
Red Books, Green Hills

The Impact of Economic Reform on Restoration Ecology in the Midlands of Northern Vietnam

edited by

Le Trong Cuc, A. Terry Rambo, Keith Fahrney,
Tran Duc Vien, Jeff Romm, and Dang Thi Sy

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LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Red books, green hills : the impact of economic reform on restoration
ecology in the midlands of Northern Vietnam / edited by Le Trong Cuc
. . . [et al.].

p. cm.

"A report of a restudy of three districts in Vinh Phu Province : a
joint research activity of the Center for Natural Resources and
Environment Studies (CRES), Hanoi University; the Program on
Environment (ENV) of the East-West Center; the Southeast Asian
Universities Agroecosystem Network (SUAN); and the University of
California at Berkeley (UCB)."

Includes bibliographical references.

ISBN 0-86638-179-1

1. Agricultural ecology—Vietnam—Vinh Phú (Province)
2. Agriculture—Vietnam—Vinh Phú (Province) 3. Natural resources—
Vietnam—Vinh Phú (Province)—Management. 4. Land use, Rural—
Environmental aspects—Vietnam—Vinh Phú (Province) I. Le, Trong
Cuc, 1940- II. Trường đại học tổng hợp Hà Nội. Center for
Natural Resources Management and Environmental Studies.

S471.V48V567 1996

333.76'15'09597—dc20

95-43343

Cover photo: A regreened hill in Vinh Phu province, photographed in August 1994.

Cover photo credit: A. Terry Rambo

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Preface

The title of this report may puzzle readers who are not familiar with the current situation in rural Vietnam, so some words of explanation follow.

Beginning in 1986 and with ever-accelerating momentum since, Vietnam has been engaged in a vast experiment with economic reform. At the heart of this effort is the substitution of market mechanisms for central planning. Perhaps the most profound policy change in rural areas is the transfer of responsibility for land management from the cooperatives that formerly dominated agricultural production to individual farm households. A major component of this transfer is the assignment to the households of long-term rights to specific plots of land. These assignments are recorded in red books issued by the district People's Committees, hence the first part of the title of this volume.

Changes in economic policy have also strongly affected the rural environment. In upland areas, as represented by the three districts in Vinh Phu province described in this volume, one noticeable outcome of the new policies has been the visible improvement in vegetative cover on the formerly barren hills; hence the second part of our title. As the subtitle makes evident, our main objective in this report is to explore the interaction between changes in economic policies and social organization and environmental quality in the Midlands.

This report is the product of field research organized by the Center for Natural Resources and Environmental Studies (CRES) of Hanoi University, in cooperation with the East-West Center's Program on Environment (ENV), the Southeast Asian Universities Agroecosystem Network (SUAN), and the University of California at Berkeley (UCB). A brief planning workshop was held in Hanoi on 8–9 August 1994. Field research was carried out in Doan Hung, Thanh Hoa, and Lap Thach districts of Vinh Phu province during 10–16 August 1994.

This study is one component of a larger survey of Vinh Phu province co-organized by CRES, ENV, and UCB. From these three collaborating institutions, three research groups formed to investigate various aspects of environmental and natural resources management problems in Vinh Phu. One group investigated agroecosystems in Vinh Lac district in the Red River Delta. Another group investigated industrial pollution and environmental problems in Viet Tri, the provincial capital of Vinh Phu. A third group,

reporting here, investigated agroecosystems in three upland districts of Vinh Phu province, part of the region known as the "Midlands" of northern Vietnam.

This report presents results of our 1994 research, which follows up on a previous study conducted in the same three districts in 1989 by CRES, SUAN, and ENV. A report of the initial research was published in 1990 as an occasional paper of the East-West Environment and Policy Institute (now ENV), *Agroecosystems of the Midlands of Northern Vietnam*, edited by Le Trong Cuc, Kathleen Gillogly, and A. Terry Rambo.

Taking part in the Midlands restudy were five CRES staff, seven students from the CRES postgraduate course on environmental science, and twelve researchers from Laos, the Philippines, Thailand, Germany, and the United States associated with SUAN, ENV, and UCB. We divided into two teams for the field research. This allowed us to carry out more detailed research in all three of the districts surveyed in 1989 within our time limitations. One team studied Doan Hung and Thanh Hoa districts while the other team concentrated on Lap Thach district. A list of participants and research team membership is provided in Appendix A. The schedule of field research activities is found in Appendix B.

A modified form of rapid rural appraisal (RRA) was the principal method employed for data collection in interviews of household members and village and cooperative officials. Prior to going into the field, the teams formulated a detailed set of guidelines to be used as a checklist during the semistructured interviewing of households. Households were in most cases selected by village officials. In Doan Hung district the local officials granted our request to interview equal numbers of well-off and poor households; in Thanh Hoa district we were only permitted to interview well-off households (who were described by the local official as "average" but who had houses that were visibly superior to those of their neighbors). Based on visual observation of houses, the actual range of wealth differentiation in Thanh Hoa is probably quite similar to that in Doan Hung, but the households in our sample in the former district represent only the upper half of the spectrum. An official from the village, and in some cases district officials as well, accompanied the team during the interviews. In a few cases the officials intervened in the questioning, sometimes responding before the farmer had a chance to reply. The Lap Thach team interviewed district officials, members of People's Committees of four diverse villages, and members of households from a wide range of circumstances.

