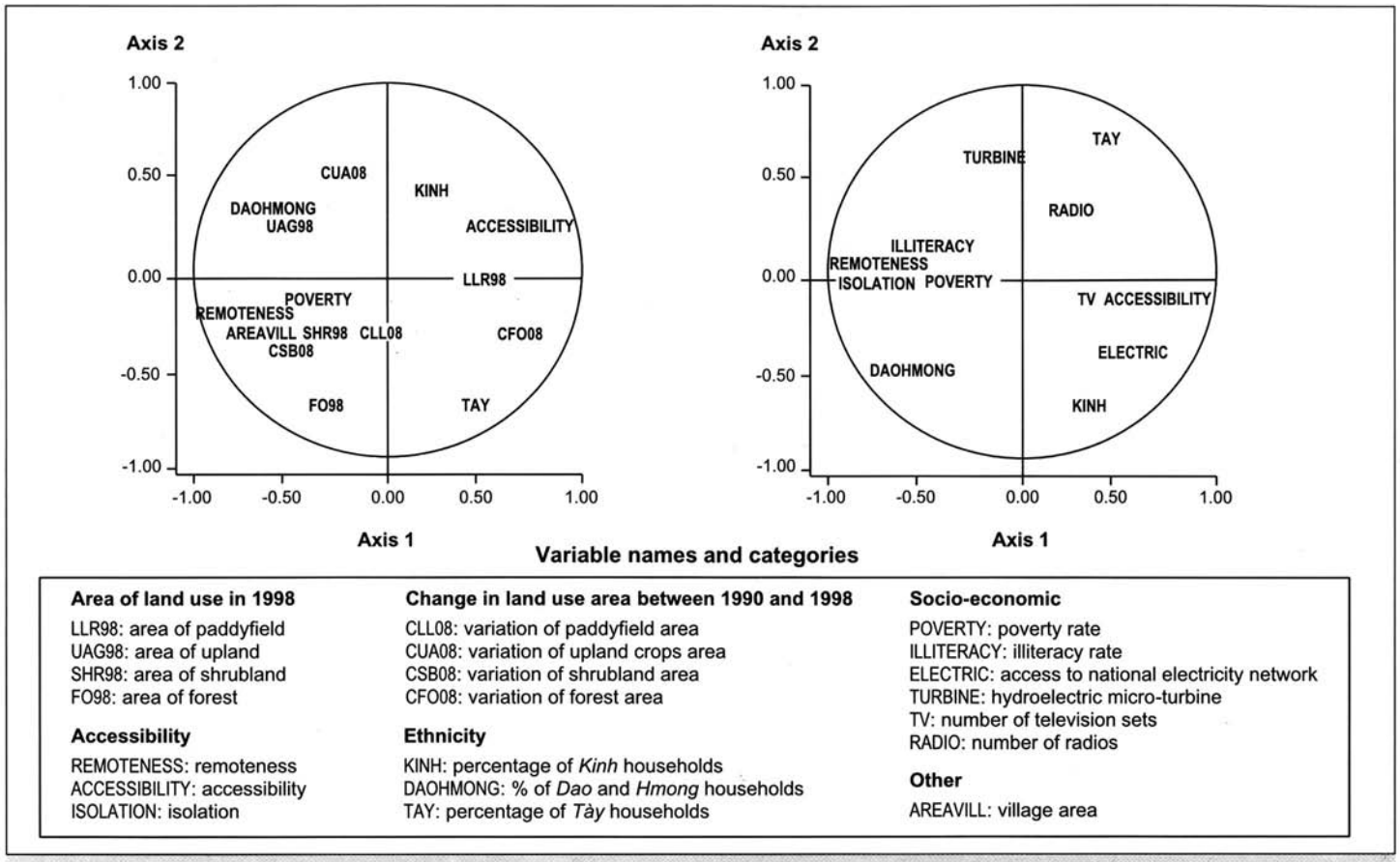


Figure 13: *Principal component analysis combining the biophysical and socioeconomic characteristics of Cho Don villages*

marginalized shifting cultivators (DAOHMONG), characterized by remoteness, isolation, high poverty, and illiteracy.

These results support the hypothesis that there is a strong relationship between the biophysical and socioeconomic characteristics of the studied villages. The statistical results further support official extension approaches that associate each ethnic group with production strategies of various levels of sustainability. This ethnicity-based classification is valid today primarily .because of the historical forces that affected how farmers gained access to natural resources. However, our monographic studies have shown that the *Dao*, for example, are not particularly attached to slash-and-burn cultivation, and are eager to purchase irrigated paddyfields when the opportunity presents it self (Castella et al., 2002c). Rather, they engage in slash-and-burn cultivation because their particular institutional and environmental setting does not offer them any other alternatives (Sadoulet et al., 2002). Specifically, they are constrained by their lack of irrigated paddyfields.

6. Conclusions

Our geographic approach consisted of examining and characterizing agro-ecological diversity at the district level and then at the village level. Through this approach, we showed that the present-day diversity among villages was dependent both on village structure (relative sizes of various landscape units) and on recent land-use changes. Knowledge gained in monographic studies contributed to this geographic understanding, allowing us to examine the interactions between landscape and natural resource management practices. The geographic and socioeconomic aspects of the survey converge at the village level, allowing us to explain district-level changes in land use in terms of local production strategies. We can now use what we have learned to generalize our understanding of complex agro-ecosystems to wider geographic areas.

In *Cho Don*, we observed deforestation from 1990-95 and then reforestation from 1995-98, demonstrating the positive effects of a 1995 land allocation policy. However, this over-generalized view masks substantial inter-village discrepancies. Type II villages (Figure 4), with small overall areas but large paddyfields, are highly accessible and populated by farmers of the *Tày* and *Kinh* ethnicities. In contrast, Type III villages are larger, based on forests and upland crops, and are populated by the *Dao* and the *H'mong* people. There remains a clear dichotomy between (i) low-accessibility villages populated by shifting cultivators and (ii) villages that are located along wide flat valleys, have good infrastructure and accessibility, and are populated by paddy-rice growers. Statistical analyses further demonstrated the main biophysical and socioeconomic elements that dichotomize these two types of villages and their recent evolution.

Although ethnicity was a major factor in explaining past landscape dynamics, it is already losing relevance as a helpful indicator. Today we can find farmers of all ethnicities engaged in all kinds of production strategies. As rural infrastructure and communications develop, particular groups will no longer be isolated and confined to particular production strategies. In addition, future population growth will reduce per capita paddyfield area. It is worthwhile to anticipate these transformations and to begin to develop new indicators that will help to characterize the future trajectories of each kind of village.

Whereas external factors, such as land allocation policy, are central to understanding previous village trajectories up to the *Doi moi* period, in the future we can expect internal village factors (e.g. population pressure, production strategies, resource management institutions) to structure land use dynamics. Villages are not equal in their potential for development, and it is important to recognize these inequalities. Development activities should be targeted with this recognition in mind, to assist the most marginalized of villages in transforming their production systems. Villages with economies based on shifting cultivation can be easily identified in our survey, based on their lack of irrigated paddyfields, low accessibility, *Dao/H'mong* populations, and recent forest deterioration. These criteria could be helpful in helping development programs target these most marginalized communities (Castella et al., 2002).

Acknowledgments

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Montane paddy rice: the cornerstone of agricultural production systems in *Bac Kan* Province, *Viet Nam*

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Abstract

In the mountains of northern *Viet Nam*, paddy rice plays a major role in most households' food security. A survey of 300 households in *Bac Kan* Province revealed the importance of montane paddy rice in recent agrarian changes. Households' production strategies were found to develop according to two key factors: access to paddy fields (montane valleys and terraces), and each household's rice self-sufficiency level. A multivariate statistical analysis helped to explain the production relationships among montane paddy rice, crop-livestock systems on the hillsides, and off-farm activities. When households lack paddy rice, they turn to rainfed rice on the hillsides, cattle and pig raising, and off-farm activities to sustain their livelihoods. Households that have met their paddy rice needs begin to diversify their production systems with cash crops and buffalo raising. The analysis of production systems that have resulted from differing levels of rice self-sufficiency led to the development of a farming system differentiation model. An understanding of the various strategies in the studied regions makes it possible to target more precisely development interventions and technical and economic advice to farmers.

Keywords: montane paddy rice, farming systems, household typology, mountain agriculture, *Bac Kan, Viet Nam*

1. Introduction

From the lowland deltas to the mountain terraces of the mountains, paddy rice has long been the essential component of agriculture in *Viet Nam* (Dumont, 1935; Gourou, 1936). Today, rice continues to represent 90% of national food production, and rice production occupies the time of 70% of the active population (Dogot et al., 1997; Barbier et al., 1997). Whether managed by cooperatives or individuals, rice production and rice-field access have been at the heart of the

J.C. Castella and Dang Dinh Quang eds. (2002) Doi Moi in the Mountains. Land use changes and farmers' livelihood strategies in Bac Kan Province, Vietnam. The Agricultural Publishing House, Ha Noi, Viet Nam. 175-195.

many agricultural changes that have taken place in recent decades. *Viet Nam* as a nation began to produce rice surpluses in 1989 and in recent years has become the world's second largest rice exporter, even while subsistence agriculture continues to dominate the mountainous regions. As in the delta regions, in the mountainous regions paddy rice is the priority for farmers and the primary means by which households achieve food security (Le Trong Cuc, 1995; Pandey and Dang Van Minh, 1998).

Although rainfed rice can be grown on slopes, "paddy'" rice production requires flat land. Paddy soil is prepared by saturating and puddling. During crop development, the paddy field is kept flooded, usually by irrigation. Since the cooperative period, development models have sought to assist mountain populations attain rice self-sufficiency by raising the productivity of paddy rice fields. Having met with success in the lowland Red River Delta region, paddy intensification techniques were applied to the mountainous regions. Collective agriculture focused people's energies on maximizing the high potential for production of paddy ricefields (Sadoulet et al; 2002). Today, paddy intensification remains a strong focus of rural development, and almost all research on agriculture in the mountainous regions continues to focus on 'the montane flatlands (Kerkvliet and Porter, 1995). In contrast, the montane hillsides are considered to be marginal in terms of potential for food production, and more appropriate for forestry (Castella et a1., 2002).

However, mountain, populations have long relied on shifting cultivation in the uplands; either as a complement to or substitute for montane paddy land production. During the cooperative period, paddy rice shortages forced many families to cultivate the uplands to achieve rice self-sufficiency. Paddy land allocations to individual households as early as 1982, and the dismantling of the cooperatives beginning in the late' 1980s, created incentives for investment in the montane paddy areas. Nonetheless, the comparative productivity advantage of upland fields led to an uncontrolled increase in slash-and-burn cultivation. Disappearing forests and new policies in the 1990s motivated those farmers who could to concentrate their energies again on the paddylands. But the allocation process had left some households with little or no paddylands, offering them little choice but to continue to cultivate the hillsides. . .

In recent years, the focus of policy in the mountainous regions has moved from livelihood to environmental issues, even while many farmers cannot yet provide for their families (Dao The Tuan, 2000). Often blamed for deforestation and increased erosion and flooding, sloping land crops are still a key component of many households' livelihood systems. While the food situation of almost all households has improved in recent years, slash-and-burn rice and maize systems continue to exist, often as the only means of nourishment for those who were left out of the post-decollectivization land allocations (Courtois et al., 1997; Godon et al., 1997; Bal et al.; 1997; Husson et al., 2001): The combination of unavailable

paddy lands, unsustainable upland production systems, and high population pressure has marginalized the poorest of farmers (Chu Huu Qhy/1995; Jamieson et al., 1998).

The *doi moi* transition from collective agriculture to a private-household, market-based economy has been accompanied by rapid household differentiation and the burgeoning of a diversity of new production strategies. The diversity is further complicated by the intricate socioeconomic and eco1ogical mosaic that now characterizes the agro-sylvo-pastoral systems of the mountains. In this context, the traditional technique of applying a single development model to a wide region is not possible (Castella et al., 1999a). Instead; the practitoners of development need to take into account 'the wide diversity of the-mountainous regions and Understand the processes that have created it. In this chapter, based on several monographic studies, we will draw regionally-applicable lessons on the diversity of mountainous agricultural production systems (Castella et al., 1999).

We have investigated local agrarian histories from the end of the colonial period to the present in several communes of *Bac Kan* Province, the research site for the Mountain Agrarian Systems Program (SAM, French acronym). The reconstruction of these histories enabled us to understand the Source and context of the current diversity of the region's farming systems (Alther et al., 2002; Castella' et al,, 2002a and 2002b; Fatoux et al., 2002; sadoulet et al., 2002). Our research indicated that the present-day diversity is based not on ethnicity but on land access and ' in particular, differences in household access to montane paddy lands. Our underlying hypothesis was that the key to understanding the current diversity is to understand rice-based strategies once households have secured access to paddyland.

Our objective was to demonstrate that in *Bac Kan* Province, (i) the diverse production strategies associated with paddy rice are different paths toward a common objective: food security; (ii) household rice-sufficiency levels determine the interactions between lowland and upland systems; and (iii) paddy rice production is the key factor for differentiating farm households.

2. Methods

Our analysis of production strategies in *Bac Kan* Province draws on a series of monographic studies undertaken in 1999 and 2000 (Alther et al., 2002; Castella et al., 2002a and 2002b; Fatoux et al.,2002; Sadoulet et al., 2002). The research sites for those studies were selected to cover the range of market integration and agro-ecological diversity present in the province (Castella et al., 1999a). The studies all followed a similar methodology. First, the agrarian histories of the studied districts and representative communes were traced through interviews with local stakeholders, farmers and officials, who were witnesses to the recent

events of the regions. Landscapes and landscape changes were studied through field observation and analysis of a chronological series of aerial photographs. Finally, individual household strategies were identified through interviews with a sample of 300 farmers selected to best represent the diversity of agricultural systems in their communes and districts. Across the research sites associated with the SAM Program, we studied twenty-one villages, six communes, and five out of the six districts of *Bac Kan* Province (Figure 1).

A comparative analysis of the five monographic studies resulted in a conceptual model that explained the production logic of household farms in terms of their different access to resources. The data collected at the various research sites were combined with official statistics on the entire districts, helping us to generalize our commune-based results to the entire *Bac Kan* Province.

The starting point of our analysis was the hypothesis that a household's paddy rice sufficiency level is a key determinant of its production strategy. We defined sufficiency as a threshold corresponding to the commonly accepted value of 250 kg of hulled rice/person/year for the mountainous areas (National Committee of Food Security, 1998). We identified a stepwise decision-making process that farmers followed in search of food security, beginning with the montane paddylands, then moving to uplands and private gardens and continuing to

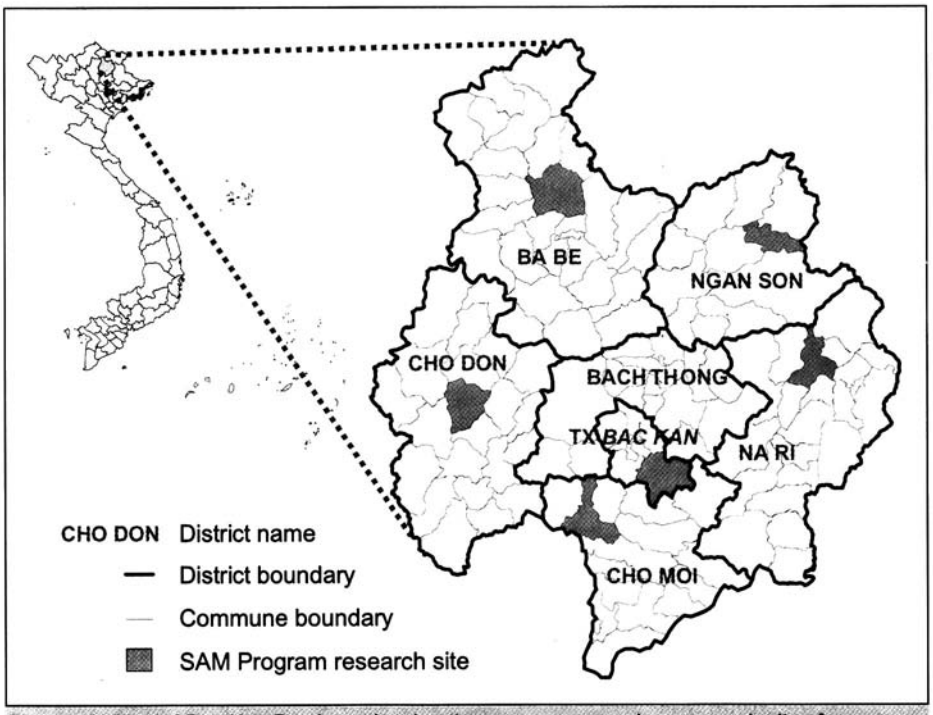


Figure 1: *Map of Bac Kan Province showing the communes used as research sites for monographic studies*

diversify until the food needs of the household were met. An analysis of farmers' iterative strategy-building process helped us to define the relationships between paddyland and upland uses, as well as relationships between cropping and livestock systems.

Our examination of production strategies in terms of varying levels of rice self-sufficiency demonstrates the continuing dominant role played by paddy rice. By identifying and separating the different production strategies in the studied areas (diversification of activities, intensification, and specialization), we developed a farming-system differentiation model that is applicable at the provincial scale.

3. Land use changes, rice self-sufficiency, and household subsistence strategies

In the context of subsistence agriculture, the primary objective of each household is to meet its food needs. The monographic studies showed that rice self-sufficiency is the key factor in understanding the region's variety of production strategies. In *Bac Kan* Province, more than 92% of families consume their entire rice production, whether paddy or upland. On average, of the 1.3 tons of rice produced per household in the province, 1.2 tons are consumed by the producer. Given that montane paddy rice productivity (with two crops a year) is about eight times greater than upland rice productivity, paddy rice is the most important food crop, and the crop with the highest rate of producer consumption, in the province (Figure 2).

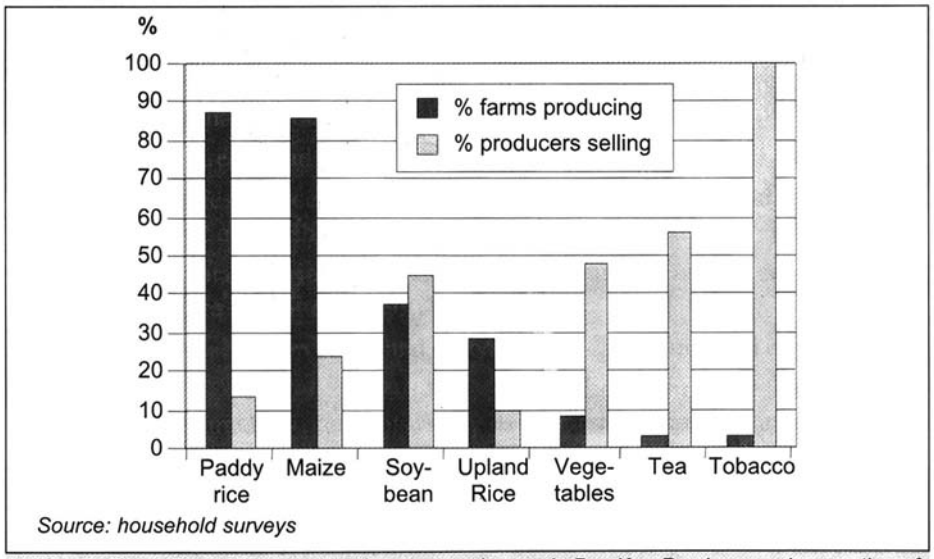


Figure 2: *Proportion of farms cultivating surveyed crops in Bac Kan Province, and proportion of those producers who sell part or all of their production*

Farmers in *Bac Kan* Province have developed their subsistence systems through intensification in the paddylands. Rising population has led to a progressive per capita decline in paddyfield area. Between 1991 and 2000, this area Dropped almost 20% from 680 to 560 m² / person. Per capita rice production has increased in spite of lower area per person because of increasing yields (Figure 3). Yields have increased over the last decade for at least three reasons: (i) increases in the amount of labor poured into the ricefields since the end of the cooperative period; (ii) the introduction of new rice varieties (*Bao Thai*, 203, Ai32, etc.); and (iii) the improvement of chemical input distribution networks (Castella et al., 2002b; Sadoulet et al., 2002). However, by far the main reason for production increases has been the addition of a second cycle of rice (spring season) on a growing proportion of paddy fields (Figure 4). Even as more and more farmers plant spring rice, the progressive improvement of techniques associated with this crop is resulting in an even greater increase in production (Figure 5). Very few households are willing to substitute another food for rice as the basis of their diet. Only a small vumber of *H'mong* and *Dao* ethnic village consume maize, and that only in times of shortage (Pandey and Minh, 1998). Upland rice is thus the primary alternative for those households who do not have

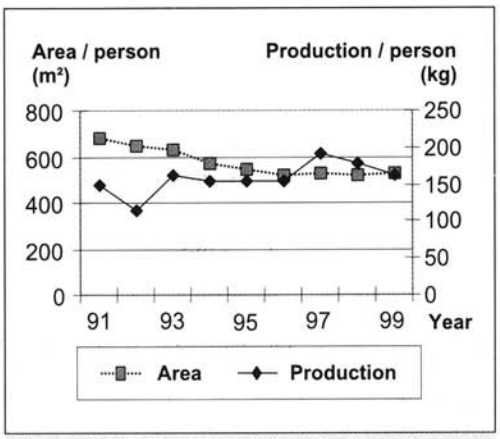


Figure 3: *Surface area and production per person of summer rice in Bac Kan Province*

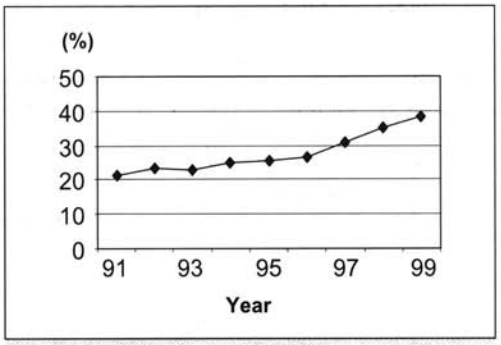


Figure 4: *Percentage of double-cropped ricefields in Bac Kan Province*

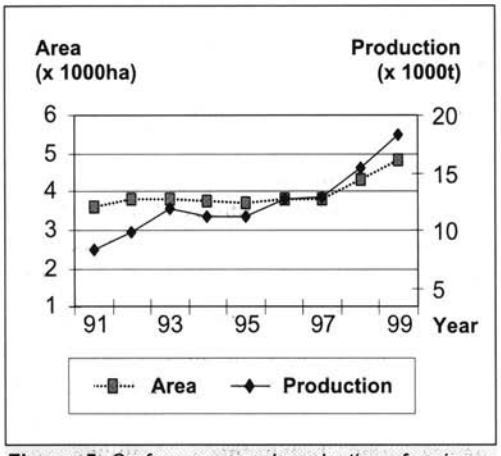


Figure 5: *Surface area and production of spring rice in Bac Kan Province*

access to paddy fields (about 12% of households; Figure 2). The substantial increase in the productivity ‘ of irrigated rice, combined with the ban on slash-and-burn cultivation, have brought about a major decrease in upland rice cultivation across the province. But in spite of progressively declining upland yields due to shortening fallow periods (Husson et al., 2001), and in spite of the increased competition for upland spaces that is putting shifting cultivators in crisis, upland rice remains the primary food production strategy for a substantial number of households. Formerly shifting cultivators of upland rice have been sedentarized since the recent forestland allocations from 1994-present (Castella et al., 2002). Confined to a fixed area, with their cultivation systems slowly exhausting the land, these farmers are now experimenting with many kinds of innovations and small-scale trials in a desperate attempt to find alternatives to upland rice (Castella et al., 2002).

Of the various cultivation systems praticed by the surveyed households, maize cultivation on the hillsides is as common as rice in the paddylands. Close to 86% of farms (Figure 2) cultivate maize, sometimes intercropped with perennial plants, usually fruit or timber trees (Castella et al., 2002b; Sadoulet et al., 2002). Maize grain, in combination with cassava and rice bran, makes up the bulk of feed for pigs and fowl. Of the surveyed households, 96% raised at least two pigs per year. Pig raising makes use .of the residues of paddy rice cultivation and allows upland maize and cassava production to be used directly rather than sold (Castella et al., 2002a; Sadoulet et al., 2002). Producers, however, do not think of pig raising as a substitute for paddy rice. There is-no correlation between rice sufficiency levels and pig production. Thus, researchers cannot use pig raising to define distinct farming systems.

Households with high levels of market integration (i.e. good access to market place and information) have the option of growing cash crops (soybean, tobacco, vegetables, fruit trees, etc.); raising animals; or pursuing off-farm activities. Farmers who are not rice self-sufficient engage in such activities to generate revenue that can then be used to purchase rice (Castella et al., 2002a and 2002b; Fatoux et al., 2002; Sadoulet et, al., 2002). Farmers who already have attained rice self-sufficiency often pursue the same kinds of activities in pursuit of capital accumulation.

Non-agricultural activities, engaged in by one or more family members can be a stable source of income, allowing investment in production tools. Thus, families with such external revenue often are both better equipped and sooner able to foot the cost of perennial plantations and their deferred revenues. A large proportion of surveyed households benefit from non-agricultural activities. Close to 40% of households gain at least 20% of their household income from off-farm activities such as forest products gathering, non-farm rural wages, self-employment (e.g., motorcycle-taxi service), or salaried employment in a local administration.

High population pressure in *Bac Kan* Province has eliminated the possibility of extending the area of cultivated land: all usable land is already cultivated. The remaining possibilities for sustaining and improving livelihood systems are intensification, diversification, specialization, and non-farm activities.

4. Paddyland rice - upland rice: two settings for rice strategies

4. 1. Historical land access and ethnicity

Almost exclusively used for irrigated rice, paddylands have been targeted by many successive land policies: (a) progressive colonization and private exploitation (pre-independence through 1960); (b) agrarian reforms and collectivization (1960-1980); and (c) cooperative dismantling and re-claiming of ancestral lowlands by descendants (1980-present; Sadoulet et al., 2002). During the post-cooperative period, land purchases also have played an important role in the resumption of private ricefield use.

Ethnicity has often been cited as a key factor in both historic and present-day diversity in production systems (Le Trong Cuc, 1995). Traditionally, people of the *H'mong* and *Dao* ethnicities in *Bac Kan* have occupied the uplands, while the *Tày* have settled the lowlands (Bal et al., 1997; Sadoulet et al., 2002). This tiered settlement of the ecosystem is linked to the order in which successive ethnic groups arrived in the region (Mellac, 2000; Castella et al., 2002c). However, this geographic division according to ethnicity is not as apparent today as it was in the past. The many different land policies and redistributions, in combination with recent sales and purchases, have made it nearly impossible to associate specific production systems exclusively with specific ethnic groups.

Today, it is primarily resource access that determines families' abilities to meet their rice needs. Unquestionably, ethnicity played a role in the results of the land allocations (Mellac, 2000; Castella et al., 2002; Sadoulet et al., 2002), but diverse households within each ethnic group now face diverse situations. Our analysis of the diversity of production strategies suggests that there is no unique *Tày* production system that stands in contrast to a *Dao*, *Kinh*, or *H'mong* system. Rather, within all groups, household production strategies are determined primarily by access to land resources.

Household access to paddy fields varies widely, ranging from 0 to 1.2 hectares per household, with yields as high as 7 tons/household (Figure 6). Annual production per unit area can vary by a factor of three, depending on yield and (especially) on proportion of double-cropped area. Households growing 1-cycle rice averaged only 4 tons/ha/year (symbolized by circles in Figure 6), whereas households growing 2-cycle rice averaged 8.5 tons/ha/year (symbolized by diamonds).