Usually, one team member asked most of the questions with other team members inserting follow-up questions as appropriate. Responses were translated into English by a bilingual Vietnamese team member so that the foreign researchers could follow the interview. All team members took detailed notes during the course of the interview. The farmers normally served us tea; we reciprocated by passing around cigarettes and candy. No money was given to informants.

The report is organized as follows:

Chapter 1 focuses specifically on Vinh Phu province and the three districts of our study: Doan Hung, Thanh Hoa, and Lap Thach. It is a revised and expanded version of the second

chapter in the initial 1990 report. Updated statistics were provided by district and provincial officials.

Chapter 2 describes some of the more important environmental problems confronting agroecosystems and sustainable management of natural resources in the northern Midlands. Approaches toward amelioration of these problems and results of research conducted by CRES on improved practices are presented. Some recommendations for land use within the context of the Midlands landscape are also included in this chapter.

Chapter 3 describes changes in national policies and social organization during recent years that have directly influenced land use and rural development.

Chapter 4 shows how policy changes at the national level (described in Chapter 3) have affected social organization and development at the local level in Doan Hung and Thanh Hoa districts.

Chapter 5 provides a more detailed characterization of the household ecology and economy in Doan Hung and Thanh Hoa districts. Information in this chapter is derived from household interviews.

Chapter 6 discusses the impact of recent changes in economic policy on the people and environment in Lap Thach district. This chapter includes detailed background information on Lap Thach district and information obtained from household interviews.

Chapter 7 provides a summary assessment of productivity, sustainability, diversity, and equitability of upland agroecosystems in the Midlands of Vinh Phu province, describing how these key system properties have been affected by recent changes in social organization and economic policy.

Acknowledgments

This field study received excellent support from officials at all levels of the Vietnamese government. Mr. Truong Trung, Chair of the Committee on Science, Technology, and Environment of the Vinh Phu Provincial People's Committee, and his staff made all arrangements for us to work in the province. The Chairs of the People's Committees and the Party Secretaries in Doan Hung, Thanh Hoa, and Lap Thach districts facilitated our work in their jurisdictions, as did the village officials in all of the villages where our interviews were conducted. Above all, of course, we owe a debt to the farmers themselves, who gave freely of their time and knowledge to answer our questions.

All arrangements for the field study were made by CRES staff. Professor Vo Quy, CRES Director, was fully supportive of this effort. At the East-West Center, Ms. Vy Ton, Project Specialist for the Indochina Initiative, oversaw arrangements for the planning workshop. Ms. June Kuramoto, ENV Program Officer, did her usual superb job of making travel arrangements for all foreign participants.

This publication benefited from the comments of our reviewers, and we express our appreciation for their contributions. Dr. Neil Jamieson of Winrock International, Hanoi, reviewed a preliminary draft. Later drafts were reviewed by Professor Robert Reed, Director of the Center for Southeast Asia Studies at the University of California at Berkeley, and Dr. Muthiah Alagappa, Senior Fellow at the East-West Center Program on International Economics and Politics. Mr. Michael DiGregorio drew the maps of our research area. Final editing of the manuscript and production was done by Mr. Dan Bauer, ENV Editorial Assistant. Only the authors can fully appreciate the magnitude of his contribution.

Primary financial support for this study, as for our 1989 investigation, was provided by a grant to the East-West Center from the Rockefeller Brothers Fund (RBF). Supplemental funding was provided by a grant to the East-West Center from the John D. and Catherine T. MacArthur Foundation. Our special thanks go to Dr. Peter Riggs, RBF Program Officer for Sustainable Development, who perceived the value of doing a follow-up investigation on the fate of restoration ecology efforts in the Midlands under changed management systems and encouraged us to undertake this effort.

PART ONE

Background on the Midlands

An Overview of the Midlands of Vinh Phu Province

Tran Duc Vien and Keith Fahrney

The Midlands compose approximately one-third of the land area of the northern region of Vietnam, consisting of most of the provinces of Vinh Phu,¹ Ha Bac, and Bac Thai, some parts of the provinces of Tuyen Quang, Yen Bai, Hoa Binh, Ha Tay, and Quang Ninh, and a small part of Ninh Binh province (see Map 1.1).

Made up of low, rounded hills and narrow river valleys, the Midlands form an arc around the Red River Delta, separating that alluvial plain from the Hoang Lien Son Highlands to the north and west. They are a transitional zone, both ecologically and culturally. Hill slopes are the dominant landform, but the sinuous alluvial valleys represent an extension of the deltaic plain into the mountains. This physical fact is of great cultural significance because it has permitted the extension of Vietnamese settlement into an otherwise alien environment.

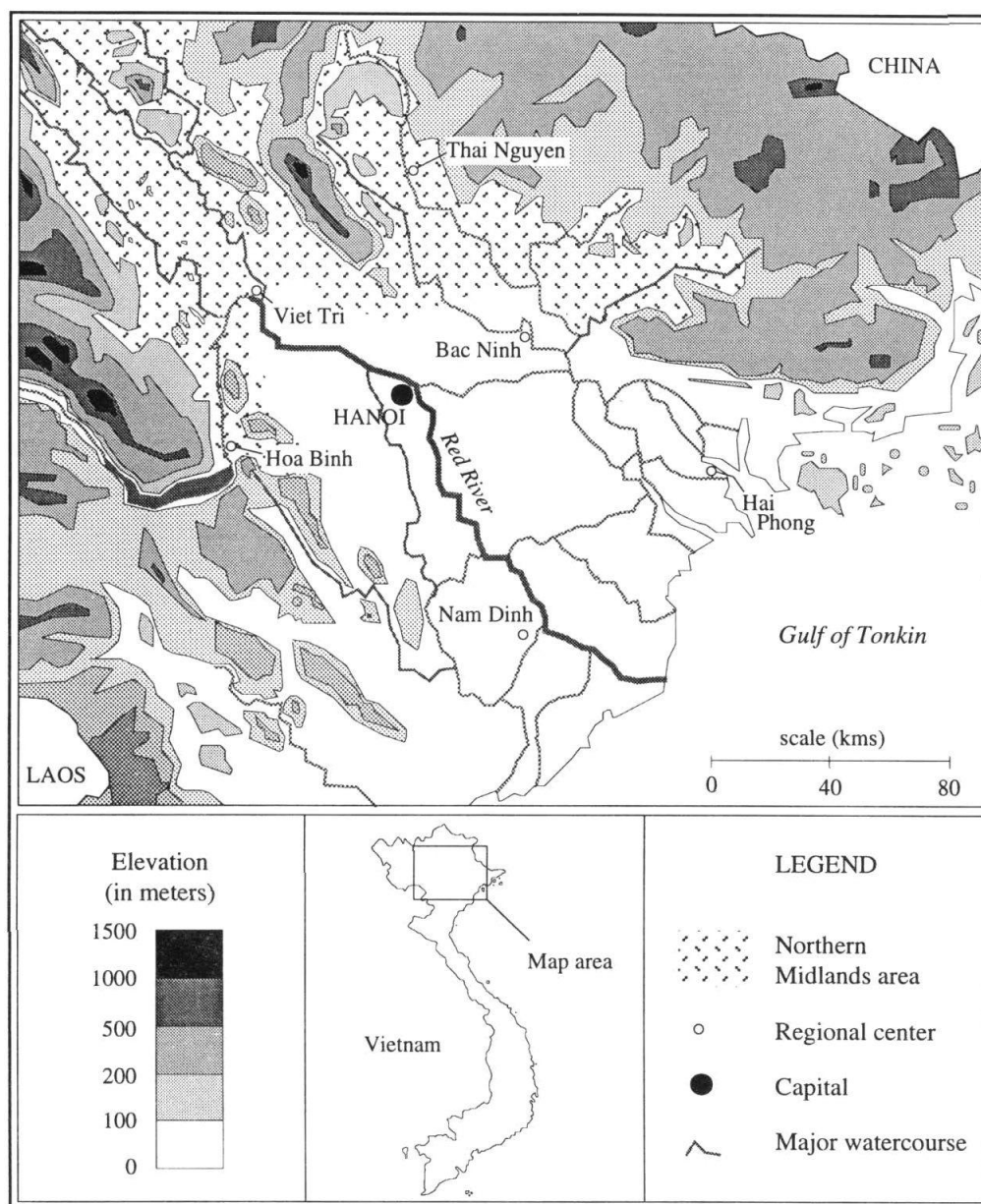
PHYSICAL ENVIRONMENT Topography

The relief of the Midlands varies from densely packed hills to plains with isolated knolls. Hills are rounded, with level tops and convex slopes of between 5 and 40 degrees. Most are 20–25 degrees, with elevations ranging between 15 and 200 meters above sea level. Between the hills are narrow valleys with alluvial soils. Valleys are used for irrigated rice cultivation.

Climate

The climate is monsoonal with hot, wet summers (April–August) and cool, cloudy, moist winters (December–February). The total rainfall is 1,500–2,000 millimeters per year. The average annual temperature is 25°C, with an average maximum of 35°C (in August) and an average minimum of 12°C (in January). Table 1.1 shows temperature and rainfall data for Vinh Phu province for 1993.

The southwest monsoon occurs from May to October, bringing high temperatures and heavy rainfall. The amount of rainfall from June to October is 80–85 percent of the total



Map 1.1 The Midlands of northern Vietnam

Table 1.1 Temperature and rainfall data for Vinh Phu province (1993)

	Temperature (°C)	Rainfall (mm)
Average	22.5–23.8	1127.9–1769.2
Minimum	14.8–16.1 (Jan)	3.5–12.3 (Dec)
Maximum	27.6–29.6 (Jul–Aug)	283.9–395.2 (Aug)

Source: Vinh Phu Province, Division of Statistics (1994).

Note: These are ranges from four stations. Data from highland stations are not included here.

annual rainfall. Highest monthly rainfall is in August, with 15–20 percent of the total annual rainfall. During the winter months (December–February), cool winds blow out of China, commencing from the northwest (dry) and later from the northeast (moist). Winds from the northeast acquire moisture over the Gulf of Tonkin, bringing a period of prolonged cloudiness, high humidity, and light rain. Generally, however, November–May is the dry season. Although it lasts six months, the amount of rainfall is only 15–20 percent of the total annual rainfall. The lowest monthly rainfall is in December and January.

Soils

Soils in the Midlands are complex and varied. The basic process of soil formation is ferralitic, through weathering of the parent material, leading to accumulation of rather high amounts of iron and aluminum, with leaching of silica and most base cations. Before human disturbance, soils may be rather thick (up to 4 meters).