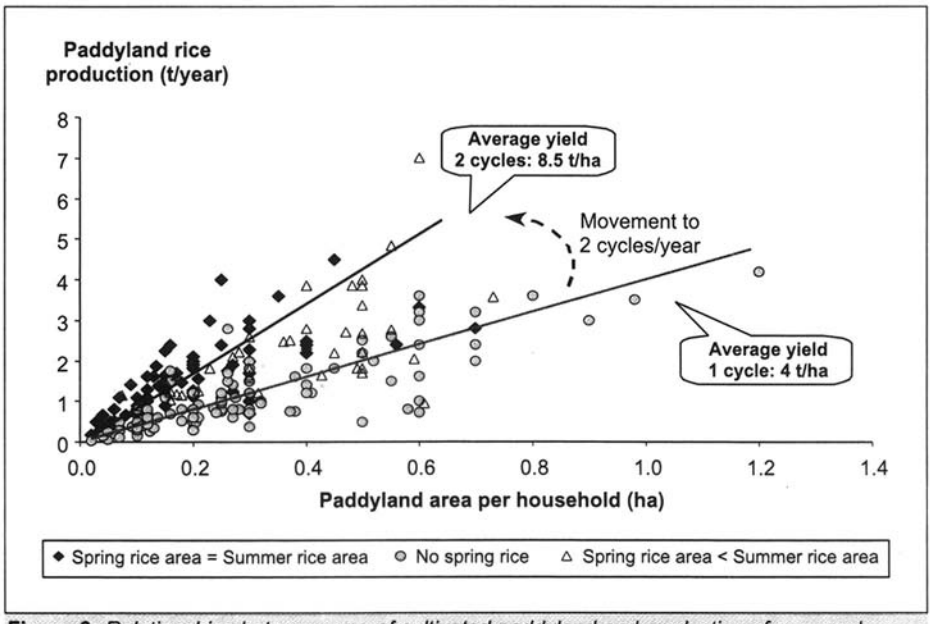


Figure 6: *Relationships between area of cultivated paddyland and production of surveyed households in Bac Kan Province.*

N.B.: Separate regression lines were calculated for households with one rice harvest per year (circles) and two rice harvests per year (triangles and diamonds). Average yield for each category of household corresponds approximately to the slope of the respective regression line.

Paddyfield yields were relatively homogeneous among the surveyed households, particularly when compared to the extreme variability of upland yields (Husson et al., 2001).

4.2. A paddy rice-based farming system typology

By classifying households according to their ability to meet their rice needs in the montane paddylands, we identified three different household strategies (Figure 7). Access to irrigation water during January and February determines the area of paddyfield that *can* be double-cropped, whereas the quantity office needed to feed the household (mouths to feed) determines the area of paddyfield that needs to be double-cropped. At the time of our study, more than 50% of surveyed households who could not attain rice self-sufficiency with one-cycle rice (summer season) were able to make up the deficit with a second cycle during spring season (Figure 7, zone B). Spring rice offers these households the potential to double their production; in 60% of households classified into type B, the entire paddyland area was double-cropped. These households have a minimum of 300 m^2 paddyland per laborer, and generate yields exceeding 3.6 t/ha/cycle.

Households who can attain rice self-sufficiency with a single summer crop per year (Figure 7, zone C) are relatively rare, making up only 12% of the surveyed households. Their paddyland area per laborer is in excess of 500 m^2, with yields of about 3 t/ha. Among these households, a small number grow a second spring cycle of rice, which generates yields in excess of 4 t/ha/cycle.

A substantial number of farmers are in the, third category: those who cannot achieve rice self-sufficiency with either one or two crops per year (Figure 7, zone A), usually because of insufficient paddyland area. Farmers in this group need to turn to other activities to feed their households. Upland rice, merely a complementary crop for household types B and C, is the most important crop in the systems of type A households.

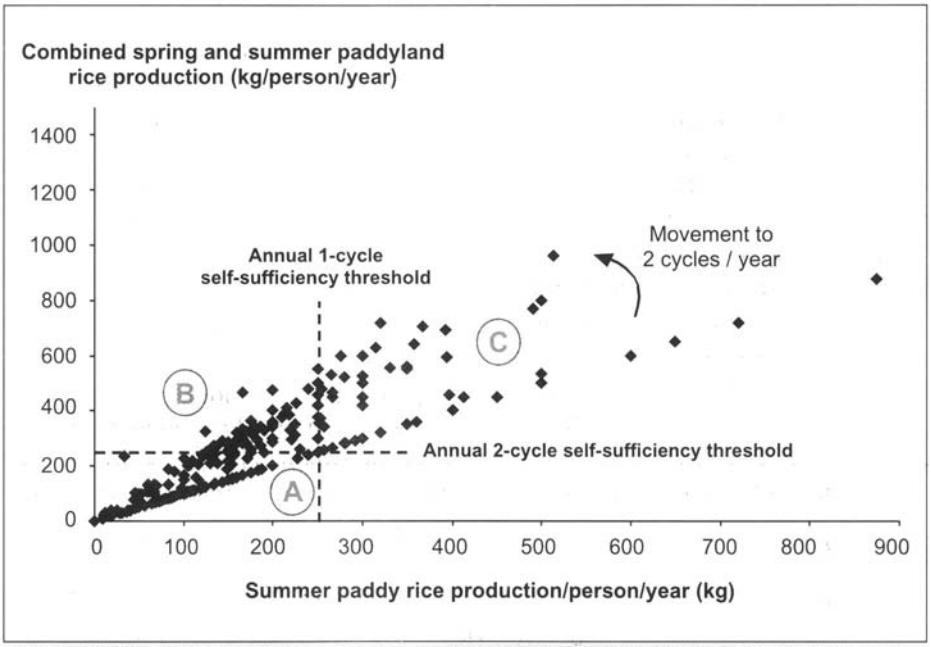


Figure 7: *Capability of one-cycle and two-cycle paddy ricefields to meet households' rice needs.*

N.B. Households can be classified into three groups according to their levels of rice self-sufficiency and their production strategies

(A) Not rice sufficient (below the threshold both for summer production and for combined spring-summer production).

(B)Rice sufficient, but dependent on combined spring-summer production (below the sufficiency threshold for summer production alone).

(C) Rice sufficient, and not dependent on spring production (above the sufficiency threshold for summer production alone).

The lower limit of combined spring and summer production (vertical axis) is the value of summer production alone.

4.3. Upland rice: an alternative in the absence of adequate paddyland

Figure 8 shows the importance of upland rice for households who cannot meet their food needs witb paddyland rice. A substantial proportion of these households cross the rice self-sufficiency threshold once upland rice is added to their systems (triangles). Some households can even attain rice self-sufficiency with upland rice alone (circles). Households producing less than 200 kg of rice per person on paddyland tend to cultivate sloping land with upland rice for household consumption.

However, as mentioned earlier, population pressure and land policy have made slash-and-burn cultivation systems unsustainable. The average yield of upland rice is 1 t/ha, and each year of cultivation requires three years of fallow. Based on an average paddyland rice yield of 4 t/ha/cycle, for each ton of upland rice produced, an equally sized area of one-cycle paddyland could produce 16 tons on rice, or 32 tons if double-cropped. Given these yield differences, it is not surprising that farmers prioritize the paddylands in allocating both manual labor and chemical inputs 1. In *Bac Kan*, there are no more "shifting cultivators at heart,"

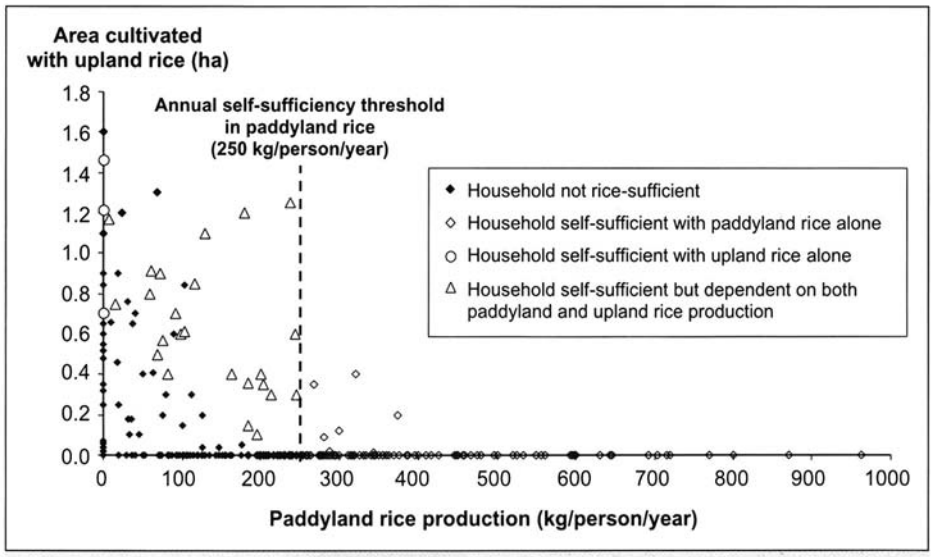


Figure 8: *Cultivated upland surface area per household versus annual paddy rice production per person*

[1]Note that this has not always been due case: in the 1980's, comparative productivities favored upland rice (because of the ill-managed paddyland reader the cooperative system and, on the other hand, the relatively pristine forest resources on the hillsides that allowed good upland rice yields).This resulted in wide expansion of slash-and-burn cultivation and extensive, province-wide deforestation (Sadoulet et al., 2002).

but rather farmers who cultivate upland rice because they have no other choice. The first objective of all farmers who do not have sufficient paddyland fields is to acquire them.

Paddyland is at the center of the decision-making processes of *Bac Kan* farmers. Access to paddyland determines the ability of a household to sustain its livelihood, and levels of rice production in both upland and paddyland environments define the range of possibilities available to (or imposed on) each household.

5. From rice strategies to diversified production

5. 1. Principal components of diversity

Rice self-sufficiency is the driving force of production strategies. By studying these strategies, we can assess the economic sustainability of the entire household. To explain household production strategies, we chose to retain eleven of the many variables quantified in our household survey. From preliminary analysis we found that these eleven variables were capturing most of the overall diversity of our household sample. A principal component analysis (PCA) allowed us to describe the dependence relationships among these eleven variables (Figure 9), as well as similarities among groups of households (Figure 10). However, principal components analysis requires a complete dataset for each household. This requirement constrained us to analyze only 277 households.

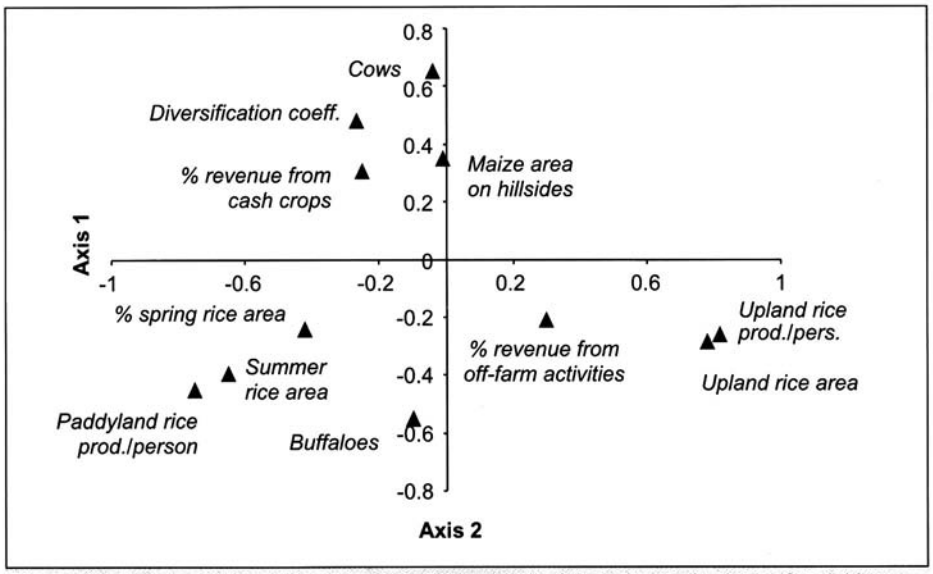


Figure 9: *Representation of Axes 1 and 2 of the Principal Component Analysis of variables characteristic of production strategies employed by 277 farms in Bac Kan Province.*

The two most significant principal components are represented as axes in Figure 9 and Figure 10. These first two axes explain 53.6% of the total variance.

Axis 1 is largely defined by variables characterizing paddyland and upland rice strategies (contributing 84% of the variance in the first axis). The first axis places the variables *'summer rice surface area'* and *paddyland rice production /person'* in opposition to *'upland rice area'* and *'upland rice production/person'*.

Axis 2 identifies an opposition between production strategies. On the negative side are variables associated with rice specialization and capital accumulation via buffaloes: *'summer rice surface area'*, *'paddyland rice production/person'* and *'buffaloes'* (number on farm). On the positive side of Axis 2 are variables characteristic of diversification strategies: *'diversification coefficient'* (number of different crops cultivated), *'surface area of maize on hillsides'* and *'cows'* are all well represented.

Axis 3 (not illustrated) includes variables that are characteristic of paddyland intensification (*'% paddyland surface area with spring rice'* and *'% revenue from cash crop sales'*) are opposed to those representing strategies of paddyland specialization ('*summer rice surface area*', 'buffaloes'), as well as extensive hillside systems (*'surface area of maize on hillsides', 'cows').*

Lastly, Axis 4 (not illustrated) opposes the two means by which farmers can generate additional income: *'% revenue from off-farm activities'* (negative) against '*% revenue from cash crop sales'* (positive).

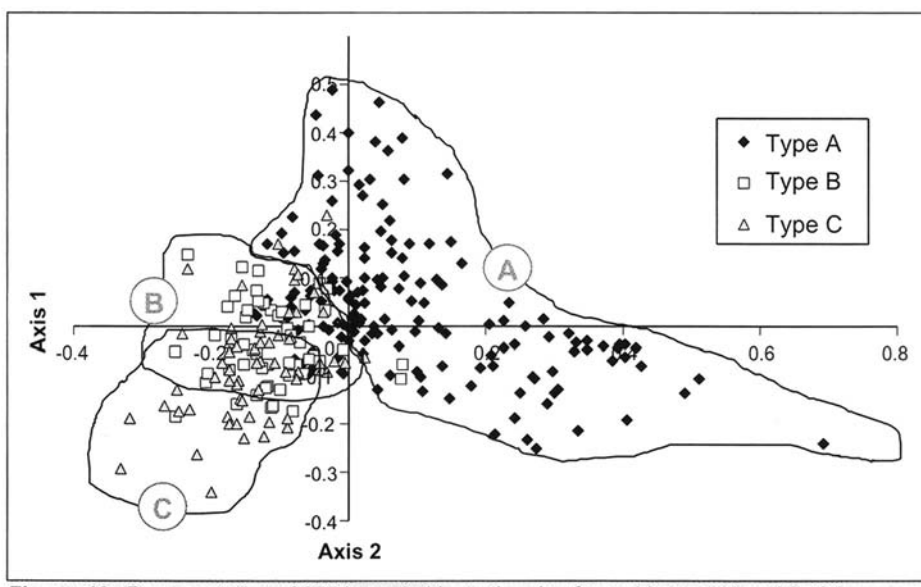


Figure 10: *Representation of 277 households on the plan formed by axes 1 and 2 of the Principal Component Analysis, showing classification of individual households into types A, B, and C (defined in Figure 7)*

This PCA should be interpreted with caution, because the first two axes explain only 53.6% of the variance. Nonetheless, we can note two major tendencies in Figure 9 and Figure 10. Firstly, there is a marked opposition between two contrasting food production strategies: the paddyland rice growers at the left versus the shifting upland cultivators at the right. Axes 2 and 3 reveal the diverse and concurrent strategies for sustaining livelihood systems and capital accumulation. Specialization in rice allowed by large ricefield areas stands in opposition to diversification of production. Paddyland intensification (double-cropping of rice, non-rice annual crops during winter, or perennial fruit trees near paddyfields) stands in opposition to the development of more extensive systems that rely on the hillsides (particularly maize and cassava for pig raising).
Secondly, there is an opposition between buffalo and cow abundance. Buffaloes are associated with paddy fields for their traction power, and are also a means of capitalization. In contrast, cows are a means of saving and diversification for farmers who rely largely on the hillsides.
Plotting individual households on the grid formed by axes 1 and 2 (Figure 10) Allowed us to associate the various production strategies defined above with farming system types A, B and C, defined earlier in Figure 7 according to their capacity to meet their rice needs.

5.2. Type A households

Type A households occupy a large area on Figure 10, revealing the internal diversity of this type in terms of production strategies. Insufficient paddyland rice production pushes these households to rice-based and non-rice-based strategies in the uplands. Shifting cultivators occupy the rightmost portion of Figure 10. Based on upland rice, their system still persists in areas that both have abundant forest and are located sufficiently distant from villages to escape the growing restrictions on slash-and-burn practices.
Where such areas are unavailable, which is becoming more and more the case throughout the province, type A households must turn to other food crops that can survive in low quality soil (maize, soybean, cassava), which are then consumed, sold, or fed to pigs. When these food production systems can be stabilized on the hillsides through partial terracing or inputs of nutrients (generally manure), these households can begin to generate income through cash crops and cow raising. The diversification of agricultural activities is characteristic of type A households, as they search for alternatives to upland rice on the hillsides. They sell fruits, soybeans, and vegetables grown on sloping land, generating 5 to 40% of household revenue. Non-farm activities play an important role for type A households who cannot generate sufficient income with food and cash crops. Over 30% of households in this group generate more than 50% of their income from non-farm activities (Figure 11).

5.3. Type B households

Type B households are those who are not self-sufficient in summer rice, but have become so with the addition of spring rice. The labor requirements of intensified paddyland production largely prevent this group from engaging in wide diversification on uplands. Intensification strategies include planting winter crops (mainly maize and vegetables) in paddy fields, and developing cash crops (soybean, tea and/or fruits) in the areas bordering their paddy fields. The tendency toward minimal diversification in upland cash crops is reflected by a low *'diversification coefficient'* accompanied by a high *'% revenue ,from cash crops'*.
The agricultural activities described above tend to occupy the entire available workforce, limiting non-farm activities to several households who just barely have their rice needs met (Figure 11).

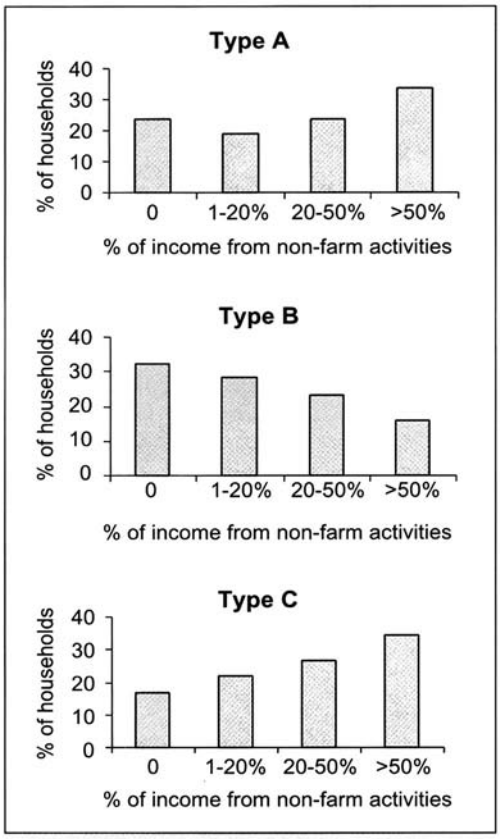


Figure 11: *Reliance of household types A, B, and C on off-farm activities*

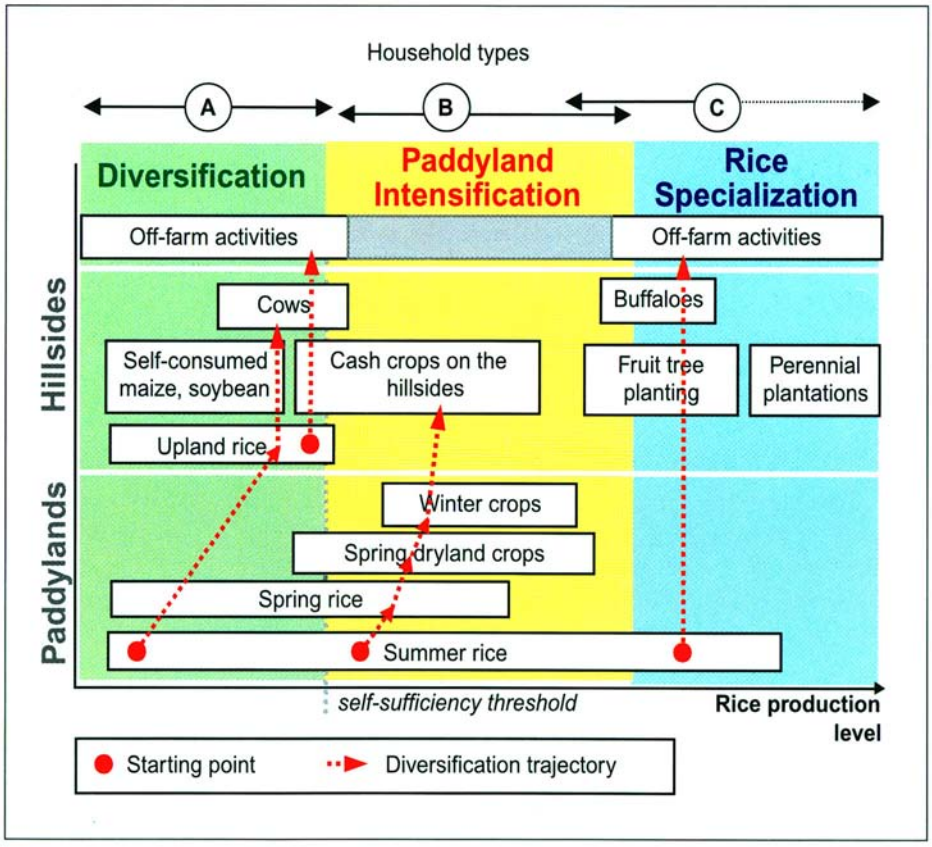
5.4. Type C households

With their food needs largely met by large areas of summer-season paddyland rice, rice specialization is the strategy favored by type C households. They tend to have developed buffalo herds, both for animal traction on their paddy fields and as a kind of living capital. Cash crops provide no more than 20% of household revenue. With annual rice production averaging 450 kilograms per head, the only non-rice agricultural income of most of these households is the sale of maize, either directly or indirectly (through pigs and fowl). In particular, type C households outside the intersection area with type B are those with the largest ricefield areas and adopt only minimal diversification strategies. Other type C households diversify their production systems in three ways. Firstly, some plant fruit trees on the hillsides bordering the paddy fields. Secondly, others produce winter crops (soybean and vegetables) in the paddylands (area on Figure 10 covered by both types B and C). Thirdly, others move to off-farm activities to generate further income.

For more than 30% of the households in the type C group, off-farm activities represent more than 50% of annual revenue (Figure 11). As the richest farmers in the community (based on land access), they have the most well-developed social networks, and often hold positions of authority in local administration.

5. 5. Paddyland-upland links and sustainability

The definition of these three groups of households according to their distinct production strategies was based on two major factors: (i) access to paddylands and (ii) the level of rice self-sufficiency attained in the paddylands. Based on these factors, households seek food security and accumulation through either diversification (type A), paddyland intensification (type B), or in rarer cases, rice specialization (type C). Figure 12 synthesizes the production relationships described above, showing the connections among paddyland rice production, upland rice cultivation, livestock systems, and off-farm activities.



The economic and ecological viability of the above-described production systems rests on the sometimes complementary, sometimes competitive relationships between the two landscape zones in the mountainous areas: the paddylands and the hillsides. These zones are inherently interdependent, and there are many associations between various upland and paddyland crops and livestock systems. For example, residues from the rice harvest are combined with maize to feed pigs, manure from which can then benefit either the hillsides or the paddylands. Profits from maize and cash crops allow capital accumulation in the form of buffaloes, which can then provide traction in the paddyfields.

But competitions also can arise between the two systems. Certain kinds of land can have multiple functions, and households with diverging interests sometimes find themselves in conflict. For example, free-grazing buffaloes owned by type C households can damage the hillside crops upon which type A households depend. The centrality of paddyland rice in the system is demonstrated by the stronger social control that roles the paddylands: although crop-livestock conflicts in tile uplands are considered to be strictly the problem of the cultivators, paddyland rice-based conflicts tend to be blamed on the animal owners. That said, the development of winter paddyland crops by type B households remains constrained by roaming animals (Castella et al., 2002b).

6. Conclusions

All households in *Bac Kan* Province share the common objective of attaining food security through paddyland rice production. Paddyland access and production are thus the defining elements of the region's production strategies. When rice self-sufficiency cannot be attained (because of insufficient water or poor water management, insufficient paddylands, low yields, or inadequate labor force), households develop alternative rice- or non-rice based strategies. In the context of a rapidly-changing agricultural system, paddyland access is the driving force of province-wide transformations. With the noted exception of household type C and its income-generating paddyland surpluses, the majority of households are in the process of acquiring additional paddyland, intensifying production on their paddyland, or both. Paddyland acquisition and intensification are funded by revenues from cash crops, animal husbandry and off-farm activities. Montane paddyfields already have expanded to their limits in *Bac Kan* Province, and make up the "backbone" of agricultural production.

Upland rice is on the decline, as it is now a low-productivity alternative practiced only by those who cannot meet their rice needs in the paddylands. Since the allocation of forestland use rights to individual households, shifting cultivators have been effectively sedentarized, and their traditional production system is slowly disappearing. Many type A farmers are now confined to fixed locations on

which slash-and-burn cultivation cannot sustain their livelihoods for any length of time. These farmers must now innovate if they are to survive; otherwise, they may be forced to migrate to new frontiers in the South or to urban areas.

The new sedentary production systems of type A households put their food security at risk, but at least have the advantage that these poorest of farmers are now in a place where they can be helped by effective development programs that can accompany them in their search for new hillside cultivation systems (Bal et al., 2000; Husson et al., 2001). It is our hope that this study will help development planners to identify this group more quickly on the regional scale (Castella et al., 2002c).

Our analysis of production strategies allowed us to develop a differentiation model based on the defining role of paddy rice production. Based on only a few criteria, we were able to classify all the Farming systems in the region, making it easier to target development interventions and technical and economic advice to the appropriate farmers. For example, paddyland intensification has been identified as a promising possibility to reduce pressure on uplands, but this intensification needs to be achieved via different strategies for different groups (increasing double-cropped areas, introduction of cash crops in spring or winter, etc.). This farming-system classification can now be generalized to the entire province based on statistical data (e.g., number of laborers and mouths to feed, rice self-sufficiency levels) readily available from communes and villages, without the need to repeat the extensive household surveys used to generate the classification.

Paddyfield expansion has reached its limits in *Bac Kan* Province. Slash-and-burn cultivation is no longer a sustainable alternative, although the practice continues to this day. Before farmers can become interested in the long-term sustainability of the upland areas, their basic food needs have to be met. Given locals' prioritization office, this will require increased food production in the paddylands to decrease pressure on the uplands. Options are limited to increasing paddyland yields (through improved water management, more manure, labor and chemical inputs)and further ricefield intensification, with spring-season paddy rice if irrigation is available, or if it is not, with aerobic rice (upland rice varieties resistant to temporary flooding that are grown on flatland) or other rainfed spring-season crops.

The interdependence of all cropping and livestock systems in the studied region, both on hillsides and paddyland, calls for a system-wide approach to development. As land use evolves, strategies diversify, and the need for rural off-farm employment intensifies, farmers need to be supported in constructing new rules of social organization that are well adapted to their new production relationships.