Based on the different kinds of parent materials from which they have formed, the soils of the Midlands can be classified into four types:

1. *Red-yellow soil formed on shale and metamorphic rocks:* These soils are generally 0.6–1.2 meters thick. The thickest of these soils are derived from mica in Vinh Phu province. The acidity of these soils is high ($\text{pH}_{\text{KCl}} = 4.0\text{--}4.5$). Humus contents are variable, and available phosphorus is low. Total potassium ranges from poor to rich, particularly on mica slate rocks. Fertility of these soils is considered to be medium.
2. *Yellow-red soil formed on acidic magma rocks (granite, quartz, liparite, porphyrite):* The weathering process is slow on these soils, producing thin-layered soils approximately 1 meter in depth. Soil texture is medium, with medium humus contents and high potassium contents.
3. *Light yellow soil formed on sandstone:* These soils contain many quartz minerals, slowing the weathering process and resulting in thin soil layers (0.5–1.0 meter). The soil texture is light but compact, with low humus content. These soils are highly erodible, and soil fertility is considered to be low because many of the nutrients have been leached or washed away.
4. *Yellow-brown soil formed on ancient alluvium:* These soils are scattered in distribution and found mostly on hills and gentle slopes. They are of light texture, acidic, and poor in nutrients. Thickness of these soils ranges from thin to very thin.

The most common soil type in the Midlands is red-yellow ferralitic. These soils accumulate iron and aluminum to form laterite. Mineralization is rapid, and organic substances quickly break down, resulting in low humus content. Intensive surface and deep leaching processes make the soil very acidic and poor in nutrients. Nitrogen, phosphate, and cations are easily dissolved or carried away to such an extent that these soils cannot be cultivated for long before they suffer serious degradation. In extreme cases of erosion, a hardpan of laterite nodules is exposed. Table 1.2 shows some physical and chemical properties of red-yellow ferralitic clay soils from selected land use systems in Vinh Phu province.

Table 1.2 Soil properties from selected land use systems in Vinh Phu province (ferralitic red-yellow clay on schist stone)

Land use type	pH (KCl)	Organic matter (%)	N (ppm)	P ₂ O ₅ (ppm)	K ₂ O (ppm)	Clay <0.01 mm (%)	
						Topsoil	Subsoil
Barren hill	4.6	1.73	0.06	0.04	0.02	42.8	54.0
Regenerated forest (8 yrs)	4.7	2.22	0.17	0.07	0.09	68.3	20.0
Manglietia plantation (11 yrs)	4.7	1.76	0.10	0.06	0.08	42.8	44.0
Eucalyptus plantation (10 yrs)	4.6	1.96	0.15	0.07	0.04	62.8	68.8
Pine plantation (10 yrs)	4.7	1.62	0.07	0.08	0.06	62.8	65.6
Lacquer plantation (6 yrs)	4.6	2.50	0.10	0.06	0.07	53.6	53.6
Tea garden (10 yrs)	4.5	1.91	0.10	0.06	0.07	55.2	57.2
Cassava	4.6	1.77	0.09	0.05	0.03	39.2	42.2

Source: Pham Canh Thanh (1989).

Note: Sampling sites were in Doan Hung district, within a 10-kilometer radius of each other.

Vegetation

The monsoonal tropical climate with high humidity prevailing in the Midlands of northern Vietnam is quite favorable for forest growth and development. Originally, the Midlands were almost completely covered by forest. At present, planted and natural forest covers only about 26 percent of the land area in the northern Midlands.

Most of the forest types in the Midlands fall into the closed seasonal tropical evergreen category. These mixed forests are rich in species, including valuable timber trees such as *Erythrophloeum fordii*, *Chukaria tabularis*, and *Manglietia fordiana* as well as medicinal plants and species providing resins, oils, and other valuable forest products. Species composition and successional patterns of natural forest and grassland communities are discussed in detail in Chapter 2.

HUMAN SETTLEMENT OF THE MIDLANDS

Until the late 1950s, the Midlands were mostly sparsely populated by tribal groups, known collectively as *Nguoi Dan Toc* ("ethnic minorities"),² a term used in contrast to the ethnic Vietnamese or *Nguoi Kinh* ("people of the capital"). The 15-meter contour line around the edge of the Red River Delta marked the effective limit of Kinh settlement. Kinh expansion into the mountains, despite the overwhelming demographic pressures in the delta (where densities averaging 650 persons per square kilometer had been reached by 1936), was checked by a well-founded fear of malaria.

Following the defeat of the French colonial forces in 1954, the Vietnamese government began a program to resettle people from the delta into the less-crowded uplands. The forest was cut to make upland fields, and the rivers and streams were dammed to provide irrigation water for the paddy fields that were constructed in the valley bottoms. These environmental changes greatly reduced the habitat available to the malaria mosquitoes, making the Midlands a relatively safe area for Vietnamese settlement. The Vietnamese population rapidly increased, and the whole of the Midlands became incorporated into their cultural domain.

The Kinh now constitute the majority population of the Midlands. To the lowland Kinh, who are by age-long tradition skilled paddy farmers, the Midlands environment has presented new problems. Dryland farming on sloping terrain is unfamiliar to them, and they are not especially skilled in this kind of agriculture, for which there is really no precedent, even in the hills. Adoption of the traditional shifting cultivation employed on hill land by the ethnic minorities is not feasible. Apart from natural and legal constraints, this technique requires much traditional knowledge to be successful and, in addition, is interlinked with a certain type of society: dispersed, small-scale, mobile, with a yearly rhythm and with social and ritual institutions that are entirely foreign to Kinh society. The Kinh people have, therefore, simply brought their lowland production technology to the uplands, exacerbating soil loss and destruction of the natural habitat.

**SOCIAL ORGANIZATION
AND INSTITUTIONS FOR
RESOURCE MANAGEMENT**

Vietnam is a highly centralized unitary state. Administratively it is divided into provinces, each of which is subdivided into several districts. Districts include a large number of villages, the fundamental politico-administrative unit.

The Village and Village Cooperative

The village (*lang, xa*) in northern Vietnam consists of a large number of hamlets or neighborhoods (*xom*) interspersed among paddy fields. Each hamlet is populated by some tens of mostly unrelated households. All those over 18 years of age residing in the village are considered village members; this includes in-marrying women.

Until recently, the village cooperative (*hop tac xa*) was the fundamental administrative unit in socialist Vietnam. This organization was regarded as a modern transformation of the traditional form of the Vietnamese village. The role and functions of the cooperatives in village administration have changed greatly during the past few years. The structure and function of village cooperatives and their relation to national agricultural and rural land use policies is discussed in detail in Chapters 3 and 4.

The Household

Historically, the household constituted the fundamental unit of farm management. With economic liberalization in Vietnam, control is once again being returned to the household. A common household group consists of an extended family of two or three generations with a large number of children.

Traditionally, both sons and daughters lived neo-locally after marriage, but inheritance of the estate was not equal. Females are regarded as kin by blood (*ho*), but like matrilineal relatives they are classified as "outer kin" (*ho ngoai*); customarily, daughters did not inherit. "Inner kin" (*ho noi*, which also refers to the patrilineage) are *patrilineal* kin with the right of inheritance. The estate customarily was divided between the sons, with the eldest son generally inheriting the house and homestead on condition that he care for his elderly parents. In the past, the division of land between sons led to increasing fragmentation of plots. However, the need for large-scale cooperation in maintaining the irrigation systems also made it necessary to establish neighborhood work teams (*xom*).

In time, the eldest son becomes the oldest male in his generation; in accordance with Confucian tradition, this male is head of the patrilineage and its record keeper, and is in charge of honoring the death anniversaries of lineage ancestors. Thus, it is very important to have at least one son to ensure lineage continuity through time. Before the August Revolution (1945), if a man had no male heirs, he might adopt a son from another household or take a second wife or mistress to bear his lineage a son. Now polygamy and unequal inheritance are prohibited by law, although the eldest son still tends to inherit the family homestead and lineage duties.

Kinship relations between households play only a minor part in production, as kinsmen often live quite far from one another. Persons in economic difficulty might turn to a wealthier kinsman for a loan, and kin should be invited to weddings, funerals, and ancestral ceremonies.

The number of children per household is currently rather high; we noted 3–5 children per household. There is already severe overpopulation (with the national population growth rate still in excess of 2 percent per year), and the government is now pursuing a birth control program. The program is showing good results in urban areas and the Red River Delta, but difficulties remain in the Midlands and mountain areas.³ Only a few young families explicitly stated they would have no more than two children. In part, this is because population growth is still possible at the expense of the forests through the practice of shifting cultivation in some areas.

Division of Labor

Tasks throughout the year vary with the agricultural cycle. For the paddy fields, the men do the plowing and carrying of fertilizer from the house area to the field. If available, draft animals are used to transport fertilizer. Everyone helps with sowing rice. The women cultivate and transplant rice. Everyone helps in the harvest. For tea production, men hoe and apply pesticides; women pick the tea leaves. Boys tend the cattle and buffalo. Women and older girls prepare the household food and feed the livestock. Fuelwood gathering (including ferns) is usually the responsibility of men and boys. For example, while the boys tend livestock foraging on the grassy or barren hills, they gather fuelwood as well.

At peak labor periods, the farmers exchange labor with neighbors and relatives. The family that calls for labor provides lunch and supper for the workers. Although not officially encouraged, well-off households hire wage laborers to assist in working their fields.

THE RURAL LANDSCAPE OF THE MIDLANDS

The landscape of a typical village in the Midlands is composed of smoothly rounded hills separated by narrow valleys. Before the recent expansion of Vietnamese settlement, primary forest and well-grown secondary forest were the dominant vegetation communities; these now survive only in a few small protected areas, such as the forest reserve at Nui Tam Dao. Elsewhere, forested areas are mostly either secondary growth (often degraded) or artificial plantations. Winding between the steep lower slopes of the hills are