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Impact of forestland allocation on agriculture and natural resources management in *Bac Kan* Province, *Viet Nam*

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Abstract

During the first half of the 20th century, several land tenure systems prevailed in mountainous northern *Viet Nam*, with either common or private property in the lowlands, and temporary rights to use the uplands acquired through the act of clearing the forest. The agrarian reforms that began with independence in 1954 established the land as State property and were followed by the collectivization of lowland agriculture. Use of uplands remained open to all households. In 1981, Decree 100 marked the beginning of a decollectivization process that gradually returned all of the means of agricultural production to individuals. In 1992, the State began distributing forest land-use rights to individual households. The new forestland policy had three related objectives: (i) the introduction of a sedentary livelihood system for those populations who traditionally had relied on shifting cultivation and regular migration; (ii) the development of the village economy through tree plantations; and (iii) the protection of forest resources. In this chapter, we discuss the land use changes that resulted from the new forestland policy, and the effectiveness of the policy in achieving each of its three objectives, within *Na Ri* District of *Bac Kan* Province. Forestland allocation had very different consequences for local populations depending on their initial circumstances. The allocation of forestland secured land-use rights but also prevented populations from migrating, as there was no more free access land available. This enforced settlement has created difficulties for groups that traditionally had relied on shifting cultivation with periodic migrations. The allocation of forestlands has induced or at least accelerated the development of new production systems, even for populations that were not relying primarily on exploitation of the forest. Populations with access to paddylands were easily able to focus their energies on intensifying their paddyland rice production, thereby permitting substantial recovery of the forest ecosystem. In contrast, populations who traditionally had relied on shifting cultivation found themselves with a production system that was not suited to the new

J.C. Castella and Dang Dinh Quang eds. (2002) Doi Moi in the Mountains. Land use changes and farmers' livelihood strategies in Bac Kan Province, Vietnam. The Agricultural Publishing House, Ha Noi, Viet Nam. 197-220.

institutional environment. The real challenge of development will be in assisting these populations of traditionally shifting cultivators to create sustainable social and production systems.

Keywords: land tenure policy, forestland allocation, natural resource management, livelihood systems, mountain agriculture, *Bac Kan*, *Viet Nam*

1. Introduction

Agriculture in *Viet Nam* has changed dramatically over the last fifteen years, with changes in production systems, ecosystems, and land policy. In launching the *Doi moi* (renovation) series of reforms beginning in 1986, the State dismantled the failed agricultural cooperatives and began to restore ownership of the means of production to individuals.

In the mountainous areas of northern *Viet Nam*, the restoration of individual rights to use paddyland in the early 1990's was intended to stimulate paddy field intensification while reducing pressure on the surrounding hillsides. The policy was successful in that it gave farmers an incentive to invest more in their own rice fields, and resulted in substantial productivity gains in the inter-montane valleys. Despite the paddyland allocations, many farmers were left without paddy fields, often those farmers who had migrated to the montane valleys either from the uplands or the delta regions. In the early 1990's, the *Tày* families had reclaimed the paddyland of their ancestors. In contrast, those who had moved to the lowlands after the establishment of the cooperatives had no historical claim to lowlands (Castella et al., 2002). Without paddy fields, these farmers turned to extensive slash-and-burn systems in the uplands, which had not yet been allocated. The upland ecosystem could not support the increased pressure of agriculture combined with mass deforestation.

The State hoped to regulate the runaway exploitation of the uplands by applying the same solution that had worked in the lowland areas. By allocating forest land to individuals, the State hoped to (i) convert the populations of shifting cultivators toa sedentary livelihood system, (ii) increase agricultural production in the uplands by giving farmers incentives to grow perennial plantations, and (iii) preserve the deteriorating forest resource base.

At first glance, the new policy seems to have been effective in transforming mountainous populations to a sedentary livelihood system. The new context of stable land rights for individuals also made it feasible to grow perennial plantations. Further, the period since the forestland allocation has shown a slight increase in overall forest cover (Sikor, 2001; Tachibana et al., 2001). However, the superficial successes of the land policy hide the deeply destabilizing effect it had on shifting cultivators. Accustomed to livelihood systems based on regular migration, these farmers now find themselves in a crisis situation, with an

unsustainable sedentary agricultural system producing rapidly decreasing yields (Husson et al., 2001), and few alternatives (Pandey and Dang Van Minh, 1998).
In this chapter, we examine the goals of the State in the many land allocations that have taken place over the last fifteen years. We then analyze to what extent these land allocations achieved their stated goals and what impacts they have had on the livelihood systems of farmers. In concluding, we will attempt to identify the possible future trajectories of production systems, and their implications for development interventions.

2. Methods: the case study

The study draws on diverse sources of data including:
- Review of published literature and official statistics,
- Legal and policy documents,
- Commune monographs,
- Land cover maps derived from aerial photographs, and
- Qualitative data collected in interviews and farmer-participatory observation.

In four remote mountain villages within *Na Ri* District of *Bac Kan* Province, we investigated the process and effects at the grassroots level of forestland allocation. We selected these villages to cover a large range of diversity in ethnic composition, natural resource base, and livelihood systems. The objective of the case study was to analyze the way that the same land policies resulted in notably different impacts on villages, even in a limited geographic area, due to the initial diversity of village situations.
None of the four villages is accessible by road or motorized transportation, and unlike many other ethnic minority villages in *Bac Kan* Province, they have not been the targets of the major government development projects (i.e., infrastructure, child education, adult training in technical innovations) associated with the policy of transformation to sedentary production (Dang Dinh Quang et al., 2001). The few development projects that have reached these villages have been limited to one-time donations of material supplies (such as blankets, mosquito nets, kettles, and rice) to the poorest families; and the donation of several tree species by the World Food Program (WFP).
Figure 1 shows the location of the four villages within Lang San and *Luong Thuong* communes of *Na Ri* District, along the *Khuoi Sung* and *Ngan Son* rivers. Our field work was performed over the course of several stays in the villages in 1999 and 2000. We combined informal interviews with direct observation to collect our data. In addition, we conducted an exhaustive survey of all village households (n = 106), allowing us systematically to complete the qualitative data collection.

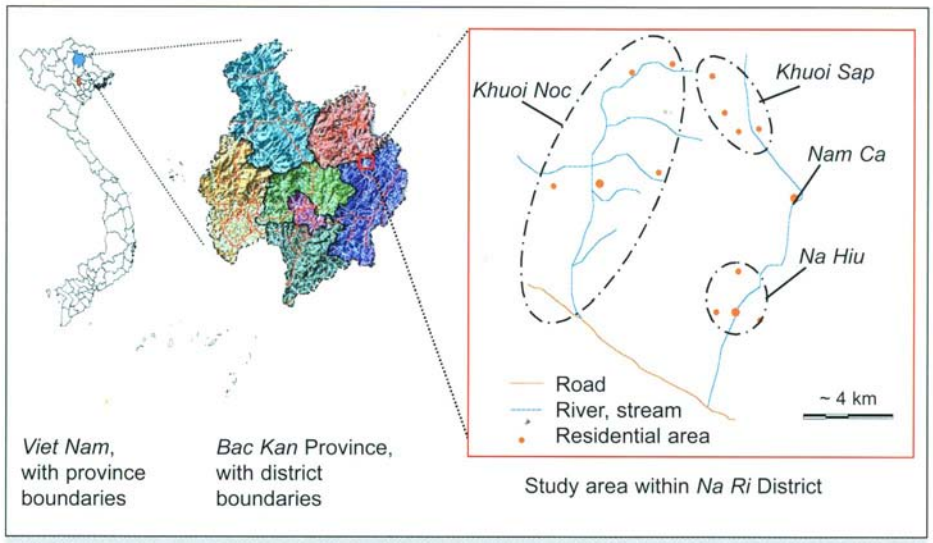


Figure 1: *Location of villages and hamlets along the river network*

3. Land dynamics in the mountains of northern *Viet Nam*

The mountainous areas of northern Viet Nam are populated by a large variety of ethnic groups with diverse agricultural practices (Castella et al., 1999; Sadoulet et al., 2002), but two major production systems can be distinguished:

- In the lower elevations, a composite system consisting of paddy rice production on the flat floors of montane valleys and intensive cultivation of maize and cassava on sloping land bordering the paddy fields;
- In the higher elevations, a system of shifting cultivation with various sequences of crops including upland rice.

In the first half of the 20th century, these production systems were accompanied by a variety of land use rights. Through interviews and written documents, we identified three major categories:

- Individually-owned lowland areas, generally used for paddy ricefields. These ricefields were claimed by whoever had constructed them, and then inherited and shared by their descendants;
- Collectively-owned lowland areas. The lands were owned by the village, which distributed temporary land use rights to individual households;
- Temporary rights to use upland swidden fields, gained by the act of clearing the forest. Such lands were cultivated for several years and then left fallow for a longer period. Ownership could last up to several years after the end of cultivation.

Few villages had absolute control over all of their territory. For example, few villages could prevent the cultivation of a plot of land by an individual from another village. More common was the "clearer's right", where land use rights were informally granted to the individual who cleared or developed a given plot, lowland or upland, regardless of its location with respect to village boundaries. The farmer who cleared a given upland field secured for himself or herself the right to use that field until it was fallowed for regeneration[1]. Traditional land access was free, with the absence of rules made feasible by the low population pressure on mountainous areas during this time period.

3.1. Land collectivization and the cooperatives

After the creation of an independent Vietnamese state in 1954, the communist government initiated massive rural land reallocations: 810,000 ha were confiscated from large property owners and redistributed to the poor. This land reform primarily affected the Red River Delta region, where population pressure was already relatively high. In the mountainous areas of what was then North *Viet Nam*, the abundance of forestland had prevented the emergence of landless farmers. Households could open as much upland area for cultivation as they desired, limited only by the available family labor force.

The collectivization of labor followed the collectivization of land. One by one, all of the means of production were similarly collectivized within the agricultural cooperatives, the first of which appeared in 1958. Before long, the agricultural cooperatives grew to cover most of the country. By 1959, 45% of households in North *Viet Nam* had joined the cooperative system, which encompassed 41% of cultivated land. By 1960, participation was at 85% of households and 68% of arable land (Nguyen Sinh Cuc, 1995).

Cooperatives soon began to experience management problems (e.g. with the labor point system, burdensome administration, increasing taxes), leading to the dismantling of several cooperatives, particularly in the northern mountains (Nguyen Sinh Cue, 1995). Cooperative problems continued during the war with the United States. In the decade following the war (1976-1986), despite several State-mandated reorganizations and expansions, continued low productivity of the cooperatives drove the economy into a protracted recession, with per capita food crop production stagnating and even declining. By 1986, the economy had almost collapsed, and a poor rice harvest threatened famine.

Faced with declining lowland productivity and food shortages, more and more households turned to slash-and-burn cultivation. A dual system of production developed, with collectively-managed work in paddy fields complemented by

[1]In the context of collective lowland fields, the newly developed land might return to the village.

individual-managed work in the sloping lands. Although the "people" officially owned all land (article 19 of the 1980 constitution), sloping lands had not been integrated into the cooperatives. For this reason, sloping lands continued to be cultivated according to the free-access rules described earlier, providing a supplementary income for many households. In times of shortage, farmers focused on the private economy, increasing the area cultivated on the slopes. The 1980's cooperative crises thus led to major deforestation in northern regions.

3.2 Progressive decollectivization

Several attempts at partials decollectivization in the 1980's led to differentiation among households without solving the problem of decreasing lowland productivity. In 1982, the first round of paddyland allocations under Decree 100 resulted in a "rush to the slopes" and serious deforestation (sadoulet et all., 2002). On the 5th of april 1988, the Vietnamese Communist Party politburo adopted Resolution 10 to address the agricultural crisis in the country (Jesus and Dao The Anh, 1998). Resolution 10 would guide agricultural policy in the years to come, and revealed an acute awareness of various problems that had developed during the cooperative period, in particular substantial deforestation and the absence of policy coordination between agriculture and forestry.

Resolution 10 emphasized the importance of private property rights, as well as the need for each region to design a development model suited to its unique natural economic, and social environments. The new policy, in recognition of the importance of the household economy and the private sector, dismantled the failing cooperatives. The means of production would be returned to individual households: cattle, buffaloes, and equipment would be sold to farmers, and paddylands redistributed to households in proportion to their labor force Forestland later would be distributed similarly, on the theory that private land ownership would both preserve forests and encourage the population to adopt sedentary livelihood systems.

Although the State remained the sole official owner of paddyland, individual farmers gained effective control. Thus, the new land tenure system was comparable in practice to that which had existed before the agricultural cooperatives. Farmers now had the necessary incentives to invest in paddy field intensification and terrace construction. By stimulating these two activities the new land policy was successful in raising agricultural production (Kerkvliet and Porter, 1995)

Implementation of the national land allocation policy varied from region to region. In *Cao Bang* Province, the *Tày* ethnic group began a movement in 1990 to reclaim the lands of their ancestors, a movement that soon spread to neighboring provinces. As *Tày* farmers repossessed the paddyland that their forefathers had contributed to the agricultural cooperatives, other groups were left without paddy

fields, particularly households who had not owned paddy fields before the creation of the cooperatives but nonetheless had been contributing to the cooperatives in recent years.Thesegroups (mostly *Kinh* from the delta region and *Dao* and *H'mong* who had emigrated from the uplands) were forced to turn to hillsides and forestlands to meet their food needs.

4. Forest land allocation

4.1.The objectives of the allocation

Forestland allocation began in 1992, using modalities that are described in Section 4.2.The State wanted to achieve three major objectives via forestland allocation: (i) fixed settlement of the mountain populations to end shifting cultivation, (ii) protection of forest resources, and (iii) development of plantations and sylvicultural production to improve living standards of mountain populations.

Fixed settlement of the shifting cultivators

The predominant upland production system was swidden, or slash-and-burn, cultivation. Swidden cultivation involves burning away a section of forest and then growing crops (usually upland rice) in the rich soil that is left behind. The quality of the soil degenerates quickly, so after several years of cultivation the land is left fallow for a much longer period so that the forest can regenerate (Husson et al., 2001; Roder 2001). The particulars of shifting cultivation differ from one group and region to another, but share the common principle of allowing the land to regenerate. This usually necessitates the constant migration of the swidden cultivators to search for mature forests to clear.

The desire to settle mountainous populations in fixed areas is not new in *Viet Nam*. Such policies first arose in the colonial era, when settled populations were necessary for political control and taxation. Later, one of the objectives for instituting the cooperatives in the mountainous areas was "bringing nomadic populations down from the mountains," and pushing them to participate in lowland ricefield cultivation (Dang Nghiem Van, 1991). Before the cooperative period, certain ethnic groups were the predominant cultivators of lowland rice, while others engaged in shifting cultivation. Today, such a distinction is no longer possible - the shifting cultivators are rather those who have been left out of the land allocations, regardless of ethnicity (Castella and Erout, 2002).

The State views shifting cultivators as leading a precarious existence with harmful effects on forest resources. By settling these farmers onto allocated pieces of land, the State hoped to end their slash-and-burn practices and motivate them to develop stable and fixed production systems (e.g., perennial plantations) that would allow them to produce and earn more.

Protection of forest resources and the battle against deforestation

Forest cover in *Viet Nam* has decreased dramatically in recent decades, from 45% of the country's area in 1943 to only 28% in 1991 (of which only 10% was primary forest; Vo Quy, 1998). These percentages correspond to a reduction in natural forest area by 350,000 ha per year over the last twenty-five years. Deforestation has been accompanied by the appearance of severely eroded cleared lands, which according to some estimates covered up to 40% of the country's surface area in 1990 (Vo Quy and Le Thac Can, 1994).

The causes of deforestation include war, timber exploitation (Poffenberger et al., 1997), relative land scarcity due to increasing population, and regulations on access to resources. Nonetheless, the State placed the blame for deforestation squarely on the backs of the shifting cultivators. The State has long perceived swidden cultivation as an "irrational" technique, a backward system that must eventually evolve into sedentary cultivation (Dang Nghiem Van, 1991; Morrison and Dubois, 1998). it is worth noting thatif a burned field is left fallow for enough time after cropping, then the soil and forest can regenerate sufficiently to provide for the next cycle of cultivation. Thus under the right conditions, particularly a combination of low population pressure and regular migration, swidden cultivation is sustainable (De Rouw and Van Oers, 1988; Mazoyer and Roudart, 1997). However, in the period following the cooperatives, low population pressure was no longer a characteristic of northern Viet Nam. Allocating the forestland and obliging nomadic peoples to practice sedentary production would, the State hoped, result in an end to the deforestation process begun decades earlier.

Increasing production via regional specialization

Resolution 10 aimed to transform the economy from a focus on self-sufficiency to a focus on the national market. For the agriculture sector, the State envisioned a system of regional specialization, with intensive rice production in the delta regions complemented by large-scale sylviculture plantations and animal husbandry in the mountainous regions. These sedentary production systems would require sedentary populations to manage them.

The granting of individual property rights to sloping land puts an end to the free access system. Free access has often been identified as a major cause of over-exploitation of forest resources, because it allows farmers to draw individual profits from the land while the costs of their exploitation would be shared by the entire community (Hardin, 1968). By granting renewable usage rights in fifty-year cycles, the State hoped to transfer responsibility to the individual, allowing him or her to reap the benefits but also to pay the costs associated with the exploitation of forestland.

Figure 2 summarizes the rationale behind the forestland allocation. Individual responsibility would give farmers the needed incentive to make "rational" use of

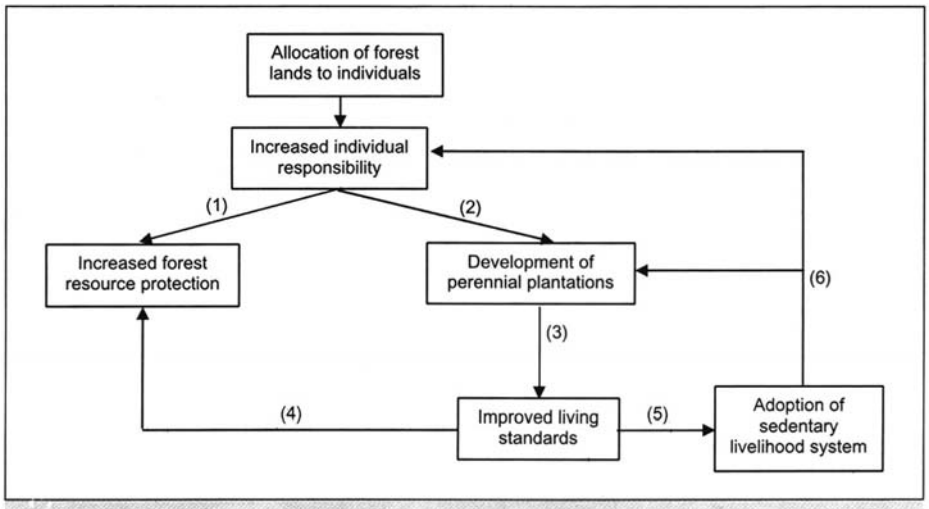


Figure 2: *Rationale for forestland allocation*

their land, leading to the protection of forestland (arrow 1 in Figure 2). Private ownership also would encourage individuals to make investments in their forestland and develop perennial plantations (2). Developing commercial perennial crops would lead to both an increase in tree cover and additional income for households, thus improving living conditions (3). Assuming that poverty is what motivates farmers to adopt short-term unsustainable survival strategies, the economic gains from perennial plantations would allow better protection of the forest (4). Further, the migration associated with shifting cultivation would no longer be necessary, tying improved living standards to decisions on sedentary livelihood systems (5). Sedentary livelihood systems reinforce individual responsibility for resources and provide an incentive for the improvement of perennial plantations (6).

4.2. The allocation process

Forestland allocation began in 1992, and was still ongoing in 2002. Resolution 10 (April 1988) defined the main modalities of the land allocation, with the 1993 land law and Decree 02-CP (January15, 1994) supplyingadditional details. The allocation policy is also closely associated with the forest protection and development code developed in 1991.

The 1993 land law (article 43) defines forestland as, *"all land identified as being destined for sylviculture, natural forest: regeneration, reforestation, timber, nurseries, forestry research and experimentation"*. Because forestland was defined according to planned future use rather than present use, the policy resulted in classification as "forests" of some lands that were currently being cultivated with annual crops and had been for dozens of years.

Forests were classified into three distinct types:
- Protected forest, for the preservation of water resources; prevention of erosion, natural disasters, and climatic risks; and overall protection of the environment.
- Special-use forest, intended for the conservation of nature and plant and animal species; scientific research; and protection of historic, cultural and tourist sites.
- Production forest, used primarily for timber and other forest products, and complementing the other types of forest to protect the environment.

The land-allocation process consists of a series of meetings, beginning at the district people's committee and progressing down the administrative hierarchy to each individual village. The district develops an allocation plan that delineates the areas to be classified as each type of forest (protection forest, production forest, special-use forest). The plan is then disseminated through the communes to the village level, where each household that wants to receive a plot of forest land must fill in a request form, sent on to the district forest service.

The district forest service then measures and classifies each individual plot. Once all conflicts have been cooperatively resolved at the village level, the forest service integrates the information into a land map and gives certificates of land use rights to households. Following the granting of land-use certificates, a meeting is held in each village to address the issue of forest protection. At this meeting, the forest service elucidates the regulations of forest protection and development, and each household possessing forest land must sign an agreement to treat their land accordingly. Each village can then develop its own system of forest management, protection, and development based on its particular circumstances. However, the rules of all villages are based on model regulations supplied by the forest service. The rule-development system appears to be participatory and flexible, but in reality it is a top-down procedure. Instructions are passed down from one hierarchical level to the next with minimal changes. At each level, only limited independent decisions can be made, and all must be approved by the higher levels of authority. Often, the management rules that are intended to reflect local circumstances have in fact been dictated to the smallest detail by the district forest service. In reality, villages are limited to reordering the various articles of the policy in terms of their local importance and removing those that do not apply to their circumstances. It is not uncommon to find that the management rules of one village are nothing more than a photocopy of those of the neighboring village, with the names of the village and its leaders changed. The top-down implementation of the system favors neither local participation nor ownership, though these goals are admittedly difficult to fulfill given the high illiteracy rates and often poor understanding of the spoken *Kinh* language[2] in these areas.

[2]Kinh (the name of the predominant ethnic group) is the official language of the country, often called Vietnamese. The various ethnic groups each have their own languages.

5. The effects of the forestland allocation

We examined the effects of the forestland allocation through a case study of four villages in *Bac Kan* Province. Village locations are shown in Figure 1. Boxes 1 to 4 describe the main characteristics of each village. In *Na Ri* District as a whole, the allocation process began in 1992 and finished in 2000. Specifically, the allocation of land-use rights in *Lang San* and *Luong Thuong* communes took place from 1997 to 2000.
The studied villages were all founded relatively recently, the oldest being *Nam Ca*, settled just one hundred years ago. All of the villages with the exception of *Na Hiu* were settled for their abundant forest resources [3], and even *Na Hiu* now relies on the forest more than ever, as two-thirds of its ricefields were repossessed during the *Tày* land reclamation movement.

Although paddy rice has gained popularity as a means of subsistence, there is almost no remaining land in the region suitable for terracing for new paddyfields. The majority of households cannot produce enough paddyland rice to feed themselves, and have production strategies based on shifting sloping-land cultivation. In our analysis, we have found it informative to distinguish between two types of households: those who can produce enough rice on paddyland to meet their food needs, and those who cannot and must rely on shifting cultivation on sloping lands (Castella and Erout, 2002). The effects of forestland allocation were substantially different for these two types of households.
To reiterate, forestland allocation was intended to achieve three goals: encouraging shifting cultivators to adopt sedentary livelihood systems, forest regeneration, and economic growth. We will now examine the effects of the allocation within the case-study area on those three goals.

5.1. Effects on sedentary livelihood systems

Clarification of individual and village land boundaries
The forestland allocation process necessitated the clear demarcation of each individual's property rights. In doing this, the forest service implicitly defined all village and commune boundaries. The "village territory" now comprised the set of land plots allocated to the households of a village, together with those plots placed under direct village ownership. Within each village territory, clear boundaries for agricultural and forestry activities were specified. By definition, the existence of individual land-use rights effectively excluded individuals from

[3]Although settlers chose the locations for these villages for their abundance of "primary" forest, the settlers did not realize that the forest was not more than twenty years old. Aerial photographs from 1954, 1977, and 1998 show that although the areas were densely forested in 1954, they had been cleared almost entirely at least once by 1977.

Box 1: *Na Hiu village*.

In 2000, *Na Hiu* village was composed of nine households spread across a large area. The village comprised sixty-two inhabitants of a diverse mix of ethnicities, including *Dao Cooc Mun*, Red *Da*o, and *Nung*. The villagers shared a history of coming to *Na Hiu* in search of cultivable land, The first arrivals came in 1985, redeveloping a group of paddy fields that had been abandoned over twenty years before. Most of those paddy fields have since been repossessed by the original owners. The remaining inhabitants (the later arrivals) were not able to acquire paddy fields and relied on the forested slopes.

Although *Na Hiu* village was founded for its abandoned ricefields, its inhabitants have increasingly turned to swidden cultivation and hunting and gathering as means of survival. Even the inhabitants who arrived in hopes of developing new paddy fields now depend on the forest for survival, as terracing requires large labor investments. Many paddy-field terraces have been under construction for years and remain unfinished.

Box 2*: Nam Ca village*

Nam Ca village was founded over one hundred years ago by a *Tày*, whose descendants now make up the eleven households and fifty-seven inhabitants of the village. He chose a location favorable for the development of irrigated paddyfields, the basis of *Tày* production systems in northern *Viet Nam* (Bal et al., 1997; Castella and Erout, 2002).

However, the lowlands now are fully occupied, and no more paddy fields can be built. This has led the village to develop new inheritance rules forcing all but the eldest son in each family to emigrate. Households rely primarily on paddy rice cultivation, with upland glutinous rice as a supplement. The forest is also used for free-grazing buffaloes in the winter season.
In the spring of 2000, most households attempted a spring-season cycle of rice. The trials were not a complete failure, but produced mediocre yields due to cold weather.

Box 3: *Khuoi Sap village.*

Khuoi Sap is the village farthest from the road, the administrative centre, and the marketplace (about an hour and a half away by foot).In 2000, *Khuoi Sap* was made up of seventeen households and ninety-five people, all Red *Dao* with the exception of one *Tày* family. The village encompasses four hamlets settled by two different family groups.

The continuous spread of the village was motivated by the abundance of old-growth forestland that could be cleared and used for the production of upland rice.Village inhabitants initially opened swidden fields very close to their houses, but with time villagers cleared areas farther and farther,from the settlements, now reaching distances of up to one or two hours by foot. The viUage production system is based on swidden cultivation, beginning with several years of upland rice, followed by cassava and maize. This is complemented by hunting and gathering. Only two families own paddy fields, and this is only a small area (1000 m^2 each).

Box 4: *Khuoi Noc village*

Khuoi Noc village occupies the entire northern area of *Luong Thuong* Commune. The village iscomposed of 394 *H'mong* inhabitants forming 70 households spread across sixhamlets. When the first households (about 22) arrived from *Cao Bang* in 1983, the land was unoccupied. Founded for the area's abundance of primary forest, the village has an economy based on the swidden cultivation of upland rice and cassava, narrow fields of maize on the flat lands along the river, and hunting and gathering. Only five of the 70 families own irrigated ricefields, which they built themselves; the combined surface area is only 8100 m^2. Some families engage in gold mining to supplement their incomes.

using land to which they did not have formal usage rights. Thus the new land policy abruptly ended the traditional free access rules that had existed before. Each village and household now possessed land that was protected from outsiders, but that same protection now constrained their actions.

The end of free access was of critical importance to those groups with production systems based on shifting cultivation, particularly the *H'mong* and *Dao*. Under the new land policy, these groups could no longer migrate in search of mature forests to clear, as other individuals now owned the right to use all forests.

At first glance, one of the goals seemed to have been accomplished: previously shifting populations were settled permanently. However, it is necessary to distinguish between sedentary housing and sedentary production systems.