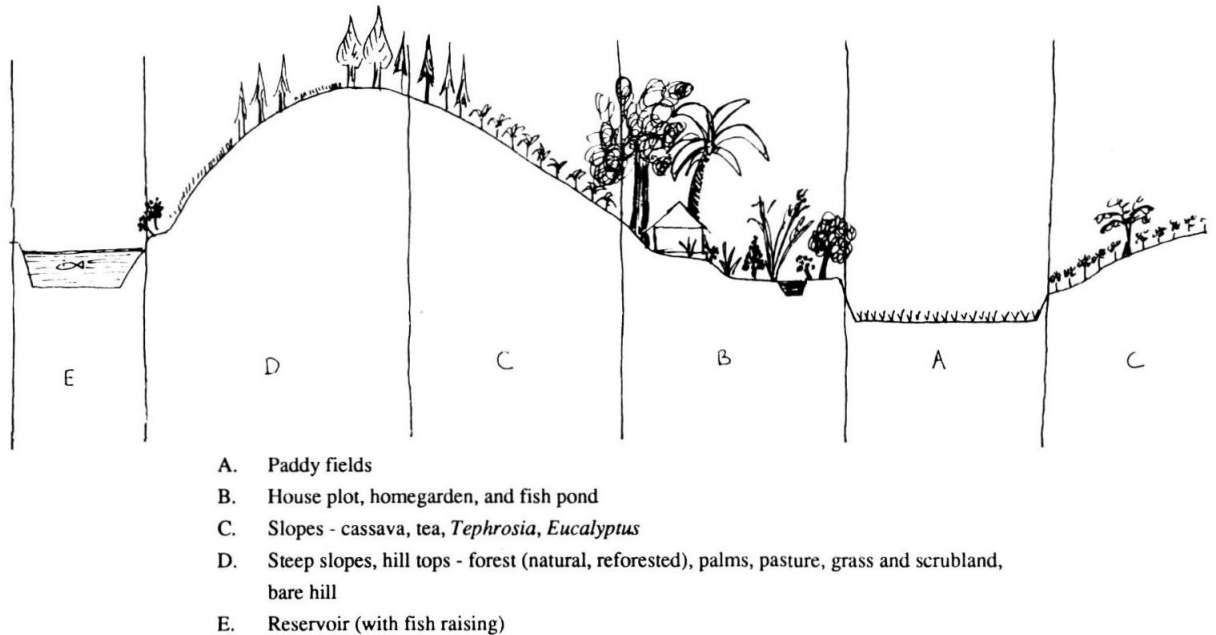


Figure 1.1 Transect of a Midlands agroecosystem (reprinted from Le Trong Cuc, Gillogly, and Rambo 1990)

narrow terraced valleys where cultivation of wet rice is dominant. House sites and associated homegardens are strung like beads on a curving string lying along the higher ground between the paddies and the hill slopes, where cassava and tea are planted. Figure 1.1 is a transect of a typical Midlands agroecosystem.

The village landscape can be classified into a number of components or subsystems. These are natural forest, plantation forest (including eucalyptus and fuelwood reforestation plots), grassland, bare hills,⁴ tea plantations, livistonia palm groves, upland cassava fields, house plots and homegardens, fishponds, wet rice fields, ponds and reservoirs, and roadside border areas. Usually tea (sometimes intercropped with tephrosia) and cassava are planted on slopes of less than 35 degrees; plantation forest is planted on slopes of more than 35 degrees. Table 1.3 shows distribution of land use types in Vinh Phu province. Table 1.4 shows a breakdown of the major land use types in the study area.

The Midlands environment has been deeply altered in the recent past. One farmer told us that when he arrived in his village in 1980, the hills were already bare and there were many paddy fields. We met others who came to this area in the 1940s, cutting their house plots and building their homegardens out of the jungle. Another farmer we met in 1989 lived in a 105-year-old house with half-meter-wide wooden panels and thick beams, indicating old forest that has long since been destroyed.

Depending on topographic conditions, people build pools and reservoirs to retain rain and underground water. These sources can provide a steady source of water to the fields. Forest areas on hills supply materials for handicraft production and also grass and leaves to make green manure. Capture and retention of water helps maintain a sufficient level of moisture and moderate the microclimate.

Table 1.3 Land use classification and distributions for Vinh Phu province

Land use type	Area in hectares	Percent
<i>Agricultural land</i>	165,077	34.21
Annual crops	127,386	26.40
Permanent crops	24,330	5.04
Grassland	7,110	1.47
Aquaculture	6,251	1.30
<i>Potential agricultural lands</i>	8,075	1.67
Hill and mountainous land	5,920	1.23
Wasteland	860	0.18
River banks, marshland	590	0.12
<i>Forest land</i>	142,606	29.56
Natural forest	116,824	24.21
Planted forest	25,782	5.34
<i>Potential forest land</i>	57,295	11.88
<i>Other land</i>	109,427	22.68
Special use land ^a	61,871	12.82
Rivers, streams	16,312	3.38
Other land	31,244	6.48
Total (non-urban)	482,480	100.00

Source: Vinh Phu Province, Division of Statistics (1994).

^aIncludes constructed areas and non-settlement urban areas.

Table 1.4 Major land use types in the study area

Administrative unit	Total area		Agricultural land		Forest land		Special use land	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Vinh Phu province	482,480	100.0	165,077	34.21	142,606	29.56	61,871	12.82
Doan Hung district	30,373	6.3	11,159	36.74	5,111	16.83	4,964	16.34
Thanh Hoa district	39,421	8.1	17,872	45.34	3,601	9.13	5,831	14.79
Lap Thach district	40,942	8.5	15,854	38.72	14,927	36.46	5,839	14.26

Source: Vinh Phu Province, Division of Statistics (1994).

Homegardens are usually located on the hills near roads and adjoining houses. Homegardens include a range of tea, vegetables, timber and fruit trees, and domestic livestock. The homegarden supplies diverse supplementary subsistence for the household. Fishponds provide extra food and income. Manure from the livestock, which may forage or be penned in the homegarden, is mixed with green manure and rice straw for fertilizer and then applied in the fields, homegardens, or fishponds.

Road transportation is currently being developed from larger population centers to the farther hill areas, via the valleys. The number of motor vehicles has increased dramatically since 1989. Many farm households now own motorbikes. Much transport is still by buffalo or oxen, carts, bicycles, and shoulder poles. There is some river transport. The price of products in the region is low because of the time and cost involved in transporting products to population centers where prices are better, or to factory locations. Table 1.5 shows the number of markets in the study area. Prices of selected commodities and consumer goods in Vinh Phu over a three-year period (1991–93) are shown in Table 1.6.

Table 1.5 Number of markets in the study area

Administrative unit	Markets
Vinh Phu province	160
Doan Hung district	10
Thanh Hoa district	11
Lap Thach district	14

Source: Pers. com., district and provincial officials.