Sedentary housing versus sedentary production systems

Effective transformation from a migratory to a sedentary society has at least two different levels of indicators:

1. Sedentary housing, indicated by kinds of homes and the materials used to construct them; and
2. Sedentary production systems, indicated by an agricultural system that is ecologically and economically sustainable within a fixed territory (without requiring regular migration).

The *Tày* village of *Nam Ca* offers an example of sedentary housing. The people of the village have lived in the same location for over one hundred years and have built houses on wooden stilts with tile roofs. Such houses require substantial investments in both materials and labor and a considerable sum - 20,000,000 VND[4] - corresponding to several years of work. Migrating populations tend not to build such houses, usually living instead in houses made from bamboo, built on the ground or on simple stilts. This type of house is mostly found in *Dao* and *H'mong* villages. For a family to build a wooden-stilt house with a tile roof is both a sign of relative wealth and an indicator that they intend to stay in one place for several years at least.

The second, more fundamental change in society is the transition from a shifting production system to a sedentary production system. The most emblematic example would be a shift from a system based on swidden cultivation to a system based on irrigated ricefields, whether in flatlands or in terraces on sloping land.

Almost all farmers in the studied area have had this transition as one of their goals, even before the new land policy. Even though the construction of paddy fields or terraces is extremely labor-intensive, farmers consider paddy rice cultivation to be easier than sloping-land cultivation. This is particularly the case when the swidden fields must be cleared from degraded forests, requiring increased time investment

[4] As a frame of reference, the price of 1 kg of paddy in 2000 was 2500 VND.

in weeding for lower and highly uncertain yields. Although the majority of households have investment in paddy fields as a major objective, few have achieved this objective. Reasons include inadequate access to flatlands, inadequate water sources for irrigating terraces on sloping lands, and insufficient labor force for construction of paddyfields or terraces.

The villages with economies based on irrigated rice (*Nam Ca* and part of *Na Hiu)* had both sedentary housing and sedentary production systems even before the forestland allocation. Therefore, transformation to a sedentary society was not an issue for them. The remaining villages (*Khuoi Sap*, *Khuoi Noc* and the rest of *Na Hiu*) have been converted to a sedentary existence only in terms of their housing. Even after the implementation of the new land policy, the majority of production systems in the studied *Dao* and *H'mong* villages continue to be based on swidden cultivation, a system that is sustainable only when accompanied by regular migration. These populations now find themselves in a very delicate situation, with a production system that is poorly adapted to their institutional environment. At the same time, their sedentary housing reveals a *de facto* transformation to a sedentary lifestyle. This is not a true transformation of society, based on a new livelihood system that no longer requires migration. Rather, it is a transitional stage compelled by the lost possibility of migration but not yet truly sustainable.

5.2. Effects on forest protection

At the time of writing, it is too early to say whether the new forest protection policy will affect the extent of land cover. The most recent aerial picture available of the studied area is from 1998, whereas the first forestlands were allocated in 1997.Therefore, in the next section we focus on people's reactions to this policy.

Individual responsibility toward forests

Farmers in the studied area are particularly conscious of the need for forest protection, as their livelihoods depend on the survival of this resource base. They frequently mention the rapid decrease in old-growth forest that has taken place in recent years, and state that the over-exploitation of the forest could have severe effects on their families. Farmers already are experiencing declining yields from swidden fields and increasing labor requirements for weeding. Forest wildlife, another important component of people's livelihoods, is also rapidly disappearing. Given their reliance on the forest, farmers are eager to learn about initiatives to protect it. Under the old system, individuals could claim lands in the territory of the neighboring villages, and the villages were powerless to stop them. This often ted farmers to blame neighboring villages for resource deterioration. Under the new land allocation system, farmers are fully responsible for their own land, and can be satisfied that no household other than their own is harming this resource. Most farmers received the land that they requested (that which would have been theirs by traditional rights), making the allocation doubly satisfying.

Although the populations of the studied villages were mostly satisfied with the land they received (either for its proximity to their house or high quality), many were less enthusiastic about the accompanying forest protection policy. Certainly not ignorant of the consequences of forest deterioration, farmers nonetheless rely heavily on forest resources for survival; after all, the forest is the basis of swidden cultivation. An outright ban on .forest exploitation jeopardizes their food security. The announcement of the forest protection policy, particularly the ban on the clearing and burning of forestland, was met with fear by a large number of farmers who had no short-term alternatives to feed their families.

New circumstances will inevitably force farmers to develop new production systems that are better adapted to the ban on swidden production. Indeed, since the allocations, farmers have been searching desperately for helpful innovations as their swidden cultivation evolves into something new and hopefully sustainable.

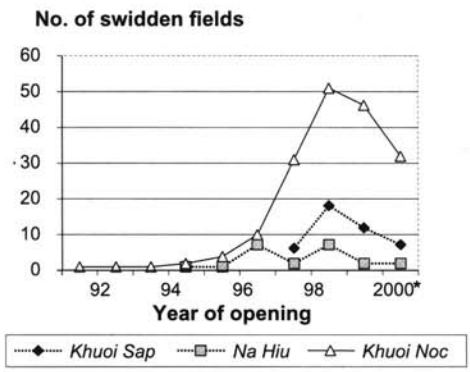
The end of swidden cultivation

Since 2000, in response to the land allocations and protection regulations, the inhabitants of *Nam Ca* have entirely stopped swidden cultivation. In the other three studied villages, every single household continues to engage in swidden cultivation, but the figures reveal a system that must change or die.

Figure3 shows that the number of newly-opened swidden fields has been decreasing over the last two years. Our field survey indicates that a large number of households have continued to cultivate swidden fields opened in previous years. This change is likely a direct consequence of the forestland allocation and forest protection policy: opening new fields is no longer possible. The cultivation of old swidden fields is particularly striking in *Khuoi Noc*, where some swidden fields have been cultivated continuously since 1990. In contrast, in *Na Hiu* and *Khuoi Sap* the oldest fields date from 1994 and 1995, respectively. An additional problem is that the yields of newly-cleared swidden fields (defined by the rice harvest in proportion to the quantity of rice seed sown) have been declining in *Khuoi Noc*. The low and still diminishing yields in this village are the result of a forest that is becoming thinner and less mature while the population of swidden cultivators, swollen by immigration, continues to rise. The surprising (and alarming) result is that fields in their first year of cultivation are producing yields even lower than fields that have been cultivated continuously for seven years (Figure 4).

The average surface area of swidden fields[5] opened three years earlier has not changed substantially (Figure 5). Taken with declining yields, this is a clear sign that, confined to fixed territories under the new land policy, production systems based on swidden agriculture are slowly failing.

[5]Because it is difficult to measure actual plot sizes in sloping lands, we estimated surface area of fields by the amount of seed sown, using a conversion factor of 100 kg seed/ha.

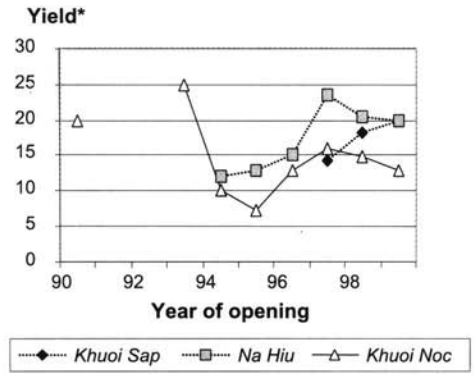


Fewer fields being opened

New land policy prevents farmers from claiming new land by opening swidden fields. Of all the swidden fields being cultivated in 2001, more were opened in 1998 than in 1999 or 2000.

* *Swidden fields opened in 2000 will be cultivated in 2001*

Figure 3: *Number of upland fields being cultivated in 2000, plotted against year of opening.*

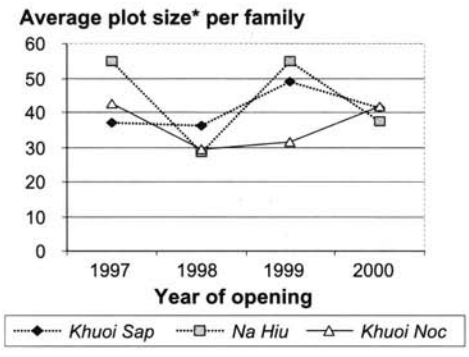


Decreasing soil quality

Swidden fields typically produce the highest yields in their first years of production. In both *Na Hiu* and *Khuoi Sap*, the newly cleared fields are returning lower yields than fields cleared years earlier, evidence of the deteriorating soil and forest quality.

* *Yields are expressed as multiples of the quantity of seeds sown. For example, if a farmer sowed 100 kg/ha and harvested 1500 kg/ha, then the yield would be 15 (1500 / 100 = 15).*

Figure 4: *Yield of upland rice crops cultivated in 2000, plotted against year of opening.*



The developing crisis

In spite of decreasing yields and a decreasing number of new fields opened in 1999 and 2000, the total number of swidden fields across the studied area is remaining approximately constant. This indicates that old fields with declining yields are not being fallowed to regenerate, but continue to be cultivated.

* *Plot size is expressed in kilograms of seeds sown per plot (the sowing density commonly used as a reference is 100kg seeds / ha)*

Figure 5: *Size of upland rice fields being cultivated in 2000, plotted against year of opening*

5.3. Effects on agricultural production and economic development

The new land policy was intended to result in both intensification of paddyland production and the use of the uplands for perennial plantations. Both outcomes were intended to increase the income and thus the quality of life of farmers. In reality, the new system exacerbated the problems of swidden cultivation without providing farmers with a sufficient alternative source of income.

Shifting cultivators in crisis

The reduction in the upland rice yields implies a reduction in the living standards of the populations that rely on swidden cultivation. In two out of the three villages practicing shifting cultivation, the average rice yield is under the 250kg / person self-sufficiency threshold (Table 1). Indeed, a substantial number of households faced rice deficits in 1999 (Table 2). This does not necessarily mean that they went hungry; these households purchased rice, or they ate non-rice staples. However, the high percentage of households facing rice deficits is indicative of a production system in crisis, a system no longer adapted to its environment. We will now discuss how farmers have adapted their production systems in response to the crisis, and more generally how they have adapted their systems to the new land policy.

Intensification of lowland production

The ban on opening new upland fields was intended to encourage households to focus their energies on the lowlands. Lowland rice production can be increased

Table 1: *Indices of upland rice production in 1999, by village.*

Index of upland rice production	Village		
	Khuoi Sap	*Na Hiu*	*Khuoi Noc*
"A" = Quantity seed sown / person (kg)	16	12	13
"B" = Average yield	18	18	14
"A x B" = Average production/person (kg)	288	216	182

N.B. Yields are expressed as multiples of the quantity of seed sown

Table 2 : *Indices of rice deficit in 1999, by village*

Index of rice deficit	Village			
	Khuoi sap	Nam Ca	Na Hiu	Khuoi Noc
Percentage of households experiencing deficit (food requirements exceeded rice production)	59%	20%	87%	67%
Average length of the deficit (months)	2	2	5	3

either by developing new paddy fields; or intensifying production in existing paddy fields (e.g., by introducing a spring-season rice crop); or both.

New paddy fields have recently been constructed in *Na Hiu* (eight households) and *Khuoi Noc* (six households), and two households in *Khuoi Sap* purchased paddy fields. However, most of this increase happened before the new forest land policy was implemented. Our interviews indicated that the decreasing availability of old-growth forest was already pushing individuals to the lowlands; land allocations were only an added incentive.

As we mentioned earlier, the paddyland within the studied area already is largely saturated; little flatland remains that could still be developed. Indeed, in *Nam Ca*, no new paddy fields have been developed since 1971. Instead, in the spring of 2000 *Nam Ca* farmers began to experiment with increasing production by adding a second, spring-season rice crop. They were aided by the district agricultural service, who sold them a new variety of seeds at a low price. However, yields were only mediocre, due to cold weather:

Farmers' initiatives to increase the area of, and intensity of production on, padyland in response to forestland policy confirm the interdependence of paddylands and sloping lands, as demonstrated by Castella and Erout (2002).

Perennial plantations

State policy suggests a future of uplands brimming with fruit tree plantations, bringing wealth or at least self-sufficiency even to farmers who lack paddy fields. With swidden cultivation no longer feasible, upland rice production will decline or cease, and perennial plantations are expected to fill the gap.

Plantations are indeed being developed in the study area, but they are far from an all-purpose solution to the difficulties faced by farmers. Cinnamon and anise plantations account for and 15%, respectively, of the trees planted in the study area,whereas fruittrees (e.g. plum, apricots) make up the remaining 15%.

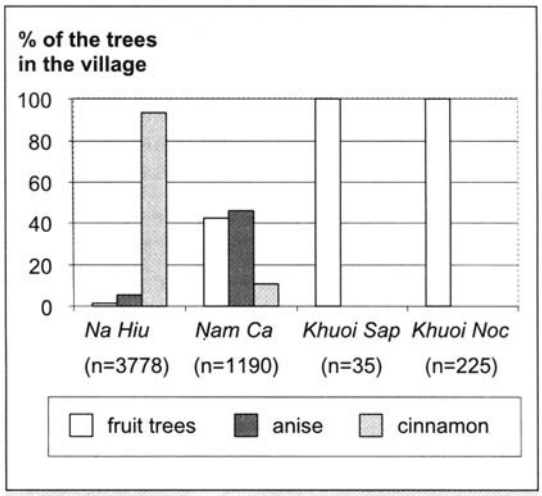


Figure 6: *Plantation composition by village.*

For most farmers, tree-crop production is still experimental, as revealed by the fact that the small - the trees are located in the vegetable garden or very

near to swidden fields, and the harvest is mostly consumed by the household. Although over 3,000 cinnamon trees have been planted in the studied area (nearly all in *Na Hiu* village), the vast majority of these belong to only two households (Figure 6). Out of all four villages, only six households (four of these in *Na Hiu*) own more than 100 trees. This concentration of plantations in a few hands can be explained by the limited number of rice-sufficient families who could afford to invest in plantations.

Plantations represent a highly uncertain source of income to farmers. Villages far from the roadway do not have the market access to sell the produce of industrial trees [6]. Even for those villages close to marketplaces, the future demand for industrial tree production cannot be confirmed, and the trees will not produce for several years. Large plantations bring the added risk of theft, and constant monitoring to prevent theft is difficult.

Despite these disadvantages, plantations represent a low-risk experiment for many farmers because various organizations subsidize the initial establishment of plantations. In *Na Hiu*, farmers have received cinnamon and anise seedlings from the WFP and continue to do so. *Khuoi Sap* also received seedlings, but because of poor management (related to the limited interest by farmers who have not achieved rice sufficiency) they have all since died or been destroyed by buffaloes. In the other two villages, plantations (mostly fruit) are mostly established on the initiative of individuals, with seedlings purchased either from a market or a state farm, or self-produced. The economic role of a tree plantation depends on the current household production system. Those households with sufficient paddy fields to meet their food needs tend to develop plantations in search of additional profit. They plant a set of trees without knowing whether or not they will turn a profit on the activity. Such "speculative" plantations are predominantly industrial trees (anise and cinnamon). They can potentially bring in high returns but carry with them high uncertainty because of poor plantation management and uncertain market; but for rice-sufficient households, the consequences of failure are not severe. Because these households have production systems stable enough to provide for their needs, they can afford to make such low-risk experiments.

Households that are still trying to meet their food needs usually develop plantations at a very small scale, in the hopes of complementing their annual-crop harvests several years down the road. Further, they tend to plant fruit trees rather than industrial trees, so that the future production could be readily sold within the village or in the commune marketplace. Proceeds would be used to buy the rice needed to feed the household or pay for other family expenses.

[6]The term "industrial trees" as used here (and in the Vietnamese literature) refers to trees producing products that require post-harvest processing - for example, cinnamon, tea, or anise.

The new land policy successfully destabilized shifting cultivation, but perennial plantations and lowland intensification have not been sufficient to meet the needs of swidden farmers. Struggling to feed their families, they are rapidly experimenting with new possibilities, from aquaculture and animal husbandry (mainly poultry, pig, and cattle) to the testing of any cropping innovation that shows promise. Another option is to move to new places in search of better environmental conditions for agriculture or opportunities for non-agricultural income.

New kinds of migration

Migrating to new communes or districts within the province is no longer a possibility because all land is now allocated to locals. However, households without opportunities in their current locations can move their houses closer to forestland they own within a village. Living close to forestland facilitates guarding and tending the plot, and thus makes feasible a wider range of production options (Fatoux et al., 2002). In *Khuoi Sap* and *Khuoi Noc*, some households have created new hamlets, and others have moved their houses to their more remote upland plots to develop irrigated paddy fields or fishponds. A few other families have moved closer to the road to engage in non-farm activities such as small-scale commerce (e.g., selling consumption goods or agricultural inputs) or motorcycle taxi services.

The more dramatic option is migration to southern *Viet Nam*, Where the New Economic Zones are being developed. Supported by State subsidies, families can relocate to work in the new industrial tree plantations (mostly coffee and rubber) in these zones, located in the Central Highlands region or in the south of the country. The New Economic Zones hold a particular appeal for highland peoples; the prospect of having sufficient land to grow commercial crops that can be readily sold leads many to dream of a better future. Ten households from *Khuoi Sap* have made the long journey. Between 1991 and 1996 nearly 1.5 million persons have migrated to the Central Highlands (Vo Tong Xuan et al., 1999). The journey south nonetheless represents a substantial risk with unknown benefit. Concrete knowledge about the New Economic Zones is scanty, and those individuals who have made the trip and then chosen to return bring reports that are lukewarm at best. Further, the journey is costly; farmers interviewed estimated that such an undertaking would cost at least ten million Dong. The migration is thus only a possibility for households that have accumulated capital, who nonetheless find themselves in sufficiently difficult circumstances to justify leaving everything behind for the great unknown.

The departure of some households for the South occasionally gives other households the valuable opportunity to buy paddy fields from the departing families. In 2000, four households in *Khuoi Sap* purchased ricefields in neighboring *Vu Loan* Commune from *Tày* families who had departed for a New Economic Zone.

6. Conclusions

Our study of four remote mountain villages in northern *Viet Nam* revealed a distinction between two kinds of farmers: those who have their food needs met by paddyland rice, and those who do not. For the first group, the new land policy had little effect - the focus of their production continues to be the paddylands, and they can now use the sloping lands to develop perennial plantations as a supplement to their income.

For the second group, those who had long been shifting cultivators, frequent migration and free access to forestland were an inherent part of their production systems. These households do not oppose the notion of a settled existence; after all, farmers of all ethnicities share the strategy of purchasing paddy fields wherever possible. Farmers associate paddyland rice with a sense of food security, in contrast with swidden cultivation and its extremely unstable yields. Unfortunately, however, there is not enough paddyland to provide for all the shifting cultivators.

By eliminating free access to sloping lands, the State has eliminated the possibility of migration, and thereby put an end to shifting cultivation. The problem is, the State has not yet enabled farmers to successfully implement a feasible alternative. New paddy-field development is not possible in the study area, and perennial plantations have been implemented on a very small scale, if at all, by most farmers. Meanwhile, swidden cultivation continues, in a spiral of declining yields and soil quality.

Farmers have sought to meet this crisis by trial and error, testing a profusion of innovations to find a sustainable way to meet the basic needs of their families. The solution-finding process can be long and difficult, and often takes place at the expense of upland resources.

Thus, the new land policy has created an intervention point for development. Shifting cultivators have long been the poorest of the rural people in northern *Viet Nam*. However, their frequent migration has made them a difficult target for development projects. Settled in a fixed place, these people are now in more dire straits than ever before, but also are now a clear and willing target for new innovations.

Development activities need to focus on facilitating these populations in their solution-finding process, not only by introducing technical innovations but also by identifying the necessary institutional environments to make those innovations economically feasible. For example, to stimulate the development of sylviculture, our case studies have shown that it is not sufficient to provide seedlings to farmers and do nothing more. Instead, a means of access to the market also needs to be developed. Further, the institutional context of the village also needs to be

addressed in order to create intra- and inter-village rules for livestock management, to prevent cattle and buffalo from damaging the new plantations.
In the future, improved transportation and communication networks will broaden the range of options available to the now-remote households. They have to prepare themselves for these coming changes to be better able to seize upon new agricultural or non-agricultural opportunities for income generation. This will require specific training efforts in how to access and use market information, accessing marketing channels, rural non-farm employment, etc.
In the case-study villages, we have looked at a set of social and production systems confronting a new institutional environment. Farmers face various levels of instability, and need to engage in transformations of varying complexities, depending on their livelihood systems at the time of the institutional changes. The challenge for sustainable development is to reduce the human and environmental costs of the necessary transitions, helping farmers in their search for systems that are adapted to their new social, institutional, and environmental contexts.

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Crop-livestock interactions in northern *Viet Nam:* Issues, diversity of farmers' responses, and alternatives for sustainable integration of animals in upland agricultural systems

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Abstract

Animal husbandry is a component of almost all of the highly diverse production systems of the mountainous province of *Bac Kan* in northern *Viet Nam*. Some households only keep buffaloes for animal traction in lowland ricefields, whereas other households rely heavily upon income from cow and buffalo raising. Since decollectivization at the end of the 1980s, population in *Bac Kan* has grown substantially and the institutional and environmental contexts of agricultural production have changed dramatically, but animal husbandry systems have remained unchanged. Longstanding free-grazing practices are harmful to the natural resource base and engender conflicts among and within villages. This chapter describes an exhaustive study of 183 households in two villages in *Ngoc Phai* Commune that characterized household livestock strategies. The data from surveys on livestock practices were joined with a database on cropping systems and farm resource base. A typology was then developed, dividing farm households into ten types according to their crop-livestock strategies. The results are instructive in identifying household types as potential targets for organizational and technical innovations for improving crop-livestock management. Innovations are proposed for systems in which animal husbandry activities complement crop production, rather than competing with it.

Keywords: crop-livestock interactions, upland agriculture, large ruminants feeding, systems approach, northern *Viet Nam*.

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1. Introduction

Cho Don District of *Bac Kan* Province, in the mountains of northern *Viet Nam*, is one of the poorest regions in the country. Predominantly agricultural, the district is inhabited by people of the *Dao* and *Tày* ethnicities. As in much of Southeast Asia, family farms of two hectares or less make up the backbone of agriculture in the region (Devendra and Sevilla,2002). Most farms produce both crops and livestock, in particular, buffaloes play critical roles as draft animals, sources of fertilizer, and also a form of capital; 80% of *Cho Don* households have at least one buffalo (Eguienta, 2000).

In the last fifty years, changes in land-use policy have contributed to an unsustainable expansion of upland use that has dramatically altered the landscape. However, these changes have not been accompanied by an evolution in livestock management practices. Farmers continue to rely on natural meadows and forests to provide fodder for their free-roaming buffalo and cattle (Eguienta, 2000). In the course of our study, we came across substantial social tensions reflecting current imbalances among the components of the crop-livestock-forestry system. For example, crop damage by animals is not uncommon and offending buffaloes are frequently harmed in return (Tran Quoc Hoa, 1999). In an environment of increasing population, both human and animal, livestock are an important cause of the deterioration of forests and pasturelands (Husson et al., 2001).

The slash-and-burn cropping systems used on the region's hillsides also have had a deleterious impact on the resource base. Since the agricultural decollectivization at the end of the 1980s, successive land reforms have driven the poorest of the mountain people back to their ancestral practices of shifting cultivation (Castella et al., 2002). In their current environmental and institutional context, these marginalized households have resorted to reducing fallow periods on the hillsides, degrading the fertility of cultivated soils and exacerbating erosion (Husson et al., 2001).

Effective natural resource management in mountainous regions needs to take a holistic approach, taking into consideration livestock systems, cropping systems and the environmental and socio-economic context. Animal nutrition and chronic shortages of forage resources are currently major constraints upon livestock production across Southeast Asia (Devendra and Sevilla, 2002). However, in *Bac Kan*, the price of cow and buffalo meat has doubled between 1995 and 2000, indicating the potential emergence of profitable livestock systems in the future (Helvetas, 2000).

This diagnostic study was conducted in the year 2000 in two mountainous villages (*Phieng Lieng* and *Ban Cuon*) in northern *Viet Nam*, in the framework of the Mountain Agrarian Systems (SAM) Program. We characterized household animal husbandry systems and their relationships with crops and forests, allowing us to

evaluate the systems' performances and identify their constraints (Eguienta, 2000). The goal of this paper is to characterize the diversity of livestock-raising households in terms of their goals, resources, constraints, and needs, in order to better identify intervention points specific to each kind of household. This will help pave the way for the diffusion and application of appropriate, sustainable innovations.

2. Analyzing animal husbandry through a systems approach

The methodology implemented in our study of animal husbandry systems was based on a systems approach. We defined an animal husbandry system as "the combination of resources, animal species, techniques, and activities mobilized by a community or a farmer to convert natural resources into livestock production" (Lhoste et al., 1993). The analysis, the framework of which is presented in Figure 1, consisted of investigating statistical relationships among variables pertaining to household characteristics, cropping systems, and animal husbandry systems (herd management practices, surveillance techniques, use of hillsides) and performance indicators (herd growth, mortality, traction needs met, household rice self-sufficiency levels). From this analysis, we developed a typology of farmers and examined their common characteristics and potential trajectories toward new organizational structures or innovative feed production techniques.

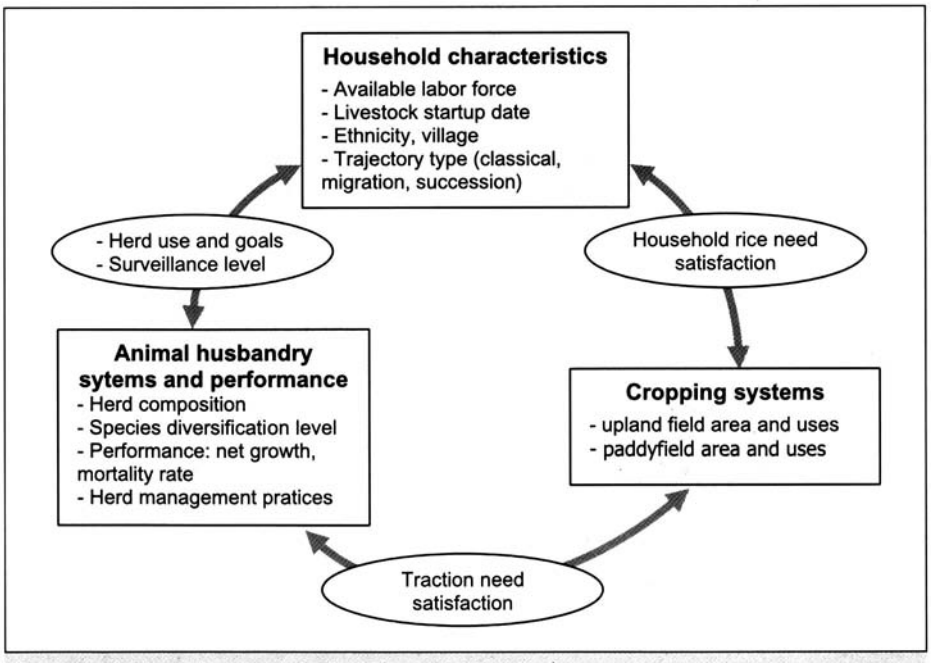

Figure 1: *Analysis framework for farm household typology*

The data collection methodology included field observations, exhaustive household surveys, and interviews with key community members: elders, officials, local cadres, etc. (Table l). The research reported in this paper is part of a wider spectrum of regional characterization and diagnostic study begun in 1999 (Castella et al., 1999). This study completes an exhaustive database characterizing each household's cropping systems and farm resource base.

3. Animal husbandry in *Cho Don*: extensive natural-resource-based systems, recently developed and exhibiting poor performance

The study was undertaken in two villages with particularly contrasting situations (Table 2). *Phieng Lieng* is a village populated primarily by the *Tày* ethnic group with production systems based on paddy rice cultivation. *Ban Cuon* is a *Dao* village with a tradition of shifting cultivation, primarily on terraces and hillsides. The differences between the two villages arise primarily out of the fact that *Phieng Lieng* farmers enjoy a much higher per capita paddy area than *Ban Cuon* farmers, leading the latter to cultivate a higher proportion of upland crops. This discrepancy arose because of traditional differences between the ethnic groups: *Tày* traditionally settled in lowlands, whereas *Dao* traditionally settled in upland areas. However, in recent decades the situation has become more complex: the most recent round of land allocations left some *Tày* families without paddyland, while some *Dao* farmers have been able to purchase paddy fields in *Ban Cuon* (Castella et al., 2002). Regardless of their ethnicity, households who cannot meet their subsistence needs in the lowlands have had to search for other kinds of income: hillside cultivation, forest exploitation, animal husbandry, and non-agricultural activities.

3.1. Forage resources and livestock production practices

The dramatic landscape of the region, with steep slopes and sharp relief, plays a major role in defining local land use. The pasturing of large ruminants has been regulated since 1996. It is officialy confined to collectively-owned public pastureland located far from village settlements and separated from cultivated land by natural and artificial barriers (fences, trenches, etc.). Local authorities tolerate growing crops on public pastureland, so long as cultivation time does not exceed three years; the subsequent fallow period then can restore fertility to the pastureland if long enough. The forage resources in these upland pastures and forests are heterogeneous, but consistently of low quality. Rotation, fallow, and meadow improvement practices are notably absent from the local system.

Since being officially defined as pasturelands, the public upland areas have evolved in different directions in the two villages. In *Ban Cuon,* with low per-

Table 1: *Data collection approach*

Components	Sub-components	Studied characteristics	Diagnosis results	Approach	Sample
Household location and cropping system	Village territory Forage resources Other agricultural resources	- Forage resource units - Distribution – Surface area - Variations	Participatory mapping	Map analysis Transects, field visits	2 villages
Interface	Feeding and spatial behavior	- Animal movements Resource use	Animals per unit area Description animal movements	Following the herds Gathering observed animal feed	2 villages
Herd	State	- Species, race, genetic type - Working capacity - Composition, structure	Age pyramid	Exhaustive surveys	183 households (all families) 160 reproducing female bovines
	Evolution (changing characteristics)	- Growth and usage rates - Significant events (births, deaths, purchases, sales)	Productivity and evolution of working animals		
	Animal (individuals)	- Female reproductive history - Health - Individual performance	Performance	Surveys Direct observation Informal interviews	
	Production	- Meat, milk, wool, … - Manure, labor, transportation	Herd management calendar Draft needs	Surveys Direct observation Informal interviews	82 households (45% of households covering 70% of animals)
Interface	Conduct and practices: Reproduction, feeding, surveillance…		- Surveillance practices - Feeding system - Reproductive practices	Surveys Direct observation Informal interviews	82 households (45% of households covering 70% of animals)
Livestock farmer	Farm structure, ethnicity, family, projects - Livestock management - Labor organization: family, others		- Socioeconomic logic - Social organization - Global farm structure	Exhaustive surveys	183 households (all families)
Interface	- Land organization - Pasture and other land management - Conflicts and other territorial issues - Strategies (manure, etc.)		- Block diagrams - Descriptions of practices - Pastureland histories - Issue characterization	Open interviews (formal or informal), and surveys of livestock practices	Resource persons (village and commune heads, Party leaders, elders, and other local stakeholders)

Table 2: *Studied villages*

Village name	Number of households	Number of inhabitants	Total surface area (ha)	Average Paddyfield Surface area per Inhabitant (m^2)	Average hillside surface area per Inhabitant(m^2)	Average number of buffalo per household
Phieng lieng	76	382	1,288	518	2,506	2.3
Ban cuon	116	623	1,579	298	2,249	2.2

capita paddyland area, pasturelands are heavily cropped with upland rice and cassava. The high pressure on the land means that plots are left fallow only for short periods, leaving only the poorest of fields for grazing. In *Phieng Lieng*, with higher per-capita paddyland area, crops are rare on collectively owned lands. Nonetheless, forage quality is low because the meadows are not maintained. The result has been an invasion of inedible or even toxic plants (*Imperata cylindrica*, *Chromolena odorata*, etc.). In both villages, pastureland is being overgrazed and slowly overtaken by *Chrysopogon* and *Paspalum conjugatum* species, both of which have low forage value. In winter, the cold and dry climate inhibits the growth of natural forage species, leading to the chronic shortage of forage. During this critical period, the food requirements of draft and breeding animals are occasionally filled by rice soup, especially for nursing females, and during the past few years by dry rice straw.

Livestock management practices (e.g. health monitoring, nutrition, vaccinations) are minimal, and reproductive management is unheard of. Human intervention usually is limited to a desultory surveillance of roaming animals. In the *Dao* village, most buffaloes are continually watched by children and the elderly, preventing them from damaging upland crops or from being stolen. In principle, in both villages unmonitored animal roaming is only permitted outside of the cropping season (i.e. from November to February), but nonetheless occurs throughout the year, particularly in the *Tày* village where fences protect the most important crops. Four different levels of animal surveillance can be found in the two villages: all-day monitoring with overnight stabling, and free-grazing with three different minimal frequencies of surveillance: daily, weekly or monthly visits. The level of surveillance is an indicator of both the goals of the farmer and the importance to the village of cropping activities on the hillsides.

3.2. Livestock productivity and performance

Animals can be raised either to produce meat or to provide labor (hauling in the forest and plowing in ricefields). In the study area, people essentially do not consume milk, Manure is widely but inefficiently used - fertility transfers are

poorly organized and severely limited by the absence of means for transportation of manure in this mountainous area. In particular, most manure from animals grazing in the forest is lost for use in cultivated fields.

In terms of draft power, 1 buffalo can plow an average surface area of 400 to 500 m^2 per working day, corresponding to approximately three hours of work. These numbers are lower than those measured in the Red River Delta region, where 1 buffalo can plow close to 700 m^2 per day in a comparable working period. The Murrah crossbreeds commonly used by farmers throughout Southeast Asia can cover as much as 1000 m^2 per day (Tong Quang Minh and Le Xuan Cuong, 1991). This paper introduces the indicator of "draft-need satisfaction", calculated for each household based on its irrigated ricefield area, the draft capacity of an average buffalo, and the composition of the household herd. Eguienta (2000) has shown that most of the households with an irrigated rice surface area greater than 1200 m^2 per draft animal cannot meet their draft needs with their own animals, and will need to rely on either mutual help or a hand tractor. If herd size is more than sufficient to meet the household's draft needs, that household may have the potential to move toward marketing their livestock.

Winter is the period in which the major animal-related events take place: female buffaloes give birth, forage becomes scarce, temperatures drop, parasite infestation rates rise, and labor is required both in ricefields and in the forest. Reproductive performance is mediocre in both villages, with fertility rates of 54% and 48%, respectively, in *Ban Cuon* and *Phieng Lieng*. The pre-weaning mortality rate of buffaloes is high in *Phieng Lieng* (close to 31%) and average in *Ban Cuon* (18%) as compared to other places in *Viet Nam* and in Southeast Asia.

3.3. Trends in herd use

Most animals in the studied villages either came from the cooperative herd, which was distributed to households in the 1980's as part of the decollectivization process (Castella et al., 2002), or were born to females who originated in the cooperative herd. The age pyramid shows an elderly herd with a low renewal rate (Figure 2). Figure 3 shows the herd evolution over time. The "usage rate" indicates the number of animals sold in a particular period. Mortality strongly affects net growth and most animal deaths occur before weaning.

As buffalo purchases are rare, because seldom affordable for most households, herd growth is closely tied to births and mortality. The number of working buffaloes in *Phieng Lieng* has been decreasing for several years, in recent years, there has been a wave of sales to fund lowland ricefield purchases and terrace constructions (these last particularly in *Ban Cuon*), and to repay loans contracted in 1996. The *Tày* tendency is to use buffaloes exclusively for agricultural production. Recent land real locations have left many *Tày* landless,so many families have sold their surplus animals. As the possibilities for ricefield

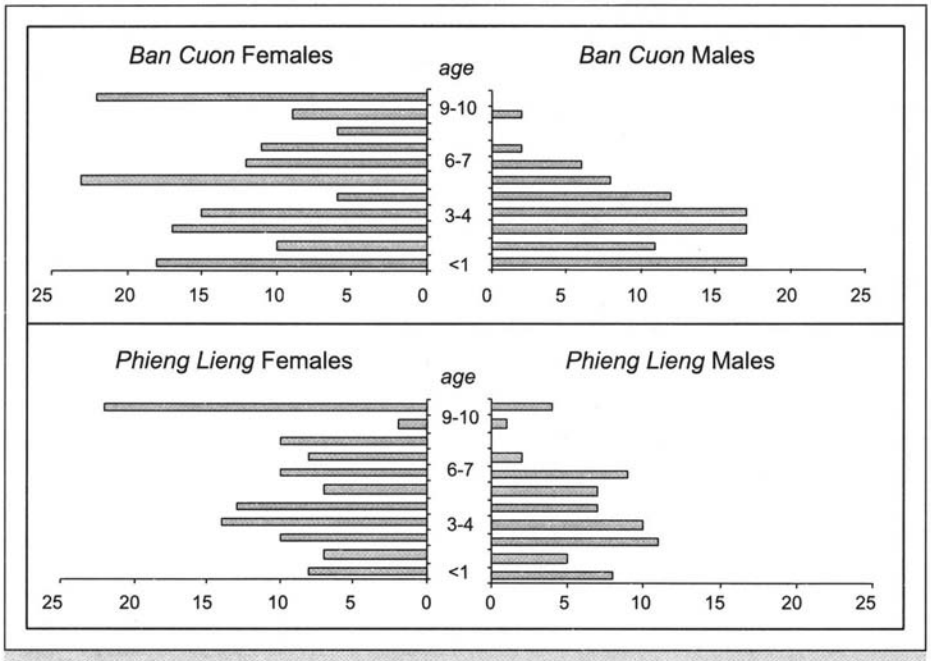

Figure 2: *Animal age pyramid*

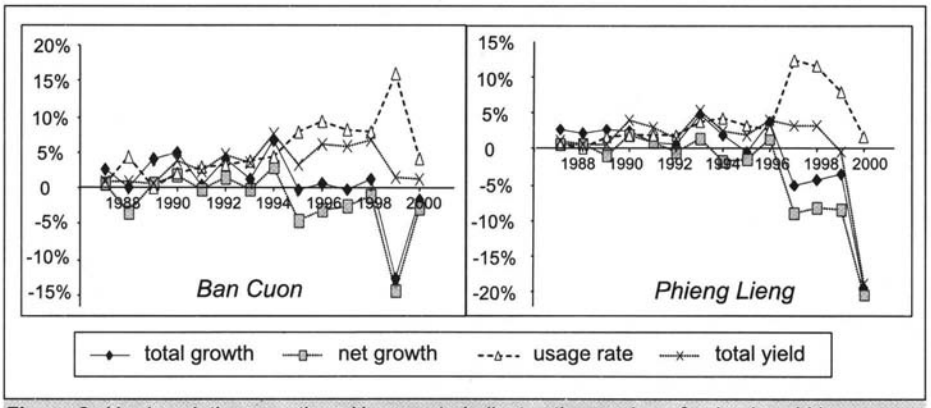

Figure 3: *Herd evolution over time. Usage rate indicates the number of animals sold in a particular period.*

extensification are now limited, buffalo ownership may become an increasingly important means of capitalization. Therefore, we may see herd sizes begin to rise again among the *Dao* and those *Tày* with few ricefields.

At present the livestock market is limited. Animal sales are primarily of culls, particularly females with mediocre reproductive performances and overly aggressive males more than six years old. However, the appearance in the last five years of other ruminants such as cows and goats (at least 30 of each per studied

village) predicates the emergence of more market-based animal husbandry systems. The development of livestock markets in nearby areas is a further indication of this rising trend.

3.4. Diversity of recent animal husbandry systems in terms of livestock strategies

The differentiation of animal husbandry systems in the studied region has occurred relatively recently. During the cooperative period (1959-88), the village herd was the property of the cooperative, and only a few families with very large labor forces were able to maintain private herds. When the cooperatives were dismantled (1988), buffaloes were distributed to individual households. Since then, family succession (inheritance, dowries, gifts) has been the primary cause of changes in animal ownership; changes in land ownership and household structure have resulted in diverging trajectories.

Farmers' strategies, including those regarding livestock, are a compromise between a set of desired objectives and the means available to attain those objectives. To analyze farmers according to classical "large-medium-small" landholder categories would be of limited usefulness in this area because land ownership is not the sole factor determining livestock strategies. For example, it is difficult to say whether a large ricefield area represents a revenue source that permits the purchase of a buffalo, or is the basis of the need for such a draft animal. Therefore, instead of analyzing farmers' strategies according to land ownership only, we analyzed it in connection with other factors: i.e. surveillance level, animal traction power needs satisfaction, etc.

At present, crop-livestock interactions have positive effects only in ricefields: buffaloes provide animal traction, can be a source of capital for ricefield purchase, and provide manure that is used as a fertilizer, albeit inefficiently. However, negative crop-livestock interactions abound, and are a major impediment to the development of both animal husbandry and crop production. Apart from much-needed rice straw in winter, crop production does not provide food for cows and buffaloes. Meanwhile, on the hillsides, livestock and crops compete for space. Animals damage crops, indirectly harming inter- and intra-village social relationships. Animal upkeep also demands a certain investment in terms of labor, either in the form of surveillance or construction of adequate fencing for crops.

In the following section, we will examine current agricultural systems and characterize types of farmers, with the intention of arriving at an integrated approach for developing both crop production and animal husbandry. With few exceptions, all farmers in the studied area are involved in both crop production and animal husbandry. The term "farmer" as used in the following sections refers primarily to the livestock component of these agricultural systems, but should not be taken to imply a lesser importance for the crop component of the system.

4. Farm household typology

4.1. Characterization of relevant variables

We analyzed our survey data through a multiple correspondence factorial analysis (MCFA), which enable us to characterize statistical relationships among quantitative and qualitative variables pertaining to the surveyed households. The statistical analysis complemented the more empirical work that was based on land-use analysis and household surveys. We built a typology based on 143 households (covering 78% of *Phieng Lieng* and *Ban Cuon* households). Our household surveys covered every household, but because MCFA cannot accommodate missing data, the statistical analysis was limited to those families for whom we could acquire all of the relevant data. We calculated household food availability by converting all household production to its equivalent in rice, based on market values. We then determined household food self-sufficiency using the reference value of 250 kg rice/person/year (National Committee of Food Security, 1998).

Draft need satisfaction levels were calculated using the method developed by Eguienta (2000). After estimating the average plowing capacity of male and female buffaloes, we calculated the field area that could be covered by each household's herd. We limited the number of working days to twenty-six per year, reflective of the climatic situation and crop seasons in the studied area. The difference between the field area that could be covered by a household herd and the total area of that household's ricefields indicated the extent to which that family could meet its draft needs with its own animals. We expressed this satisfaction level in terms of the number of average buffaloes required to meet the household's animal traction needs. The parameters associated with changes in herd size (birth, mortality, export rates) were calculated for the period 1996 to 2000, to reflect recent trends. Available labor force was calculated based on a distinction between laborers (adults between 15-60 years old) and half-laborers (children younger than fifteen and elderly people older than sixty). We assumed that the entire labor force was available during labor peaks.

We chose to work with only the first two axes of the MCFA (Figure 4). Though they account for only 21% of the total variance, their use is justified by their independence from the other axes. The distribution of modalities for each variable indicates two clear axes of variation: (i) a "cropping systems" axis that separates variables including irrigated rice self-sufficiency level, draft need satisfaction level, and lowland/upland cultivated area ratio; and (ii) a "livestock/time" axis that separates variables including herd size, year of starting livestock farming, and household head's age. The other studied variables do not follow clearly defined axes. We will now characterize household structures and farming systems according to the variables that make up the "cropping systems" and "livestock/time" axes.

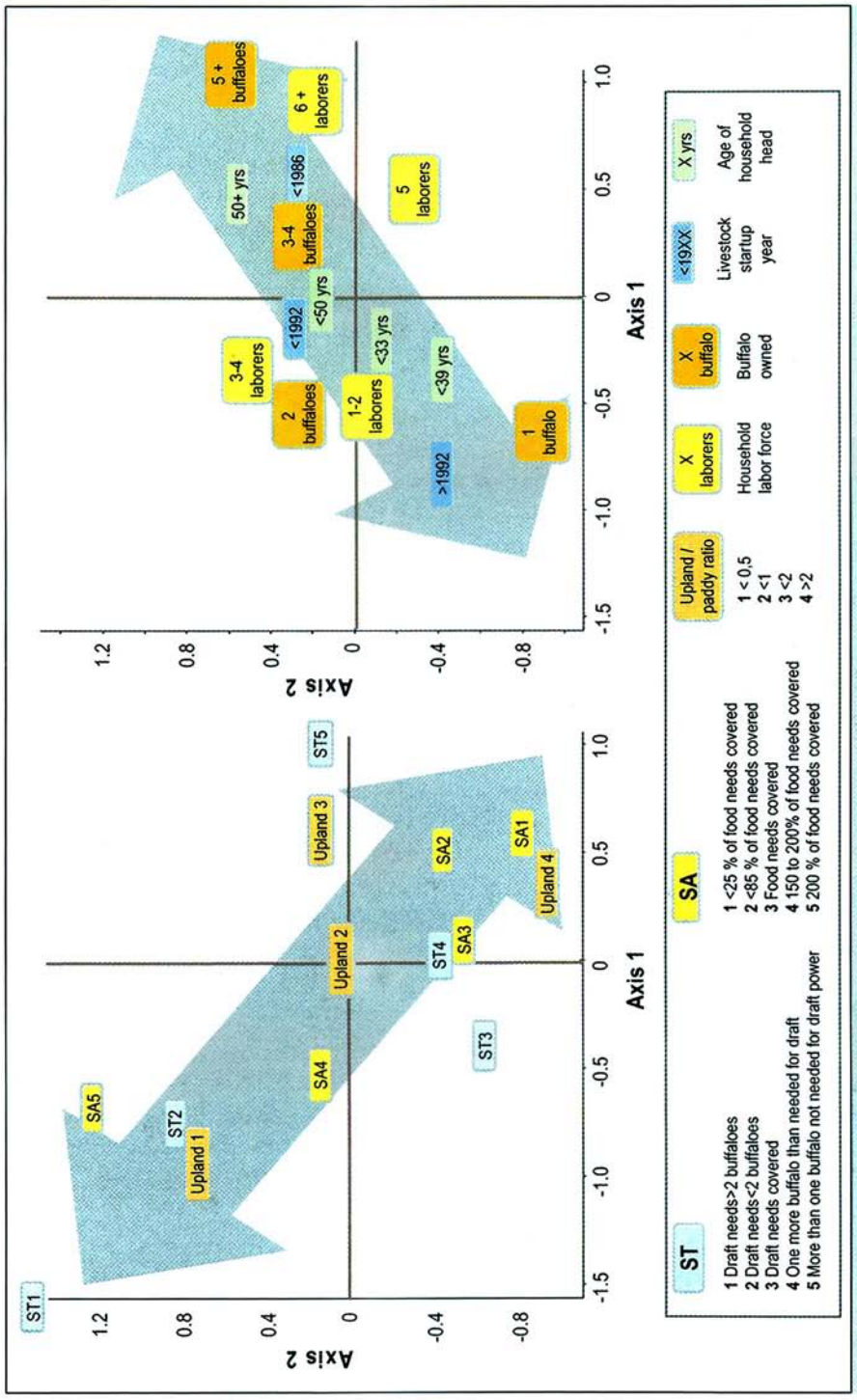

Figure 4: *Distribution of variables on axes 1 and 2 of the MCFA*

4.2. Identification of four major household types

Figure 5 shows the distribution of livestock-raising households on axes 1and 2 of the MCFA (households without livestock were excluded from this analysis). The "cropping systems" and "livestock/time" axes reveal the ability of each household to meet its food-sufficiency and draft needs, as well as its structural characteristics (number of animals, importance of various crops, age of household head, etc.).

Four main types of households could be distinguished (Table 3, Figure 5):

- Along the "livestock/time" axis, types A and B are the young farmers (head of household younger than 38 years), who began to raise livestock some time after 1992 and currently own one or two buffaloes. Types C and D consist of more established households who have been raising livestock since 1992 or earlier, with household heads older than 38 years, and who own three or more buffaloes.
- Along the "cropping systems" axis, types A and D represent households with large ricefield areas. They are rice self-sufficient and gain income from selling surplus rice. They make minimal use of the hillsides, limiting themselves to some maize crops tbr pig-feeding and small fruit tree or industrial-crop plantations (timber, bamboo, cinnamon, etc.). They have high draft needs because of their large ricefield areas. Types B and C are households with small ricefield areas. They cannot meet their food-sufficiency needs with lowland rice, and compensate for this by heavily cropping the hillsides (Castella and Erout, 2002). Given their small ricefield areas, their draft needs are easily satisfied by their buffalo herds, giving them the potential to evolve toward a market-based buffalo raising system.

Household labor force does not follow a clearly defined axis in the analysis. However, it is correlated with the age of the household head: in general, the further a forum advances in the household life cycle, the greater the number of members (and thus laborers) in the household. For the younger household types (A and B), the only laborers are the household head and his spouse; the other household members are too young. Type D households tend to have three to four laborers, whereas type C households often have as many as five to ten laborers.

An examination of socioeconomic characteristics (Figure 6) shows a clear correspondence between ethnic or village origin and the types identified in the statistical analysis. Type D is made up almost exclusively of *Tày* families (from *Phieng Lieng*), whereas type C is made up of *Dao* households (from *Ban Cuon*). The explanation lies in tlae cultural norms of these two ethnic groups. *Tày* children tend to leave their homes fairly early, and only the youngest child lives at home until the farm succession. *Tày* households' large ricefield areas lend themselves well to division among autonomous descendants. In contrast, several *Dao* generations can often be found in the same household, including both individuals with close and with distant family ties (Mellac, 2000). Beyond its cultural roots, this tendency for families to stay together can be related to the small lowland area

owned by each *Dao* family - further division of land among descendants would not be feasible. The large number of laborers also facilitates the organization of extensive labor on the hillsides.

Phieng Lieng households (in green in Figure 6) have production systems based on paddy rice, whereas *Ban Cuon* households (in violet in Figure 6) focus equally on the hillsides and the paddylands. However, some *Ban Cuon* households have structural qualities that are similar to the *Tày* in *Phieng Lieng*. These include *Kinh* or *Nùng* immigrants, *Tày* founding families who have returned to the land of their ancestors, and the few *Dao* families who have gained paddy field access since decollectivization.

Type A (large paddyfield areas) is exclusively *Tày*, whereas type B (few ricefields, substantial use of hillsides) is ethnically mixed. Type B is composed of both *Tày*

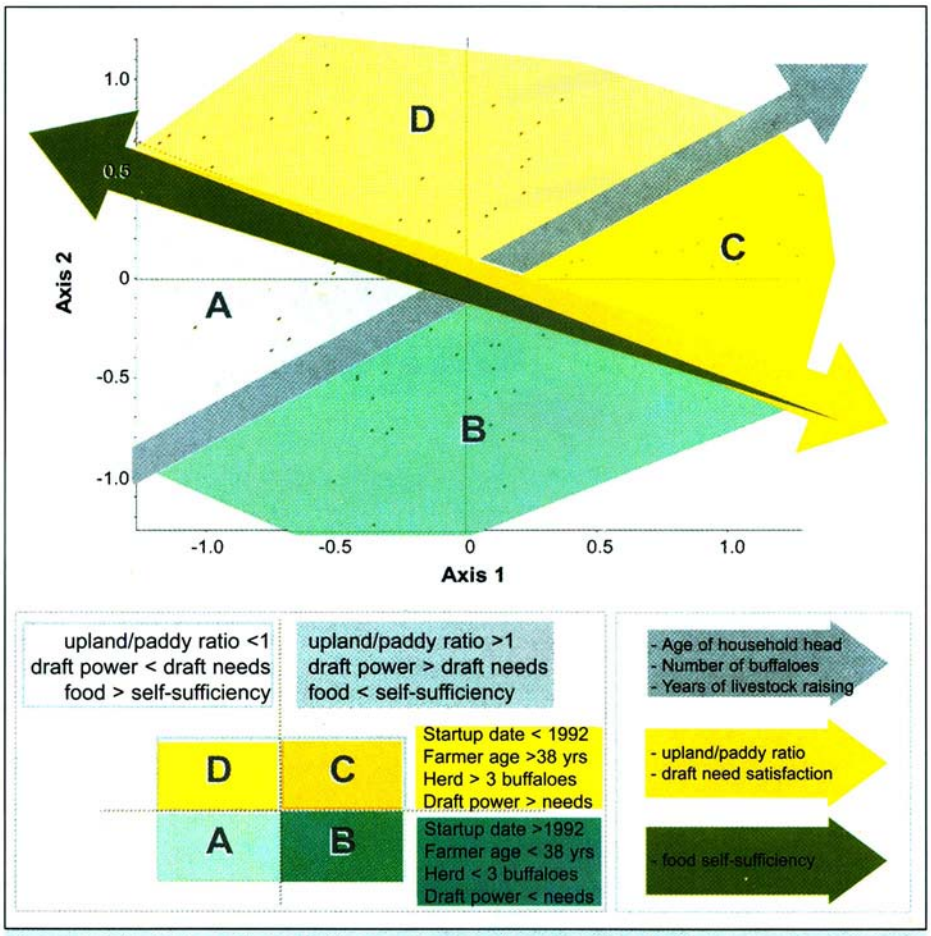

Figure 5: *Distribution of households types on axes 1 and 2 of the MCFA*

Table 3: *Characterization of livestock raising households*

Types	**A**	**B**		**C**			**D**			
Sub-types	**young *Tày* farmers**	**B1 young *Dao* and *Tày***	**B2 stricken**	**C1 merchants**	**C2 savers**	**C3 soon retiring**	**D1 rice-growers w/draft animals**	**D2 rice-growers w/animals for capital**	**D3 stricken *Tày* abandoning husbandry**	**D4 abandoning husbandry**
Food needs	covered	not covered					covered			
Importance of upland crops	low	high					low			
Animal draft needs	not covered	covered					almost covered			
Number of buffaloes	1 to 2 buffaloes			3 to 4 buffaloes	> 5 buffaloes	3 to 5 buffaloes	3 to 4 buffaloes	>5 buffaloes	2 to 3 buffaloes	2 buffaloes
Labor force	1 to 2 laborers		less than 5	6 to 10 laborers			3 to 4 laborers			
Age of household head	less than 38 years		all ages	more than 38 years						
Livestock startup date	after 1992		variable	before 1992						
Hand tractors	no							yes	no	
Other ruminants	no	yes					no			
Ethnicity	*Tày*	*Dao/Tày*		*Dao/Tày*	*Dao*	*Dao/Tày*	*Tày*	*Tày/Dao*	*Tày*	*Tày/Dao*
Animal sales	none			some	occasional	none	some	regular	many	very many
Mortality	none		high	medium	low to medium				medium	none
Surveillance	free-grazing	mixed	night stabling	night stabling	night stabling	night stabling	night stabling	night stabling	mixed	night stabling
Main goal of husbandry	traction (starting up)	capital (starting up)	marketing	marketing	accumulation	capital for succession	traction	capital	abandon livestock	abandon livestock
Proportion of all farmers surveyed	11%	16%	12%	12%	13%	7%	7%	8%	5%	9%

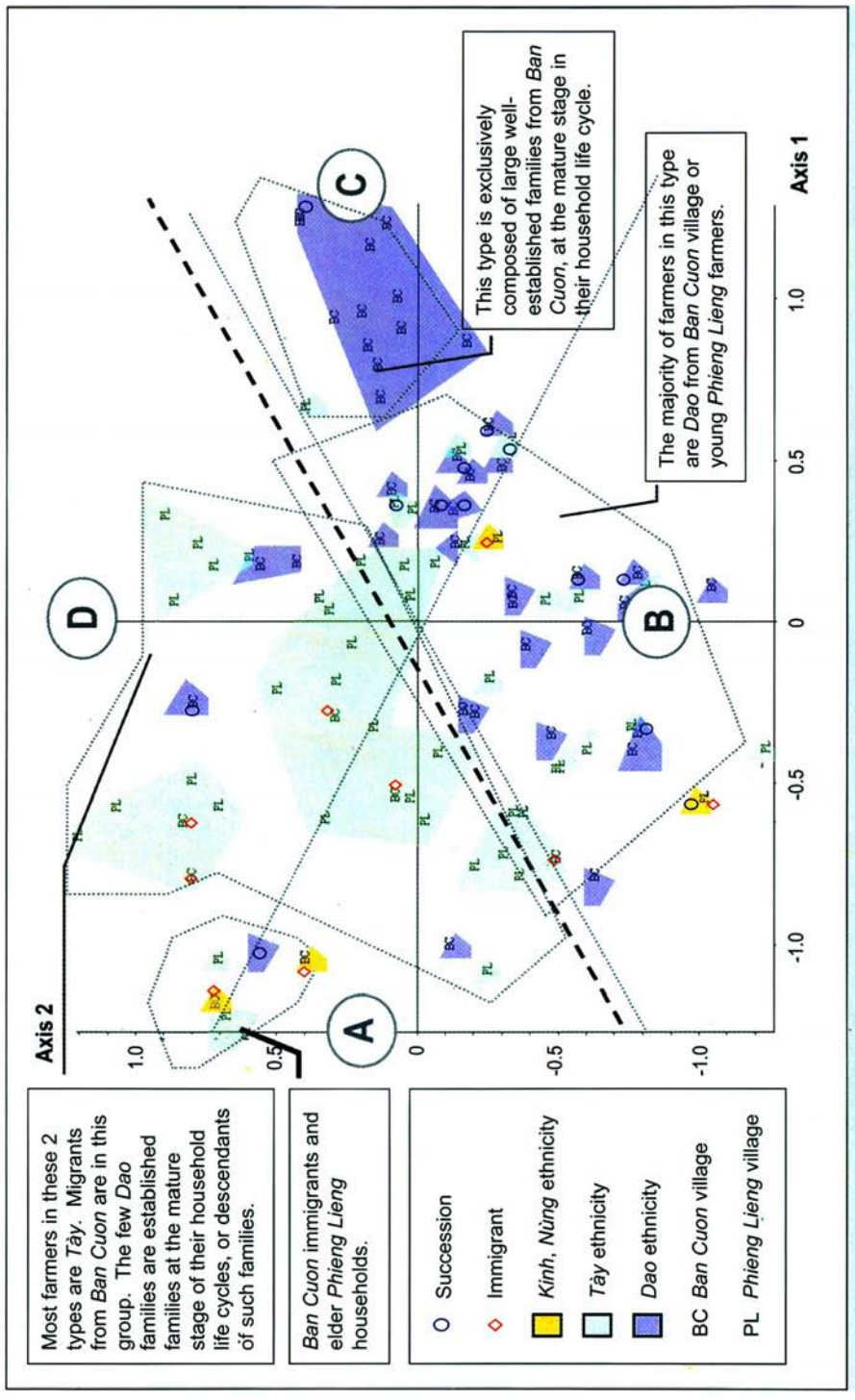

Figure 6: *Characterization of household types according to socio-economic characteristics*

and *Dao* who set up their farm after the end of the land reforms, and have had limited access to paddy fields. The high population pressure and scarcity of paddylands have diminished the ethnic differentiation among households that depend on animal husbandry and hillside crops to make up for a lack of lowland ricefields.