Table 1.6 Prices of selected products for sale in Vinh Phu province (1991–93)

Product	Unit	Price (VN dong)		
		1991	1992	1993
Paddy rice (including husk)	kg	1,475	1,365	1,215
Sticky rice (husked)	kg	3,009	2,868	2,538
Maize (dry grain)	kg	1,414	1,382	1,280
Sweet potatoes (fresh tuber)	kg	505	500	497
Cassava (fresh tuber)	kg	412	416	253
Pork (grade A)	kg	9,119	11,358	11,679
Beef (grade A)	kg	9,260	13,547	14,750
Chicken (one bird)	kg	7,929	11,588	11,681
Duck eggs	egg	463	623	635
Carp (grade A)	kg	5,783	8,581	10,329
Mung beans (dry grain)	kg	4,286	6,284	6,185
Black beans (dry grain)	kg	3,962	5,228	5,442
Soybeans (dry grain)	kg	2,989	4,215	3,971
Peanuts (dry grain, shelled)	kg	5,168	5,795	5,937
Tomatoes	kg	1,193	1,558	1,233
Cabbage	kg	438	406	515
Lemons	kg	1,615	1,700	—
Bananas	fruit	70	100	85
Green tea (dry)	kg	9,060	12,625	15,031
Sugar (from Viet Tri)	kg	4,300	4,512	4,567
Detergent/soap	kg	1,900	2,756	2,600
Domestic stamp	stamp	200	200	400
U.S. dollar	US\$	9,307	11,197	10,624

Source: Vinh Phu Province, Division of Statistics (1994).

CROPPING SYSTEMS IN THE MIDLANDS

Rice, cassava, sweet potato, maize, tea, and peanut are the most important crops in the production system of the Midlands. The strategy of cultivation is mixed intensive lowland cultivation, so that land is covered by vegetation year-round.

Production systems have a more-or-less fixed topographic location. The lowland and terrace irrigated agricultural systems are used to grow rice. Crops such as cassava, maize, peanut, mung bean, and soybean are found on the gentler upland slopes. Plantations for cash crops are located on the upper and medium slopes. These include tea, lacquer trees, and other forest plantations. The homegardens are usually situated on foothills, sometimes on the slopes around the house.

Table 1.7 Populations of large livestock in the study area (1991–93)

Administrative unit	1991	1992	1993	Average
Buffalo				
Vinh Phu province	105,303	110,455	116,688	110,815
Doan Hung district	7,435	7,672	8,140	7,749
Thanh Hoa district	8,147	8,123	7,814	8,028
Lap Thach district	10,936	10,866	11,733	11,178
Oxen/Cattle				
Vinh Phu province	144,066	148,023	15,660	102,583
Doan Hung district	4,618	5,410	6,192	5,407
Thanh Hoa district	11,339	11,563	12,027	11,643
Lap Thach district	20,153	21,559	23,851	21,854
Pigs (> 2 mos.)				
Vinh Phu province	447,642	528,264	606,005	527,304
Doan Hung district	20,192	21,740	23,520	21,817
Thanh Hoa district	35,397	42,525	44,523	40,815
Lap Thach district	51,603	62,957	66,286	60,282

Source: Vinh Phu Province, Division of Statistics (1994).

Animal production is also important for the whole agricultural production system. It provides draft animals for the farm, manure for fertilizer, and animal protein for human nutrition. Table 1.7 shows populations of large livestock species over a three-year period (1991–93) in the study area.

Rice Production

Rice is the most important food crop. It is the main source of nutrition for people and constitutes the basis of the daily diet. Until recently, the goal at both the district and household levels was to be self-sufficient in rice. The paddy fields are where people prefer to concentrate their labor in preference to work on other crops. Cultivation is highly intensive and employs advanced technology, including pesticides, improved seed varieties, and fertilizer (both chemical and organic). All the products of the paddy fields are used. For instance, rice straw is used in the household as fuel (25 percent), as fodder for livestock (25 percent), or as mulch recycled into the fields (50 percent). When fields are fallowed for part of the year, livestock are grazed there, thereby recycling rice straw and depositing more manure in the fields.

Two crops are grown: one spring and one summer. The first crop is sown in December and transplanted in late January to early February, harvest is in late May or early June. The second cropping season starts in June with preparation of the seedbed and sowing. Transplanting is performed in July; during October and early November, the crop is harvested (see Table 1.8).

Both cropping periods have problems. In the spring crop there is a shortage of water, and in the summer there is often a surplus so that flooding is a hazard. There is more land with sufficient water during the summer, which makes the summer crop production

Table 1.8 Crop calendar for the Midlands region

Crop/activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice												
Nursery					-----						*****	
Soil preparation						-----						*****
Planting		*****						-----				
Fertilization		****		****				---		---		
Weeding	****		****					---	---			
Harvest					*****					-----		
Tea												
Fertilization			---	---							---	
Pesticides			---				---			---		---
Weeding			---			-----					---	
Harvest			-----+-----									
Cassava												
Soil preparation		-----										
Planting		-----										
Fertilization		-----										
Harvest										-----		
Peanut												
Soil preparation						-----						*****
Planting		*****					-----					
Fertilization		*****					---	---				
Weeding		*	*	*			---	---				
Harvest				*****					---			

Source: Modified from Le Trong Cuc, Gilgoly, and Rambo (1990).

***** = Winter crop

----- = Summer crop

+++++ = Peak season, when labor demand for tea harvest conflicts with that for rice harvest.

higher than the spring crop production. Insect attack on crops is a major problem. Losses caused by insects and other pests during storage are negligible.