Mechanization and livestock diversification

The households with the fewest ricefields have the most diversified livestock systems (types B and C), as their inability to meet subsistence requirements with lowland rice has pushed them to the hillsides. Their buffalo raising is specialized in breeds with high quality meat, regardless of draft power. Since its introduction in the commune, about three years ago, cow production is preferred, as cows do not destroy fences and have much more of a herd instinct, allowing for a more lax surveillance. Furthermore, cows reproduce more frequently than buffaloes (one calf per year), and the marketing channels for their meat are better developed (Helvetas, 2000).

Families with hand tractors are either *Dao* or *Tày* with substantial ricefield areas (exclusively type C). The purchase of a hand tractor is made possible by the sale of buffaloes, or by off-fan-n income such as soldiers' pensions or cadres' salaries. Families with hand tractors are usually close to having their draft needs covered by the household herd, as they tend to own more than three buffaloes each. This shows that the ownership of a hand tractor does not preclude buffalo raising - the two activities are complementary. Buffaloes are a form of security in case a hand tractor should break down, and can also be loaned or sold at a profit. However, if the current conflicts due to crop-livestock interactions should persist, we may see hand tractors begin to replace buffaloes in households with this option, increasing social differentiation levels.

High herd export rates can be explained by three elements of the household situation:

- Availability of mechanization (hand tractors, motorcycles, mills);
- The need for capital for purchasing ricefields, repaying loans, or meeting social requirements (marriage, schooling, etc.); and
- Abandoning livestock raising for various reasons (theft, natural resources degradation leading to high winter mortality, farm succession, etc.).

An examination of structural and historical herd characteristics (input-output balances from sales, mortality, etc.) allows us to further subdivide the household types defined above into ten distinct subtypes (Figure 7, Table 3).

Surveillance practices based on ethnicity and circumstance

In *Ban Cuon*, the presence of crops in the collective pasture areas makes close surveillance and nightly stabling veritable necessities. For families that have been

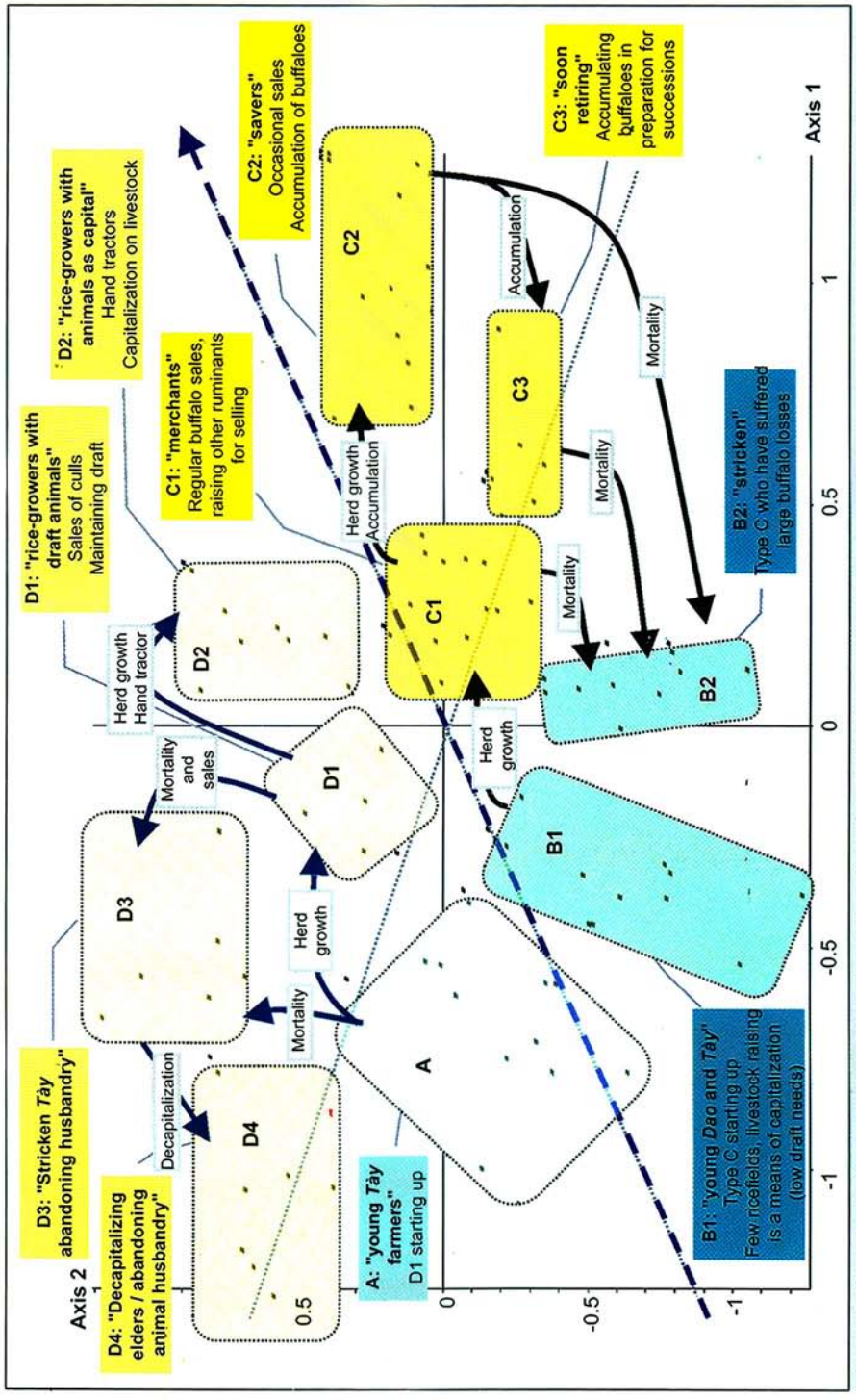

Figure 7: *Characterization and recent evolution trajectories of crop-livestock households*

raising livestock for more than l0 years, surveillance is daily (Figure 8), due to their increased experience and greater importance of livestock as an income generation source.

In *Phieng Lieng*, upland crops are mostly in areas that are not accessible to animals and are rarely located in collective pastures, permitting a lax surveillance of livestock. There are only two categories of *Tày* families that watch over their livestock very closely: (1) those who have been victims of high animal mortality; and (2) elder families, which distribute many of their animals to their children settling new households. Such families are motivated to monitor their livestock closely (mostly to guard against theft) because of the relative importance of the few remaining buffaloes they possess. In both villages, older families (i.e., household head over 40 years old, with eldest children starting to found their own households) tend to watch over their animals more closely than younger families. Here again, this is likely because of a greater availability of labor force, but also in part because of their longer experience with animal husbandry practices.

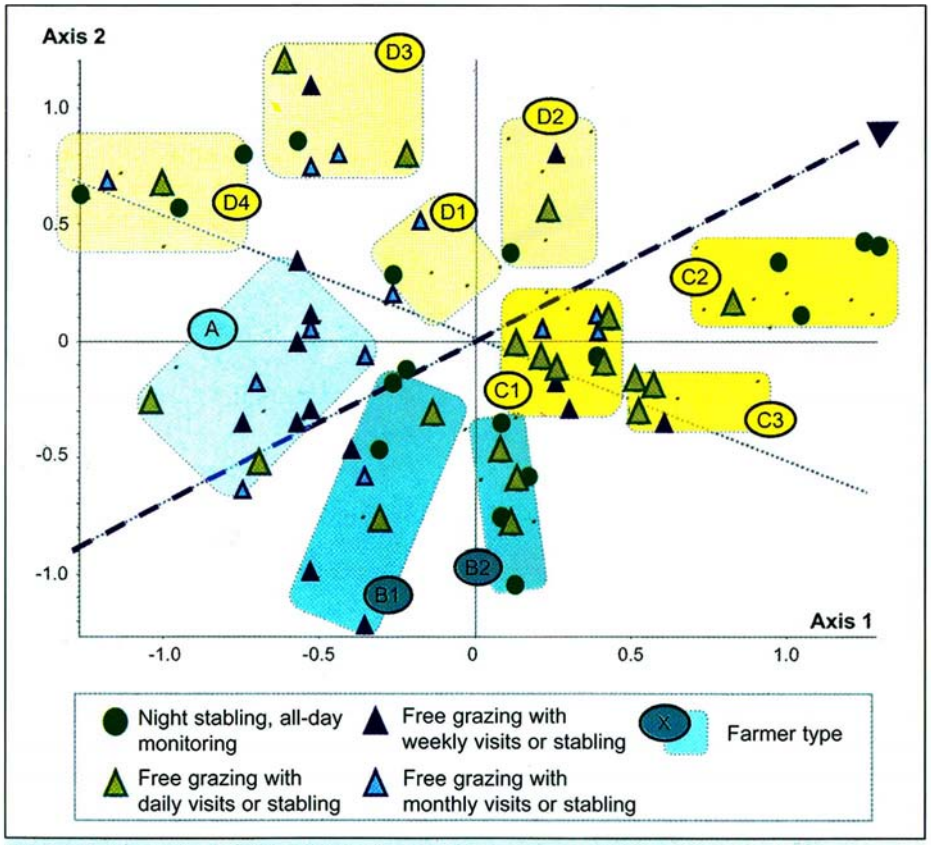

Figure 8: *Livestock surveillance techniques of various household types and sub-types.*

4.3. Recent trajectories of household evolution

About 10 years into the differentiation process initiated by paddyland allocation and livestock distribution, the household types and observed trajectories are similar to the one that have been documented by Castella and Erout (2002) in other case studies in *Bac Kan* Province (i.e.,driven by farmers' access to paddyland, and within each household type, according to the stage in the family life cycle).

Trajectories for descendants of families who founded *Phieng Lieng*

Type A is largely homogeneous. These young *Tày* farmers are just starting out in their livestock production, are well endowed in terms of irrigated ricefields, and have inherited one or two buffaloes from their families. Their large capital endowment is the result of the privileged position of their families, who were among the founders of *Phieng Lieng* (Castella et al., 2002). Since starting up their animal husbandry practices, they have neither sold animals nor faced animal deaths. Their buffaloes allow them to integrate themselves into mutual aid networks associated with ricefield work.

Type D evolved naturally from Type A (Figure 7). Four different sub-types of farmers can be found within Type D. They represent various stages in the evolutionary trajectories of *Tày* farmers, most of whom live in *Phieng Lieng* village: Type D1 farmers are lowland rice growers who raise buffaloes for their draft power. They plan to increase the size of their herds until their draft needs are covered, including contributions from mutual aid. Their strategy is a balance between maintaining a minimal herd and generating additional income from animal husbandry.

Type D2 consists of *Tày* families with higher numbers of buffaloes who have decided to turn to mechanization to provide traction for their ricefields, either by purchasing or by renting hand tractors. Livestock in this system is for capital and savings. Livestock sales are regular and often involve multiple animals. These are the most prosperous households in both villages.

Types D3 and D4 are households whose herds have decreased considerably in size in recent years. Type D3 is made up of middle-aged farmers whose herds have been stricken by high mortality. Their draft needs are high (shortages range from two to seven buffaloes per household), but past losses have discouraged them from trying to increase the size of their herds. They may also have sold a number of animals, and now keep only two or three buffaloes. Some rent hand tractors for ricefield work, but most households in this type meet their needs with the help of labor exchanges based on mutual help. Their remaining buffaloes let them participate in mutual aid networks.

Type D4 families are nearing the mature stage of their household life cycle and are in the process of distributing most of their capital among their children. They have a minimal labor force to occupy and their children have already set up their own

farms or are in the process of doing so. Livestock numbers are decreasing either because of gifts to children or sales. The animals that remain are for financial security.

Trajectories for other families

Type C1 consists of middle-aged farmers who have developed their livestock herds to make up for insufficient ricefields. Their draft needs are covered and their goals are market-oriented. Some raise cows and goats in addition to buffaloes. Type C2 is made up of older households with larger herds. They regularly sell culls, and their livestock represent accumulated capital. Type C3 households are also older but they do not have a history of selling their animals; instead, they are accumulating livestock and preparing to pass it on to their children. As these households do not have large ricefields, the buffaloes will be the major part of their children's inheritance.

Types B 1 and B2 have very small herds. Type B1 is made up of farmers who are just starting up livestock production. With minimal access to ricefields, their most likely trajectory is toward type C1. Type B2 households were initially type C2 or C3 farmers who then suffered high rates of animal mortality, and therefore have not sold any livestock in the last five years. These were well-established families who lost animals to chance occurrences (disease, losses in the forest, deaths of calves, etc.).

5. Discussion: developing sustainable livestock feeding systems

5.1. Improving crop-livestock interactions

Given the increasing land scarcity and shortage of natural fodder, the priority for animal husbandry systems in the region is to find ways to feed livestock through the entire year by developping integrated food-feed cropping systems. Responding to this need must take precedence over any efforts to improve the performance (meat and labor production and reproduction rates) of livestock raising systems in the area. However, because of the diversity of households' strategies, the best option for meeting this need is different for each of the ten household types.

There is a pressing need to find alternatives to free grazing for large ruminants. New approaches need to allow for the maintenance or growth of household herds without damaging the natural resource base, in a way that complements the extensive hillside agriculture already present in the system, in the future, farmers should be able to create livestock feeding systems from a series of components that make use of local resources in a timely and labor-efficient fashion. The components of such systems could incorporate the following concepts:

Integrating forage production into innovative rotational cropping systems

Within the studied area, techniques are already being researched in the framework of the SAM Program to implement cropping systems that make use of improved fallow management. The idea is to develop a rotational cropping system that incorporates two to four years of forage production. This portion of the rotation would serve both to produce feed for animals and to improve soil fertility via improved, permanently-covered fallow. Trials currently are underway with certain cover and fodder crops that improve soil structure (grasses such as *Braccharia* and *Pennisetum*, forage legumes such as *Stylosanthes*, etc.). However, fences are needed both to protect fields from overgrazing and to ensure sustainable rates of fertility extraction. Given the high labor inputs for annual repair of traditional fences (bamboo and wood), and the high cost of alternative materials such as barbed wire, hedges seem to offer the best fencing option. SAM Program is conducting trials in the two studied villages with multiple-function living fences composed of combinations of complementary species: fodder trees (e.g., *Glyciridia* spp.), fertility-restoring plants(e.g., *Acacia* spp.), and thorny hedges. In addition to feeding animals and protecting cultivated fields, these fences can also provide green manure by pruning, which can be incorporated to help restore soil fertility of the whole field. Here, the challenge is to balance fertility flows at the plot level, by giving back fertility exported through nutrient uptake by plants (and then through plant consumption by animals). Another way to achieve a fertility balance is to return manure from buffaloes to the corresponding fodder-providing field, but suitable modalities (secondary cowshed dose to the plot, controlled direct grazing, etc.) still need to be tested in the particular circumstances of *Cho Don* farmers.

Supplementary forage production outside of agricultural fields, in rotating improved pasturelands

This technique involves growing hedges as well as intensifying and maintaining meadows as part of a rotating forage cutting system. However, the implementation of this system would be costly (transportation of feed across long distances, high labor investment, required pasture surveillance, cost of chemical inputs). The system would be most feasible if the costs were shared by the village community as a whole on collective lands, and even more so if it could be supported by commune and district authorities (e.g., through land-use authorization and/or economic subsidy). In addition to its technical requirements, the implementation of improved public pastures would require an effective collective management of the system by the village community. Again, returning manure to the pasturelands would help substantially in maintaining soil fertility levels.

The introduction of a cold-resistant crop in ricefields in the Fall

Such a crop could help to provide for livestock during the most difficult period of the year. Barley, oats, and wheat all have shown promising results in trial plots. For example, oat plots in *Bac Kan* yielded 2 kg/m^2 of vegetative-stage fodder in January (under an average monthly temperature of 14^{o}C). These crops not only could provide an additional source of income for farmers, but also could enrich the soil if part of the biomass was left in the field as a mulch into which the next crop would be directly sown. As with the innovations described above, returning manure to the system is an important way to counter nutrient loss from crop uptake. Winter fodder production could be particularly effective in the case of poorly-irrigated fields that are only suitable for one rice crop per year.

Efficient use of crop residues through improved silage

For several years, *Bac Kan* farmers have been countering fodder shortages by storing rice straw to distribute it to animals during the winter. Researchers can contribute to the further improvement of this practice by offering adaptive techniques, such as treating rice straw with urea. This treatment consists in cutting the straw into 15-20 can lengths, moistening it with a 3-4% urea solution, and storing it for 1-1.5 months in anaerobic conditions (e.g., in plastic bags or in boxes made of bamboo plait and banana leaves that are buried in the soil). This technique, commonly practiced in other regions of Southeast Asia, has not yet spread widely in the study area because of the lack of local materials mid poor farmers' knowledge on this technique. It increases the straw digestibility and nutritional qualities while preserving it against damage from rats, insects, and fungi.

In summary, there are at least four components that farmers could incorporate to Create sustainable livestock feeding systems: (1) feed-food crop rotations, (2) improved management of common pastures, (3) cold-resistant winter fodder crops, and (4) improved silage techniques. In deciding how to integrate these components into livestock feeding systems, it is important to consider both specific household types and the needs of the community as a whole. Households who maintain minimum herd sizes to meet their draft needs (e.g., types A, D1 and D4) probably will not participate as actively in community-based livestock management schemes as households whose income relies on the sale of a larger number of livestock (types D2 and C1). Regardless of household type, the implementation of any of the above systems would require substantial labor input, particularly during the first year of fodder species establishment, and may also require chemical inputs. These input requirements conflict with already-existing crop production practices - farmers will need to make cost-effective decisions regarding how to allocate their labor force.

New livestock systems will require a major shift in the perspectives of farmers toward the labor requirements of animal husbandry. Animals currently free-graze and feed upon natural resources; neither the animals nor the resource base requires

substantial interventions on the part of farmers. Farmers' prioritiesare in the ricefields, and as such, it is the ricefields that receive most of their attention, and also the bulk of animal manure. Meanwhile, commercial mineral fertilizersare too expensive for most farmers; only the descendants of *Tày* founding families have sufficient capital in the form of ricefields, plantations, and cattle to invest in expensive commercial fertilizers (Castella et al., 2002). The transportation of animal manure to the hillsides remains a very real problem that was quickly identified in a trial effort to feed cows with a *Braccharia* cover crop. Part of the problem is that most of the laborers engaged in livestock management are children and the very elderly. In contrast, the transportation of manure and *Braccharia* are tasks that an adult must perform.

The challenge remains to develop a feeding system that is not overly labor-intensive. Part of the solution may be to improve the spatial management of forage resources that shift between pasturelands and forests during the course of the year. Feeding could be simplified through the effective use of stables and improved meadows, forage crops integrated with food crops, and on-the-spot feeding (with a moving corral or animals tethered to stakes, in appropriate fields). To implement any of the above combinations, changes in the spatial organization of livestock management could be beneficial. An on-the-spot feeding system would minimize labor requirements during peak labor periods and make possible fertility transfers that are presently limited by transportation difficulties, benefiting both the crops and the livestock that feed upon them. Keeping animals in stables makes it possible to care for them better during the most critical winter period, and better care during the winter will result in more efficient animal traction in the ricefields. Finally, combining several of the innovations listed above can give grazing lands (i.e. both pastures and forests) a period to regenerate, reducing the pressure of livestock on the natural landscape and thereby benefiting the community as well as the individual farmer.

5.2. The role of research and extension

To implement the above systems, farmers will need to be assisted by research and extension experts. Currently, peak labor periods are already fully occupying farmer labor when livestock is left to roam freely. Thus, the proposed livestock practices will not only require a switching of labor from current practices but also a local validation of research findings, and an education of farmers in the following areas:

- Forage crops that can resist winter conditions;
- Most efficient production levels of forage crops, as well as their values as fodder or as green manure to improve soil fertility;
- Optimal fertilizer amounts for a balance between satisfactory production and minimal input cost;

- Quantification and assessment of the management modalities of available forage resources (cutting, on-the-spot consumption, rotation, quantities, etc.);
- Animal needs (identified through feeding trials that include examination of animal growth and health);
- Methods for fodder quality improvement through cutting, drying, and silage treatment, with minimal chemical input costs.

The issues associated with fertility transfer require further research, given their Importance to sustainable interactions between crop production and animal husbandry. Research is needed in improving both the quality of the manure itself, and the management of the manure. Higher quality manure leads to better fertilization and thus to higher-quality forage crops, resulting again in higher quality manure - a positive feedback loop. Some *Bac Kan* farmers already are treating cowpats by composting, first adding vegetable scraps and later urea. However, composting practices remain rudimentary. For example, trenches for composting are covered only with palm leaves, allowing rainwater to percolate. Alternatively, manure can be enriched by covering stable floors with rice straw, which immediately mixes with animal wastes.

In addition to enriching the manure, the constraints to manure management, particularly to economical transport, remain to be addressed. To spread 800 kg of manure across a 1000 m^2 field, laborers must make approximately 20 round trips between the stable and the field, which indicates the need to streamline the fertility transfer process.

Researchers also need to continue to devote themselves to experimentation within the farmers' environment. Farmers'-field experimentation is an effective way to remain aware of the constraints faced by farmers and to develop customized feeding systems in consultation with the farmers who will use them. Finally, experience has shown that the adoption rate of technical innovations is highest when farmers have access to training (Hoang Lan Anh et al., 2002). Technical innovations practiced in isolation risk losing their effectiveness because of low adoption rates. It is thus very important to institutionalize within the Government extension system the effective innovations that will develop from research or development activities.

6. Conclusions

The raising of large ruminants in the mountains of northern *Viet Nam* is an important, even vital activity for most farming families, whatever their ethnic origin. Extensive cow-buffalo raising systems can offer draft power, capital, and meat to farmers, but are currently in crisis and need to evolve if they are to survive. Up to now, neither the livestock systems nor the imminent system crises have been analyzed or documented. Solutions to problems of crop-livestock interactions in

this region need to begin with a solid understanding of the multi-faceted livelihood strategies of the farmers involved.

Households with only a few draft animals can use rice-harvest residues and winter crops to feed livestock in winter, providing the energy that will be needed for spring labor. The rest of the year, animals could feed on forests and natural meadows. For households with greater means who are more reliant on livestock raising, it would be worth considering investments in forage-crop production either in the form of crop-forage rotations on cultivated fields or improved pastures. These alternatives need to be effectively organized both spatially to minimize labor requirements, and temporally to avoid conflicts with labor peaks and to ensure that the needs of livestock are met during the most crucial periods of the year. Identifying the most effective arrangement of resources in space and time necessitates the use of the tools of participatory diagnosis, communication, and adaptive decision-making (Castella et al., 2002a). Hopefully, new livestock-feeding practices could be organized in the frame of innovative food-feed cropping systems whose components (see section 5.1) are spatially and temporally combined in accord with the characteristics of the different farm households. This would resulting better animal performance, making such feeding practices a worthwhile investment for farmers.

This characterization of livestock systems and farmer situations makes it possible to orient research or development activities based on a thorough understanding of household strategies and crop-livestock interactions. Cultivated fields producing forage crops can constitute an initial stage in a stepwise process of food - feed systems integration. It could be complemented by subsequent innovations such as fertility management and improved labor efficiency. The development and intensification of sustainable animal husbandry practices through food-feed cropping systems integration has the potential both to increase agricultural production and to improve the living standards of mountain people.

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Contesting policies: Rural development versus biodiversity conservation in the *Ba Be* National Park area, *Viet Nam*

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Abstract

During the last few decades, the mountain environment of northern *Viet Nam* ha been undergoing tremendous land cover changes due to expanding agricultural activities. Loss of forest cover and resultant threats to biodiversity hotspots have caused increasing national and international concern. Environmental policies and programs have been launched to counteract the degradation processes and to assist the mountain populations to intensify and diversify their livelihood systems. However, both environmental and agricultural policies get re-interpreted and modified by local actors. In other words, their objectives and implementation are locally contested. This chapter adopts an historical perspective to analyze the rural development and biodiversity conservation policies implemented in the *Ba Be* National Park area of *Bac Kan* Province from the 1970s to the late 1990s. It makes use of land-use maps and interprets land-use changes in the light of changing policies. The research reveals the conflicting objectives of early conservation versus development policies, as well as present-day conflicts between biodiversity conservation and rural development. The research findings indicate that the past and current policy and institutional frameworks have not generated the intended results in environmental protection, which has been outweighed by the effects of agricultural development in the region. Flexible policy frameworks are needed for ecologically- and ethnically-diverse mountain regions, and programs for conserving biodiversity need to adopt a more participatory approach.

Keywords: land use changes, upland agricultural, policy process, conservation, rural development, *Viet Nam*

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1. Introduction

1.1. Environmental changes in Viet Nam's mountains

For many centuries, mountain agriculture and environment have modified each other in a two-way adaptation process. People have adapted their livelihood systems to the mountain conditions, and the environment has been manipulated to suit people's changing food demands. For hundreds of years, a great number of ethnic groups have inhabited the northern mountain region of *Viet Nam*, basing their subsistence on both sedentary and nomadic agriculture. Traditionally, the *Thài*, *Nùng*, and *Tày* ethnic groups have lived in the valley bottoms, where they have cultivated paddy rice and maize. In contrast, *Dao*, *H'mong*, and *San Diu* have populated the hills, largely relying on the forest resources for shifting cultivation. It cannot be assumed that the ethnic groups of northern *Viet Nam* have always lived in balance with the mountain environment, However, in former times they at least were able to extract resources at a rate that met their sustenance needs, thanks to low population density, a vast resource endowment, and little interaction with wider economic and political structures. Environmental protection mechanisms, such as sacred forests and belief in supernatural control (geomancy) (McKinnon, 1997; Pham Quang Hoan, 1999; Corlin, 2001) have shaped human agricultural activity, helping slow the intensity and rates of resource use. In addition, the biophysical factors of the mountain environment also have influenced the pace and patterns of resource use (Jodha, 1997).

Today, the context in which the "traditional" practices of these ethnic groups worked well no longer exists. The population has grown; market forces and the exchange with lowlands have been strengthened; and the State has pursued a number of political, economic and development interventions. All of these factors have altered mountain agriculture and put pressure on the natural resource base. The expansion of agricultural fields to ever-higher altitudes and steeper slopes, and the extraction of valuable forest products, have reduced the forest cover and threaten the biodiversity pools. During *Viet Nam*'s ongoing period of economic reforms, the exploitation of the ecologically fragile mountain environment has been intensified and has reached unsustainable dimensions (Rambo, 1995 and 1997; Romm and Dang Thi Sy, 1996).

Many authors associate the current state of the mountain environment with resource degradation and crisis (Donovan, 1997). They use terms such as "vicious circles" and "downward spirals" to describe the problematic link between poverty and environmental degradation in the northern mountain areas (Jamieson et al., 1998).Therefore, in recent years the *Viet Nam* government and international development organizations have launched a number of programs to reduce poverty while protecting the environment in the northern mountain areas. In particular, these programs address the direct and ecologically-crucial link between

agriculture and the remaining natural resources. In *Ba Be* District of *Bac Kan* Province, as in most other parts of the northern mountain region, the intensification of agricultural production has been prioritized since the early 1980s. However, giving priority to agriculture has endangered *Ba Be* National Park, rich in both biodiversity and cultural relics. In response, international organizations and donor agencies have stressed that current patterns of use and management in the natural resource sector are a threat to *Viet Nam's* continued economic viability (IUCN, 1999; United Nations in Viet Nam, 1999). Today, *Viet Nam* is under increasing internal and external pressure to enhance the effectiveness of its natural resource sector; environmental accountability has become a new priority. Unfortunately, however, the local people's role in the policy process has often been neglected.

In this chapter, we focus on the programs concerning environment and development in the northern mountain areas. We present the outcomes of policies for rural development and biodiversity conservation, and interpret those outcomes as the result both of local responses and of power relations among diverse actors. We show that if the livelihood struggle of mountain communities is neglected when designing and implementing policy, then environmental policies will fail to produce their intended effect.

1.2. Focus and approach

This study examines the agricultural intensification and the biodiversity conservation policies as implemented in *Ba Be* District between 1970 and 2000. It attempts to uncover the inherent tensions and sectoral conflicts between production and protection. The objective of the study is to understand the present agricultural and environmental situation in the *Ba Be* National Park area and to identify the major local concerns that challenge agricultural and environmental policy in *Ba Be* District today.

The study asks three broad questions:

- How do policies concerning agricultural intensification and biodiversity conservation get established and implemented?
- How have mountain agriculture and mountain environment changed during *Viet Nam's* reform era (1986 to present)?
- What are the local responses to, and outcomes of, agricultural and environmental policies?

The study is framed by concepts such as the policy process and the social organization of natural resource management. Methodologically, it draws on data from diverse sources, such as official statistics; land cover maps; policy documents; monographs about individual communes; and qualitative data collected in interviews, oral histories, and stakeholder-participatory observation. Section Two provides details about how the concepts and diverse sources of data

were used. Section Three analyzes the main agricultural and environmental changes within the *Ba Be* National Park area during the last twenty years. Furthermore, it examine show local communities respond to policy change. Section Four discusses policies that had considerable impact on agricultural production and the state of the environment in *Ba Be*, and also draws general conclusions at the local and provincial scale. Lastly, Section Five considers a broader scale, identifying the major challenges for development and conservation in the mountain region of northern *Viet Nam* and providing a general perspective on research and development.

2. Theoretical background and methodology

2.1. Policy interventions

The act of defining problems such as environmental degradation and deforestation, and of designing policy interventions to address them, is a socially and politically complex process (Thompson and Warburton, 1985; Keeley and Scoones, 1999; Blaikie and Sadeque, 2000). Nonetheless, many policy-makers incorrectly assume that the policy process follows a linear succession of problem definition, agenda-setting, decision-making, and implementation (Thomas and Grindle,1990). Indeed, the political practice in *Viet Nam* seems to be shaped by this view. Following investigations of existing problems, usually conducted by the Communist Party, the political leadership in *Ha Noi* sets the policy agenda and designs policies according to specific, sometimes incomplete problem definitions. Subsequently, policies are implemented by government agencies at various levels of the state hierarchy.

There is much evidence to suggest that the model of a linear policy process is far from reality (Sutton, 1999). Alternative views on the policy process draw attention to competing policy interests, groupings and networks of policy actors that influence the policy process by sharing different interests and views of the world (Lindblom, 1980; Apthorpe and Gasper, 1996; Tait and Campbell, 2000). Many aspects of the policy contents get re-interpreted according to the local understanding or interests. Government officials and people's representatives negotiate the policies' feasibility and the implementation strategies. Local systems of knowledge provide frames of reference within which people act in their daily lives. They shape the way that social actors influence the world around them (Hajer, 1995; Keeley and Scoones, 2000).

In *Viet Nam*, central policies therefore frequently get tailored to the local context. Although in *Viet Nam* political power is concentrated in the hands of the Party leadership, policy spaces for local actors have always existed (Dang Phong and Beresford,1998). This might not give local actors policy-making power, but

certainly gives them influence in the implementation of policy. These local policy actors are low-level cadres and local leaders such as secretaries of the Party Cell, Chairmen of the People's Committee, or village heads. They function as the mediators between the public and the State. Thus, their capabilities and attitudes are decisive in determining how policy will be implemented, and how central policies will be tailored to the local context. An historical example is the collectivization policy, which was unevenly and diversely implemented throughout the country (Kerkvliet, 1995; 1999). Even in a centrally-managed country such as *Viet Nam*, policy making and implementation tend to be diverse, diffuse, and complicated activities, where sometimes competing, sometimes overlapping policy positions are advocated by a range of stakeholder groupings including Party leaders, government officials, scientists, administrators, international agency personnel, and rural people.

In this article, we argue that the dynamics of environmental change clearly show the multi-faceted nature of environmental and agricultural policy development and implementation. We conducted a historical analysis of landscape changes and in-depth research on the social and institutional dynamics that structure access to and use of resources (Leach and Means, 1996; Leach et al., 1999). In *Viet Nam*, institutional and policy changes during the cooperative era (1954-1986) and subsequent economic transitions were key causes of land cover changes in mountain environments. Policies such as collectivization, resettlement-sedentarization of ethnic groups, and the economic reforms of the 1980s altered the macro-level structures in which mountain agriculture unfolds today.

2.2. Sources of data

The research reported here results from a partnership among a number of research and development projects having converging interests in improving farmers' livelihood systems while preserving the natural resource base in the *Ba Be* National Park area. As shown in Box 1, these projects pursued different objectives; involved different disciplines (e.g. agronomy, geography, sociology, forestry, conservation and agricultural extension); used different approaches and methods; and had different mandates and agendas. We developed an original collective research process to ensure that each partner could contribute its own materials and knowledge and that the results would be useful for all partners. The participating projects contributed both quantitative and qualitative data to this study. The main sources of information used were:

Land cover maps derived from 1983, 1989, and 1998 aerial photographs. The maps had been developed by various projects according to their own needs, which led to a diversity of scales and legends. It wag thus necessary to rationalize and standardize these maps to make sure they would be comparable, and to generate two land-use-change maps, one each for the periods 1983-89 and 1989-98.

Box 1: *Projects, institutions, and individuals involved in the collaborative research*

The PARC (Protected Area and Resource Conservation) project is a UNDP-funded project on biodiversity conservation. Its two main objectives are (1) "to improve operations capacity in order to efficiently and sustainably manage and maintain the protected areas" and (2) "to reduce external threats to biodiversity through integrating conservation and development objectives and activities at the local level". It has contracted VTGeo to implement a remote-sensing, GIS-based tool for environmental characterization and monitoring of the National Park area.

The Vietnam-Finland Forestry Support Program aims at contributing to sustainable rural development in the mountainous regions of *Viet Nam*, through the integration of forestry activities into rural land-use and economic planning. It is a bilateral development project under the Department of Agriculture and Rural Development of *Bac Kan* Province.

The NTFP ("Sustainable utilization of non-timber forest products") project, a biodiversity conservation and economic development project, was established in 1998 with technical support from IUCN (International Union for the Conservation of Nature). It operates in *Bac Kan* Province and involves the Non-Timber Forest Products Research Center of the Vietnam Forest Science Institute, Ministry of Agriculture and Rural Development (MARD), and the Institute of Ecological Economics (Eco-Eco).

Helvetas (Swiss Association for International Cooperation) has carried out a grassroots-level development project on "Empowering local people for managing natural resources in *Ba Be*, Bac Kan Province, *Viet Nam*". Helvetas supports local households through the agricultural extension services.

Claudia Zingerli is doing a Ph.D. thesis on policy-making and institutional changes in the natural resource sector in *Viet Nam's* uplands. She is a researcher in the School of Development Studies, University of East Anglia in Great Britain and conducted her field work under the umbrella of the Helvetas program.

SAM (French acronym for Mountain Agrarian Systems) Program is a joint research program of the Vietnam Agricultural Science Institute (VASI, *Viet Nam*); Institut de Recherche pour le Développement (IRD, France); Centre de Coopération Internationale en Recherche Agronomique pour le Developpement (CIRAD, France); and the International Rice Research Institute (IRRI, Philippines). It started in 1997 with the main objectives of improving (i) Agricultural productivity (ii) natural resources management, and (iii) living standards of highlands ethnic minority groups.

Statistical data collected from the district's agricultural and statistical services. Long-term data series related to land use and agriculture (areas of main crops, yield and production, number of livestock, etc.) for four communes of the National Park area and for the entire district of *Ba Be* were collected and compiled into a database. Although this kind of data is inherently uncertain (due to possible errors in collection, calculation, and manipulation), in long-term series it nonetheless is reliable for identifying historical trends.

Official policy documents (e.g. laws, decrees) and interviews with local authorities and policy makers. We studied many edicts issued in the environmental and agricultural sector, particularly those related to forestry and conservation, and discussed them in the locality. These include the statutes concerning forest development and protection (National Assembly of the Socialist Republic of *Viet Nam*, 1991), biodiversity conservation, and forest land allocation

(Government of the Socialist Republic of *Viet Nam*, 1995; 1999; 2001; General Cadastral Department, 1997).

Monographic studies conducted in Bac Kan Province from 1999 to 2001 (Sadoulet et al., 2002; Castella et al., 2002b; Fatoux et al., 2002). The SAM Program carried out on-farm surveys in a set of communes representative of *Bac Kan* Province's agro-ecological diversity and selected across a gradient of integration into the market. Land use changes from 1950 to 2000 were analyzed based on aerial photographs interpreted and discussed with local informants. Subsequently, farmers' livelihood strategies were investigated in terms of their diversity and especially how they emerged in response to the policy changes that occurred over the past decades. The combination of landscape analysis and farming-systems surveys led to a better understanding of the main forces driving land use changes at the local level (i.e. household or village) and at the regional level (i.e. district or province) (Castella et al., 1999).

A study on the social organization of natural resource use, conducted in three villages of the Ba Be National Park area. This study examined institutional arrangements governing access to and control over forestland and forest resources, and the process of negotiating and adapting national policies in a local development context. Qualitative data was collected in interviews, oral histories, and stakeholder-participatory observation.

2.3. The research process

The quantitative data provided by the participating projects were standardized and compiled into a database. We generated preliminary maps and graphs from this database to quantify land-use changes in *Ba Be* National Park area over the past decades. On 16 May 2001, these preliminary results were presented to a panel of local informants. Village heads, People's Committee chairmen, and agroforestry officers from four communes in the southern part of *Ba Be* National Park area, as well as field officers of the National Park and of the participating projects, attended this meeting. They commented on the statistics and the maps and provided explanations and/or hypotheses about the driving forces behind the observed land-use changes. The participants expressed different views through lively discussions and reached some consensus in explaining major trends in land-use changes. This meeting provided us with many elements of validation of our preliminary hypotheses, as well as recommendations on how to improve our analysis (e.g. minor corrections on the land-use maps, data entry to check on the statistical database). Then, we analyzed our collective results in the light of empirical research studies conducted in the *Ba Be* National Park area by Zingerli (2001) and in other parts of *Bac Kan* Province by SAM Program (Castella et al., 2002a).

3. Production versus protection: policy challenges in the *Ba Be* National Park area

3.1. The natural environment of Ba Be National Park

Ba Be National Park was established as the eighth national park in *Viet Nam* in 1992 (Prime Minister of the Government of *Viet Nam*, 1993). It is located 256 km to the north of *Ha Noi* in *Ba Be* District of *Bac Kan* Province. *Ba Be* National Park consists of 7610ha and includes the famous lake *Ba Be*, which is located in a karstic depression and surrounded by rugged limestone mountains (Figure1). A dense forest covers the core zone of the National Park, which occupies the entire area of *Nam Mau* Commune and parts of three surrounding communes (Figure 2). The National Park is a representative of the tropical evergreen broadleaf forest on limestone karst, and one of the few remaining habitats for two highly-endangered species of primates[1] and other rare and endangered mammals[2] (Hill et al., 1997). The narrow valleys in *Ba Be* National Park area are bordered with houses and cropped with irrigated rice. Agricultural area is very limited because of the steep slopes of the mountains that border the valleys. Several rivers drain the surrounding watersheds into the lake, and during the rainy season the rising lake level causes annual flooding of agricultural land.

The buffer zone of *Ba Be* National Park covers the entire area of the communes of *Cao Thuong*, *Cao Tri*, *Khang Ninh*, *Quang Khe*, *Hoang Tri* and *Dong Phuc*. As shown in Figure 2, the landscape on the rounded flagstone mountains of the buffer zone is very different from the core zone of the Park. Large watersheds of acid ferralitic soils drain into wide valleys cultivated with irrigated rice. Land use typically varies across the toposequence with ricefields in the valley floor, then houses surrounded by small gardens on the colluviums that make the first gentle slopes (Sadoulet et al., 2002). Rice terraces, usually located close to the streams, occupy the next tier up the watershed. Further up one finds terraced, rain-fed fields and gardens. Pastures are usually located on relatively flat areas in the upper part of the watersheds. The upper part also contains an extensive agricultural system forming a mosaic of upland fields (mainly maize and cassava, but also upland rice on land cleared from older forests) and fallows of various ages ranging from grass to shrub and open forest, with the proportion of timber species increasing with age. A dense forest usually covers the tops of the mountains.

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[1]Tonkin Snub-nosed Monkey (*Rhinopithecus avunculus*) and Francois Leaf Monkey (*Semnopithecus francoisi*).

[2]Lesser Slow Loris (Nycticebus pygmaeus),Owston's Banded Civet (*Hemigalus owstoni*), Sun Bear *(Ursus thibetanus*), Asiatic Black Bear (*Ursus malatyanus*), Asian Golden Cat (*Catopuma temminicki*), and Southern Serow (*Naemorhedus sumatraensis*).

Figure 1: *Three-dimensional block of the Ba Be National Park area displaying the main feature of the relief and land cover (created by wrapping a 1999 Landsat TM satellite image on the digital elevation model).*

N.B.: The red line delineates the core zone of the National Park. The yellow lines correspond to the commune boundaries, the names of which appear inside.

3.2. Local actors in policy implementation

Ba Be District is attracting growing national and international interest. Since 1997, a number of internationally funded development and environmental projects have been launched. The first projects of the Swiss non-governmental organization (NGO) Helvetas and of the Vietnam Finland Forestry Support Program focused on agricultural extension, forestry, and infrastructure development. Both projects were carried out together with the Agricultural and Rural Development Office (ARDO) of *Ba Be* District. At the end of 1999, the "Creating Protected Areas for Resource Conservation" project (PARC) was launched. PARC is funded by the Global Environmental Facility (GEF) and the United Nations Development Programme (UNDP), and is implemented by a private consultancy company in partnership with the Ministry of Agriculture and Rural Development (MARD). It assists the National Park management unit ill biodiversity conservation and sustainable natural resource management for the National Park area. Other projects in the district are the Non-Timber Forest Products (NTFP) project, funded by the International Union for the Conservation of Nature (IUCN); and the Mountain Program of the European Union (EU), which engages in reforestation and infrastructure development in the northern part of the district.

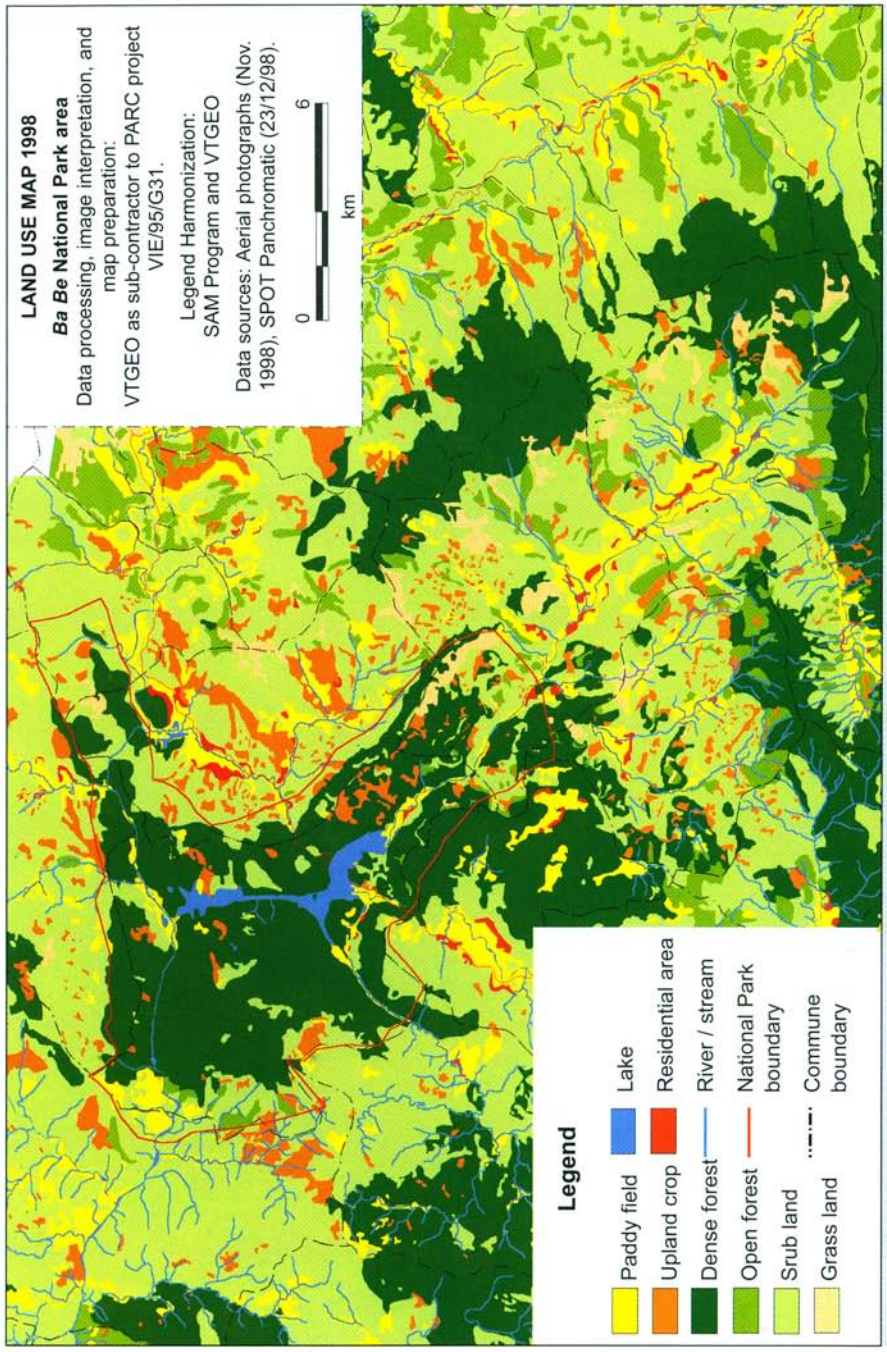


Figure 2: *Land use map of the Ba Be National Park area in 1998.*

A number of research activities were carried out by both Vietnamese and foreign scholars, mostly focusing on rural livelihoods in the *Ba Be* National Park area. In addition, the National Park is attracting a growing number of foreign and Vietnamese tourists. Ecotourism is one of the promising future industries for the remote mountain district of *Ba Be*.

All of these actors interact with the local residents as well as with district and commune authorities, who of course are the central policy actors around whom development in *Ba Be* District revolves. The local residents mostly belong to the ethnic groups of *Tày*, *Dao*. and *H'mong*. Their cultures and traditions, histories and livelihoods are different from those of the mostly urban and western 'outsiders' listed above. Local authorities and staff act as mediators between the local villages on the one hand, and central and provincial State authorities as well as national and international projects on file other hand.

In the face of increasing environmental pressure in the *Ba Be* National Park area, conservationists and State authorities have concluded that traditional local livelihoods and resource-use patterns are no longer sustainable. In response, they have developed several strategies that use diverse approaches and seek diverse objectives:

Agricultural intensification through irrigation infrastructure and crop varieties better adapted to mountain conditions, as well as the promotion of fruit tree planting and reforestation, is in line with the Green Revolution approach.

Land allocation and land use planning, including clear agro-ecological zoning and management plans for agriculture, forestry and conservation. This follows an approach of smallholder participation in environmental protection and livelihood security.

Resource conservation in the National Park, as promoted and practiced by the policy actor group allied with the National Park management board (i.e., PARC, MARD, GEF, and UNDP), reflects tendencies of 'green imperialism'. The resource conservation strategy places local people and their livelihood needs second to the preservation of a rare fauna and flora.

The diverse strategies of the different policy actors in the *Ba Be* National Park area therefore range from rural development objectives to strict-conservation. Ideally, a balance should be found among them, based on a consensus among all stakeholders involved in managing the *Ba Be* National Park area. However, there are sectoral conflicts between the policies that are extremely difficult to resolve. In the following section, we will summarize some recent examples of conflicting policy goals and management schemes in the study area.

3.3. A short history of rural development in Ba Be District

Between 1959 and 1989, agricultural production throughout the nation was largely organized in cooperatives (Castella et al., 2002b; Fatoux et al., 2002; Sadoulet et

al., 2002). However, after national reunification in 1975, the farmers' already-eroded enthusiasm for the cooperatives and very low agricultural productivity called for reforms. The Sixth Party Plenum, held in 1979, issued Resolution No.6, which represents the turning point in the agricultural sector of *Viet Nam*.

Resolution No. 6 facilitated the allocation of agricultural output. It also initiated the agricultural reform process, which some years later was formalized by Decree No. 100 (1981) and Resolution No. 10 (1988). Resolution No. 6 eliminated the paradox of underemployed 'farmers suffering poverty and hunger because of food shortages while large areas of cooperative land laid idle (Ngo Thi Meh, 1995). Prior to Resolution No. 6, individual work in upland fields was constrained by the rigid working-hour system of the working brigades. In *Ba Be* District, Resolution No. 6 increased availability of high-yield rice mad maize varieties, and more land was brought under cultivation. Land was contracted out to cooperative members, who were allowed to keep or sell any surplus above the declared output. These two factors (improved varieties and incentives for higher production) resulted in increased agricultural productivity and better food and income for the people.

A combination of lowland and upland cultivation is characteristic of *Tày* mountain agriculture. In contrast, *Dao* and *H'mong* traditionally have relied much more on forest resources. Therefore, families from all ethnic groups with labor to spare during the cooperative period were engaged in upland cultivation as a means of complementing the insufficient production shares received from the cooperative. But upland farmers were tapping a limited natural resource base, and by the end of the 1980s they had exploited and deforested all the area that was suitable for upland agriculture (Castella et al., 2002; Sadoulet et al., 2002).

Authorized by Resolution No.10 (1988), the allocation of paddy fields to individual households in 1990 was intended to stimulate renewed farmer investment in paddy fields, thereby reducing pressure on the hillsides. Indeed, rice production in *Ba Be* District increased by 30% between 1991 and 2000 (Figure 3). This increase was due to a combination of increased investment (more-efficiently-allocated chemical fertilizers, and use of manure); intensification (double-cropping with spring-season rice); and extensification. While the paddy land allocations were successful in stimulating increased production and investment in paddy fields, they were by no means a universal solution to high population pressure and land scarcity in the region. Land was largely claimed by the pre-cooperative-period owners and was returned to them. Most paddy land ended up in the hands of the *Tày*, leaving approximately 20% of farmers in *Ba Be* District in the beginning of the 1990s without paddy fields (Castella and Erout, 2002).

Paddy land offered productivity advantages over the hillsides, making possession of paddy lands the objective of farmers of all ethnic groups. But the scarcity of addy fieldsforced most *Dao* and *H'mong* farmers to continue the resource-intensive upland cultivation in the forested zones. In search of new land, a number

of *H'mong* households from other parts of the district migrated into the core zone of the National Park. Wherever possible, they now engage in paddy land cultivation, but nonetheless rely substantially on forest resources. These households are now under heavy pressure from the National Park management board to leave the area, but only a few of them have been relocated. The majority who remain find themselves within an increasingly-restrictive policy framework that prohibits clearing new fields for shifting cultivation. In Fact, upland cultivation is practiced by all households within the study area, *Tày*, *Dao* and *H'mong* alike, and

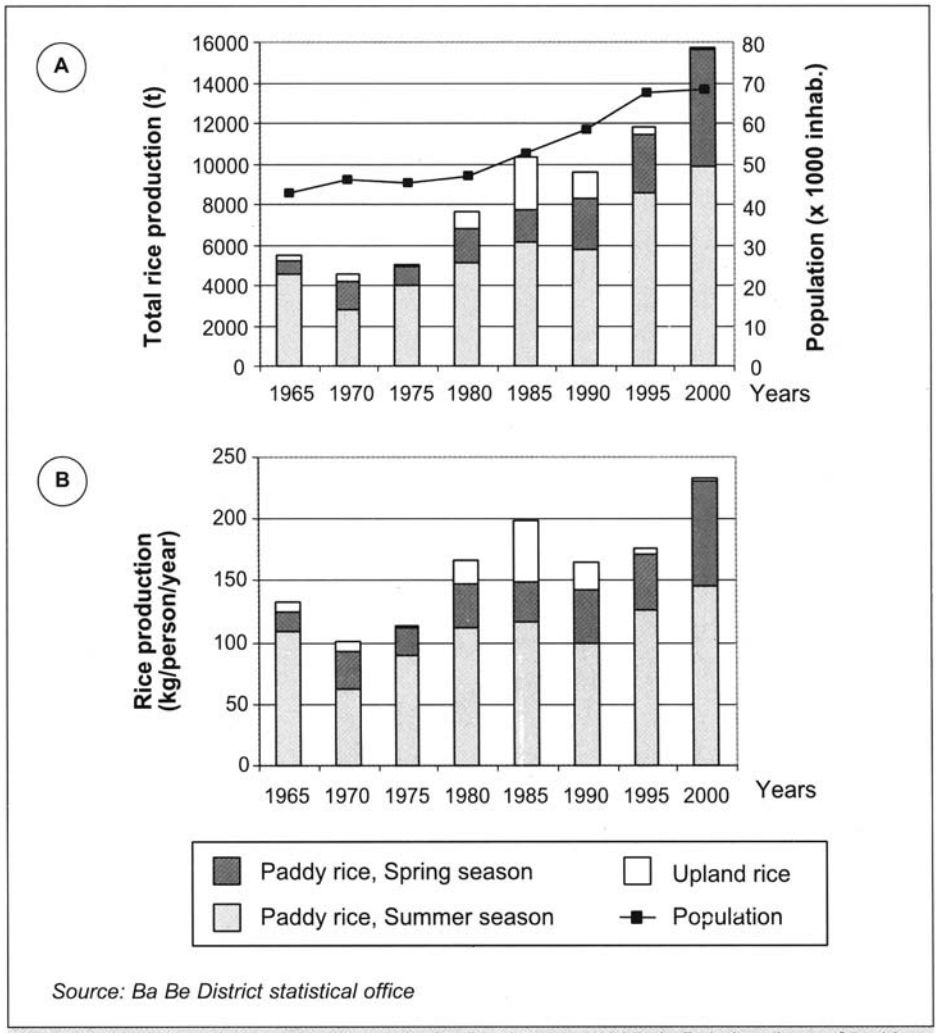


Figure 3: *Evolution of rice production in Ba Be District since 1965: A. Relative share of paddy rice (spring and summer seasons) and upland rice on the hillsides in meeting food needs of an increasing population; B. Per-capita rice production.*

is an integral part of their livelihood systems. Upland fields provide a safety net in times of floods or outbreaks of crop pests. Thus, policy analyses indicate that the allocation of lowland achieved the desired effects at the district level. However, at a smaller scale, the most impoverished and marginalized of farmers have lost their access to the lowlands, and now face an increasingly difficult situation (Castella et al., 2002).

Policy reforms also have taken place in the forestry sector, During the cooperative period, forestry policy largely had the objective of contributing to agricultural and industrial production by increasing the output of timber and non-timber forest products. Gilmour and Nguyen Van San (1999) point out that *Viet Nam's* forestry between 1954 and 1986 was characterized by substantial over-exploitation, as production quotas were set based on state needs rather than on the productive capacity of the forests. Nationwide, most forestry production was under state control. Similarly in *Ba Be* District, a state-owned forest enterprise was established during that time. The Ministry of Forestry[3] followed a resource-intensive production strategy, and the role of the forest generally was considered as to, "serve as a basis tbr the development of agriculture" (Gilmour and Nguyen Van San, 1999). In 1983, the Central Committee of the Communist Party of *Viet Nam* initiated a process of forest land distribution. The agricultural cooperatives leased forestland to their members with the condition that members reforest or transform natural forests into production forests. The declared purpose of the forestland distribution was the establishment of a productive forestry sector as well as the eradication of shifting cultivation and slash-and-burn practices in old-growth forests (Nguyen Thuong Luu et al., 1995). However, the policy change did not produce the expected results and was repeatedly refined. In 1994, the forest land allocation policy was launched (Government of the Socialist Republic of *Viet Nam*, 1994; 1999). It provides organizations, households, and individuals with land tenure rights for up to fifty years. The policy-makers generally assumed that farmers would value trees much more if they 'owned' them and that farmers' control over forest resources would lead to sustainable forestland management (Morrison and Dubois, 1998).

The forestland allocation policy was applied uniformly throughout the country. The forest management authority classifies specific forestland areas into one of three categories: (1) special-use forest (2) protection forest, and (3) production forest. Special-use forest, as in National Parks and other protected areas, is not allocated to individual households but falls under the management authority of management boards or forest protection units. This is the case in the core zone of *Ba Be* National Park (*Nam Mau* Commune). The *Tày* people in *Nam Mau* Commune, who for generations cultivated both lowland and upland fields around

[3]The Ministry of Forestry was founded in I976, but was later integrated into the Ministry of Agriculture and Rural Development.

Ba Be Lake, have lost the right to cultivate the hillsides. They are forced by the National Park policy to restrict their agricultural activities to gardens close to their houses and paddy fields.

In the buffer zone of *Ba Be* National Park, the forest is officially classified as special-use forest, but in practice is treated as a mixture of protection and production forest. Therefore, the buffer-zone communes have started allocating forestland to village communities and individual households. Individual land-use titles (so-called Red Books) and community land rights co-exist. Each village community sets a policy for how to redistribute and allocate its forestland equally among all households. Generally, the *Dao* communities have opted for individual land tenure rights for a period of fifty years. The *Tày* village communities, on the other hand, preferred communal rights over the forestland, although control over the forestland is clearly claimed by a few families in each village community. However, individual arrangements among the households allow everyone to access, use, and cultivate the hillsides. The forest on the hilltops is considered as protection forest, and the protection enforcement largely lies in the hands o1: the village heads.

3.4. The struggle between livelihood security and biodiversity conservation

The disparity between local people's efforts to achieve food security, and MARD's and international organizations' efforts to achieve biodiversity conservation, causes major challenges in the *Ba Be* National Park area. Conflicts between agricultural and environmental goals have caused considerable tensions in the local policy context, especially during the past few years as the National Park management board has grown more influential. Since 1999, it has received technical and financial support from the international Protected Area and Resource Conservation (PARC) project mentioned in Section 3.2. The PARC project tends to place rural development second to conservation, yet sees socio-economic development as a side-product of conservation. Together the National Park management board, MARD, and PARC constitute an influential policy actor group in *Ba Be* District with considerable power to orient land use towards the goal of restoring forest cover and rehabilitating biodiversity.

In collaboration with the PARC project, the National Park management board encourages local people to intensify lowland agricultural production and to develop an ecotourisrn industry. Forest-protection contracts are issued by the National Park management board that provide farmers with small amounts of money for carrying out protection services. The contracts are seen as a means to prevent people from destroying the forests by binding them to village conventions and official law, and by regulating access to and control over the forest resources (Ministry of Agriculture and Rural Development,1999; 2001; Government of the

Socialist Republic of *Viet Nam*, 2001). However, a member of the National Park management board admitted that true collaboration between the National Park and the local residents is difficult. The local residents say that they feel deprived of their former access to forestland, which for some was essential for their livelihoods. Furthermore, they claim that the compensation payments for patrolling and reforestation activities are far too low. Although they acknowledge the importance of biodiversity conservation for a potential benefit derived from a future ecotourism industry, at present many residents are desperate and struggling for livelihood security. In particular, the landless families regularly disregard the protection and management regulations. The current institutional situation and the lack of stakeholder participation in setting policy leads to their further economic and social marginalization.

In the buffer zone area, the local communities are under less pressure because the policy guidelines for buffer zone management have not yet been formulated. The institutional situation there allows room to maneuver, permitting pluralistic policy responses. However, in an attempt to close some institutional gaps, commune authorities have implemented some of the policies on agricultural intensification and forestry. For example, some forestland has been allocated even though the forest is officially classified as special-use forest. This reflects contradictions between the policy objectives of the Ministry of Agricultural and Rural Development and those of the General Cadastral Office. The disparate approaches to implementing policy reveal that the policy framework for the buffer zone is not well defined. Therefore, the village communities in the buffer zone area enjoy more autonomy in decision-making concerning agricultural and environmental development than their neighbors in the core zone of the National Park. However, some buffer-zone communities still struggle for livelihood security, which makes the enforcement of environmental and forest protection regulations inherently difficult. The account of a village elder makes this clear. She recounts:

"In the hills, the *Dao* people continue to clear and destroy the forests. The forest rangers, such as my son, do not allow them to do so. They said to him, 'You do not let us clear forests for agricultural land, but can the government support us with food for the whole year? If the government can, we will be happy to stop clearing and destroying the forests for upland fields.' And then my son said, 'I am a government offices. Please do what l tell you because it is stipulated in the government policy. I tell you to stop clearing the forests, but concerning your difficulties 1 do not know what to answer.' When people broke the rules, my son confiscated their property (work tools) in order to prevent them from cutting trees. He said, however, that he could not do this job here anymore because they were our neighbors and we see them every day. And so he moved to work in *Na Nong*."

The village elder's account also highlights the social relations that are central for life in the remote mountain communes. Cohesive communities and networks of families and clans are important "social capital" for future development of the

villages. Quite frequently, forest rangers and local authorities do not report violations of the official environmental law, despite the risk of being fined themselves. Village solidarity in the buffer zone areas seems to be stronger than obedience to the state. This contributes to pluralistic policy outcomes and discrepancies between formal regulations and local practice (e.g. Sikor, 2001). In places such as the buffer zone of *Ba Be* National Park, where local authorities have discretionary power through consultation with the people, the policies get negotiated and the formal guidelines get modified to fit the local context. In such places, the communities tend to be more self-confident and aware of the opportunities and constraints implicit in policy and environmental changes. They act as entrepreneurs, and are open to discussion and change. However, where the central policies are rigidly imposed, such as in the core zone of the National Park, there is no room for maneuver or pluralism. People feel deprived and dependent on decisions made outside their reach and influence. Some of them lose their self-esteem and hope (Jamieson et al., 1998). To break the vicious circle of marginalization and environmental degradation grows ever more difficult.

4. Conflicting agricultural and environmental policies

The preceding discussion shows that a number of policy changes and interventions impacted the environment and the livelihoods in the *Ba Be* National Park area. The divergent policy goals and unequal power of the various policy actors have caused conflicts between rural development and environmental conservation. Environmental and agricultural policies seek different outcomes from the same resources, creating conflict within the study area. The struggle for livelihood security has contributed to substantial changes in land cover, exemplified by the core and buffer zone areas of *Ba Be* National Park. Forest cover decreased sharply between 1979 and 1998, as shown by the figures and maps for the communes of *Nam Mau* and *Dung Phuc* (Figure 4 and Figure 5 respectively).

In 1979, Resolution No. 6 introduced major agricultural reforms that stimulated household-based production and generally improved living standards in rural areas. However, in the *Ba Be* National Park area this policy reform coincided with the establishment of a protected area around *Ba Be* Lake. This early attempt to protect *Ba Be's* biodiversity was diametrically opposed both to the government's production plans and to the resource-intensive production strategy of the then-Ministry of Forestry, both of which were intended to enhance the well-being of the local residents.

Despite the early recognition of the important biodiversity pool around *Ba Be* Lake, it proved impossible to preserve the landscape of the protected area in the state it was in 1979. Subsequently, the formal establishment of *Ba Be* National Park in 1992 likewise failed to prevent further encroachment on the forest

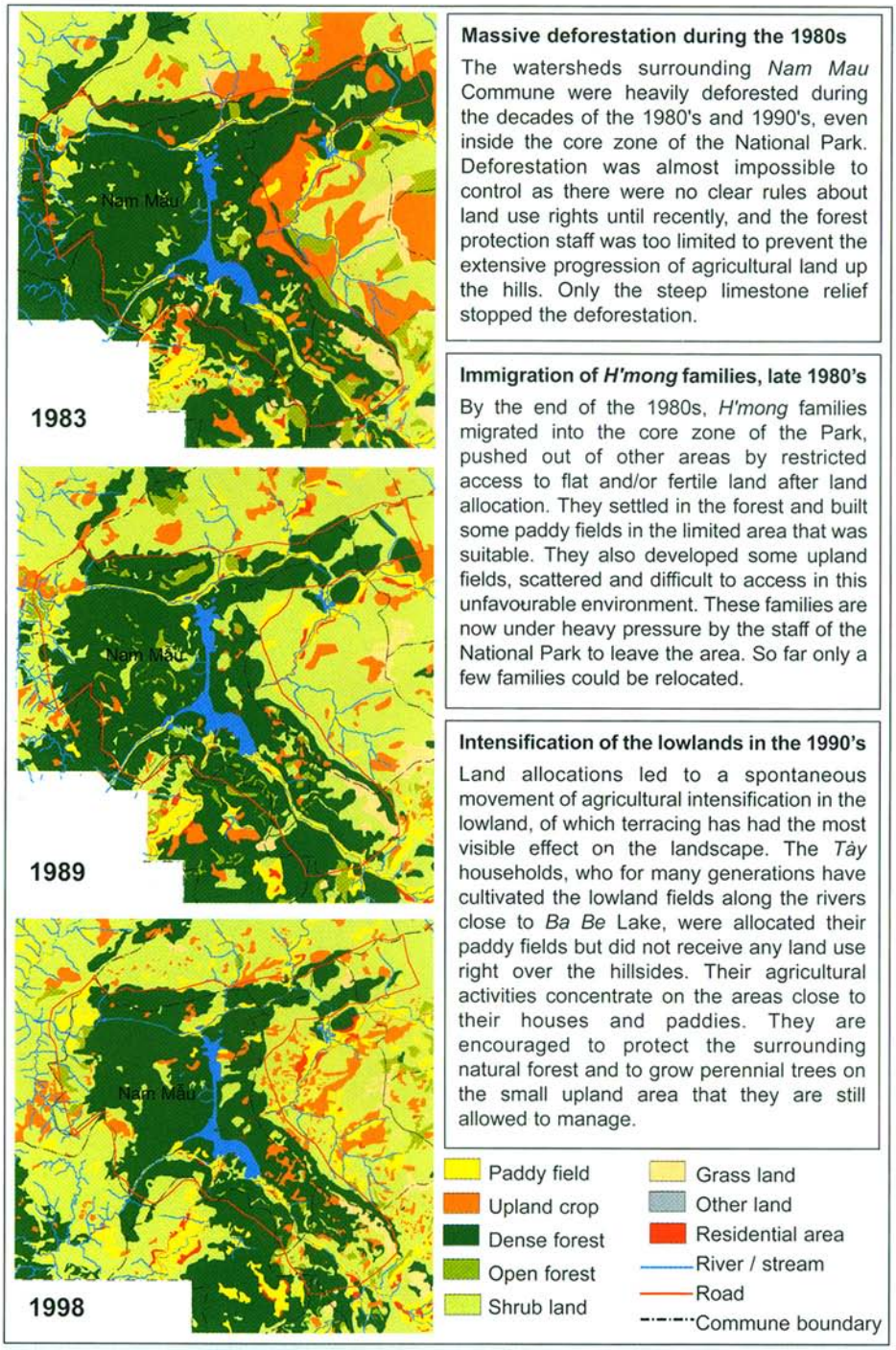


Figure 4: *Land use and land-use-change maps of Nam Mau Commune.*

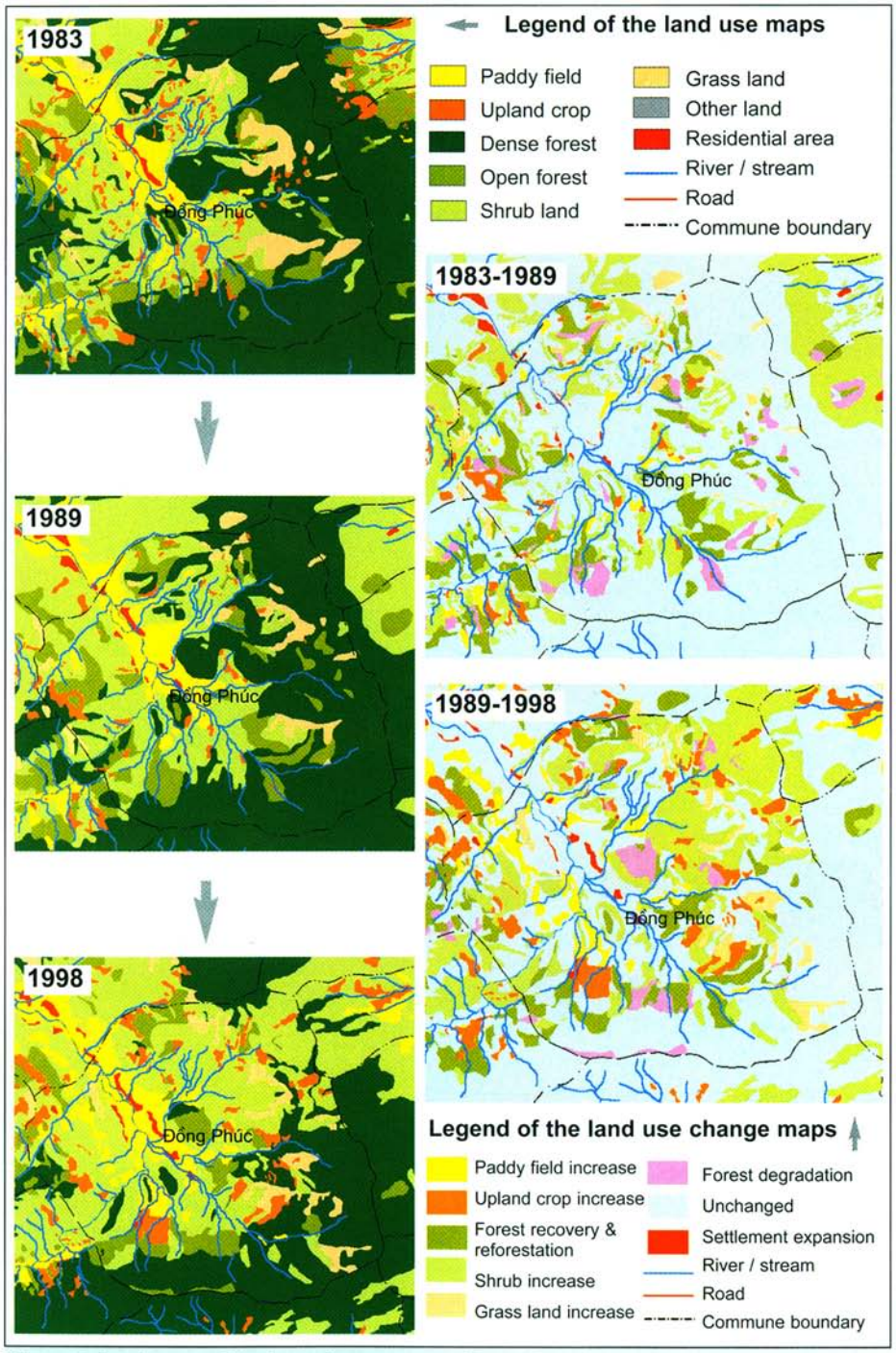
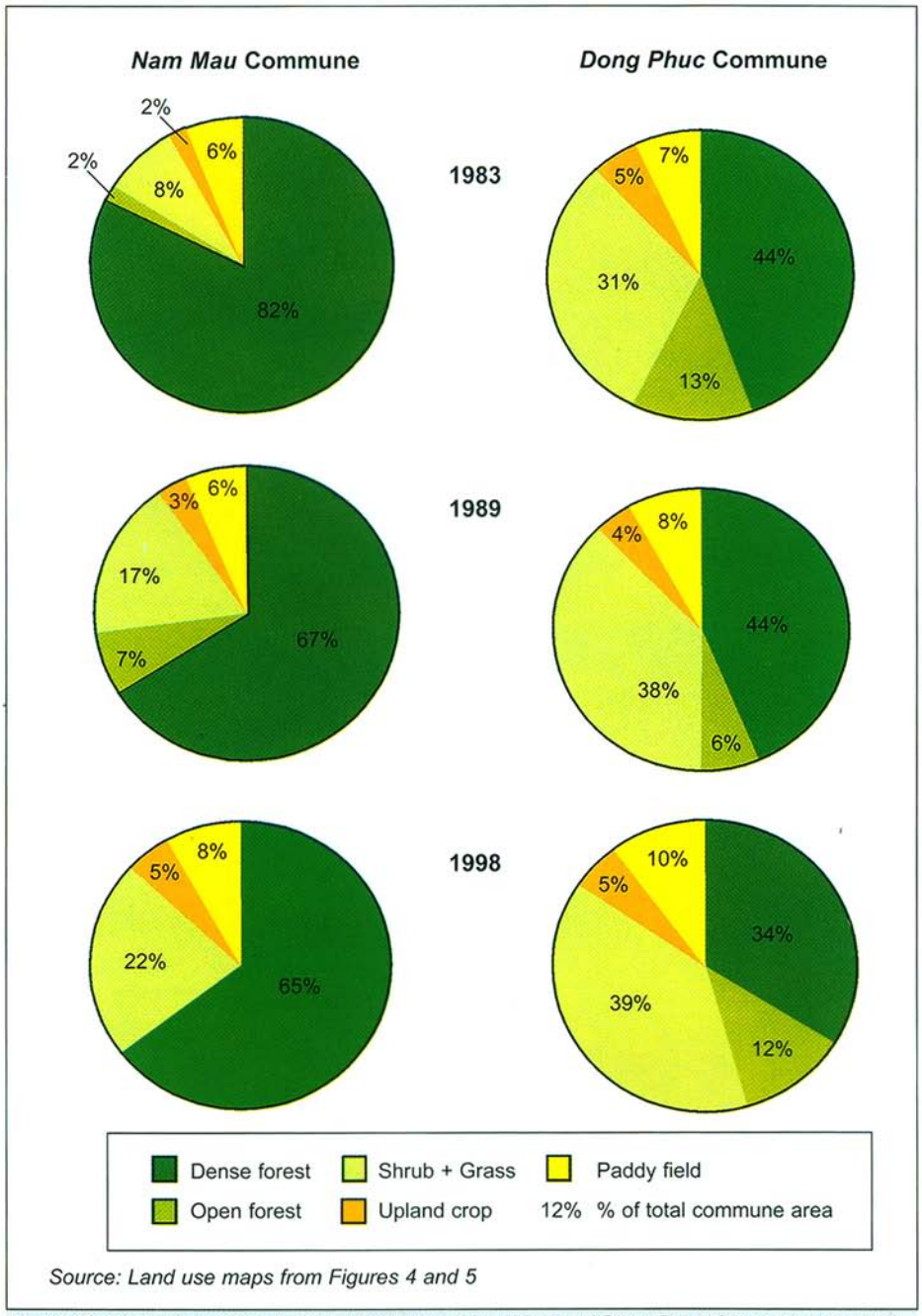


Figure 5: *Land use and land-use-change maps of Dong Phuc Commune.*

resources. The National Park area has been undergoing a gradual conversion from a natural to an (agri-)cultural landscape during the past twenty years. The biodiversity conservation policy of the Forest Protection Unit and the Ministry of Agriculture and Rural Development has not been effective in the *Ba Be* National Park area. Livelihood needs and agricultural production targets clearly outweighed the idea of a protected area. The land cover changes depicted in Figure 4, Figure 5, and Figure 6 therefore reveal consequences, of these rival policies. In most parts of the study area, farming communities made tremendous efforts to intensify agriculture in the lowlands, which is exemplified by the extensive terracing implemented in *Dong Phuc* during the 1990s (Figure 5). However, both the agricultural potential of the uplands and forest resources were and continue to be crucial for the fanning households, providing a safety net in times when the lowland resources are not accessible or do not generate the necessary food.

The protected area in *Ba Be* District indicates, nevertheless, that policy-makers recognized the importance of preserving the landscape and the rich biodiversity around *Ba Be* Lake. Conservation was put back onto the agenda by the many international conservation organizations that became active in *Viet Nam* during the 1990s. Conservation is a powerful concept that enables conservation organizations to generate and allocate large sums of money in biodiversity-rich regions of the world, in many countries, the implementation of the conservation concept depends almost entirely on international funds. Yet, the concept of conservation is differently understood and interpreted in *Viet Nam* than amongst the mostly Western conservation organizations and policy actors active in this debate. In particular, national and international actors seem to have different systems for valuing nature, and different attitudes toward natural resources. Therefore, there are many contradictions between international and national ideas and plans for conservation. The *Ba Be* National Park area, for example, is not managed according to a natural resource management plan, but according to an investment plan. For the national policy actors, conservation is closely linked with economic development, such as the promotion of a tourism industry. This understanding of conservation and development has recently led to the construction of a paved road in the very core zone of the National Park, which required major manipulations of the biophysical landscape and, of course, totally contradicts the idea of a strictly protected core zone area (Nepal and Weber, 1995).

The concepts of conservation and forest protection through land allocation also undergo re-interpretations at the interface between the international and national policy actors and the local residents. Environmental policy objectives are interpreted in each locality and tailored to the capacity of the communities to carry out the required reforestation activities or protection services. However, those who barely reach food security find their daily livelihood struggles hard enough. Poor farmers do not share the conservationists' ideas, and disregard the rules and regulations. Instead, they rely on and sustain the local customs and follow a



Source: Land use maps from Figures 4 and 5

Figure 6: *Proportions of each land use class in Nam Mau and Dong Phuc Communes in 1983, 1989, and 1998.*

natural resource management regime that is more appropriate for their immediate needs and future benefit. An example of such local institutional arrangements is land use tenure systems that are still based on common-property regimes even though private tenure rights are promoted by the government. Common-property rights benefit the community as a whole by allowing families to negotiate access to resources amongst themselves (Gibbs and Bromley, 1989). The introduction of non-traditional concepts of environmental conservation and natural resource management is therefore not a straightforward, linear process. Rather, it is locally contested and re-interpreted according to the socio-cultural context of the village communities.

5. Conclusions and outlook

Agricultural activities have transformed the natural landscape of the *Ba Be* National Park area during the last two decades. Rural development policies mostly overruled any attempt at biodiversity conservation in the1980s and early 1990s. The environmental changes in the *Ba Be* National Park area have been similar to those in other localities within *Bac Kan* Province that were not considered for protection and conservation. In short, the official protection and conservation status of the *Ba Be* National Park area largely failed to prevent encroachment on the forest by the expansion of agricultural production areas and the exploitation of forest resources such as timber and wildlife.

The only protection to the forests and wildlife in the core zone of *Ba Be* National Park was provided by the biophysical factors themselves. The rugged limestone mountains and unfavorable soil conditions prevented further human encroachment on the forest resources. It can therefore be concluded that it was mainly the natural conditions and not the institutional and policy framework that contributed to a partial preservation of the natural environment in the core zone. The biodiversity conservation policy up to the late 1990s had little effect in counteracting the increasing demand for agricultural land and forest resources. More recently, the policy framework linked with an exclusionary concept of conservation has created tensions in the socio-economic realm as it deprived people of traditional resources without providing alternative opportunities to secure their livelihoods.

Agricultural and environmental policies are particularly incompatible for households who cannot attain food sufficiency because of a lack of access to paddy land fields. A communication mechanism is needed between the communities and the policy makers. The diverse groupings of actors should collectively develop a management plan for the *Ba Be* National Park area that will be accepted by all stakeholders. Local policy makers and other stakeholders, including the partnership of projects described in this chapter, already are undertaking several initiatives related to the adaptive co-management of natural

resources. We hope this chapter will contribute to the understanding of the local tensions between rural development and biodiversity conservation, demonstrating the need for innovative institutions that can satisfy the needs of all partners.

Acknowledgements

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