Land areas, production, and yields of annual, spring, and summer rice crops over a three-year period (1991–93) in the study area are shown in Tables 1.9, 1.10, and 1.11.

By minor adjustment of the rice planting schedules, it is sometimes possible to produce vegetables in the period between the two rice crops or to grow winter catch crops on drained paddy fields following the harvest of the summer rice crop. Table 1.12 shows land areas, production, and yields of winter crops grown in Vinh Phu.

Land areas, production, and yields of major non-rice crops in the study area are shown in Table 1.13.

Maize Production

In terms of land area, maize is the most important non-rice crop grown in Vinh Phu. Maize is generally grown on gentler upland slopes and is also a popular catch crop on drained paddy lands in the off-seasons. Productivity of the maize crop is low, with annual

Table 1.9 Land area, production, and yield of combined spring and summer rice crops (1991–93)

Administrative unit	Land area (ha)				Production (t)				Yield (t/ha)			
	1991	1992	1993	Avg.	1991	1992	1993	Avg.	1991	1992	1993	Avg.
Vinh Phu province	146,322	144,442	144,358	145,041	263,090	401,416	429,618	364,708	1.798	2.779	2.976	2.518
Doan Hung district	6,955	6,891	6,834	6,893	10,977	15,729	16,250	14,319	1.578	2.283	2.378	2.080
Thanh Hoa district	12,185	11,551	11,755	11,830	18,825	28,581	31,138	26,181	1.545	2.474	2.649	2.223
Lap Thach district	13,473	13,706	13,181	13,453	24,074	36,747	34,947	31,923	1.787	2.681	2.651	2.373

Source: Vinh Phu Province, Division of Statistics (1994).

Table 1.10 Land area, production, and yield of spring rice crop (1991–93)

Administrative unit	Land area (ha)				Production (t)				Yield (t/ha)			
	1991	1992	1993	Avg.	1991	1992	1993	Avg.	1991	1992	1993	Avg.
Vinh Phu province	74,482	73,795	72,025	73,434	51,092	209,140	208,287	156,173	0.686	2.834	2.892	2.137
Doan Hung district	3,262	3,306	3,197	3,255	1,844	7,546	7,085	5,492	0.565	2.283	2.216	1.688
Thanh Hoa district	6,132	5,919	5,701	5,917	3,080	14,259	14,538	10,626	0.502	2.409	2.550	1.820
Lap Thach district	6,858	6,878	6,600	6,779	5,920	18,460	16,560	13,647	0.863	2.684	2.509	2.019

Source: Vinh Phu Province, Division of Statistics (1994).

Table 1.11 Land area, production, and yield of summer rice crop (1991–93)

Administrative unit	Land area (ha)				Production (t)				Yield (t/ha)			
	1991	1992	1993	Avg.	1991	1992	1993	Avg.	1991	1992	1993	Avg.
Vinh Phu province	71,840	70,644	72,334	71,606	211,998	192,276	221,331	208,535	2.951	2.722	3.060	2.911
Doan Hung district	3,693	3,585	3,637	3,638	9,137	8,183	9,165	8,828	2.474	2.283	2.520	2.426
Thanh Hoa district	6,053	5,632	6,054	5,913	15,745	14,322	16,600	15,556	2.601	2.543	2.742	2.629
Lap Thach district	6,615	6,828	6,581	6,675	18,151	18,287	18,386	18,275	2.744	2.678	2.794	2.739

Source: Vinh Phu Province, Division of Statistics (1994).

Table 1.12 Land area, production, and yield of winter crops, Vinh Phu province (off-season catch crops on drained paddy land; 1991–93)

Crop	Land area (ha)				Production (t)				Yield (t/ha)			
	1991	1992	1993	Avg.	1991	1992	1993	Avg.	1991	1992	1993	Avg.
Maize	11,714	14,431	16,557	14,234	24,595	28,082	32,636	28,438	2.10	1.95	1.97	2.01
Sweet potato	12,400	14,047	13,359	13,269	25,144	80,588	85,924	63,885	2.03	5.74	6.43	4.73
Potato	1,428	1,256	801	1,162	12,982	8,430	6,341	9,251	9.09	6.71	7.92	7.91
Vegetable	4,626	4,246	4,286	4,386	53,812	43,814	50,440	49,355	11.63	10.32	11.77	11.24
Bean	609	670	467	582	348	415	379	381	0.57	0.62	0.81	0.67
Soybean	1,073	789	1,128	997	734	589	958	760	0.68	0.75	0.85	0.76

Source: Vinh Phu Province, Division of Statistics (1994).

Table 1.13 Land area, production, and yield of non-rice crops (averages, 1991–93)

Administrative unit	Land area (ha)	Production (t)	Yield (t/ha)	Land area (ha)	Production (t)	Yield (t/ha)	Land area (ha)	Production (t)	Yield (t/ha)
	Maize			Sweet potato			Peanut		
Vinh Phu province									
Annual	24,031	41,809	1.73	18,143	101,404	5.59	6,964	5,571	0.79
Spring	21,384	37,418	1.74	16,542	96,771	5.84	5,626	4,662	0.82
Summer	2,646	4,392	1.65	1,601	4,634	2.90	1,338	909	0.68
Doan Hung district	1,112	2,072	1.84	567	2,049	3.61	322	231	0.73
Thanh Hoa district	1,494	2,505	1.72	803	3,317	4.16	977	946	0.97
Lap Thach district	2,366	3,587	1.50	3,183	13,535	4.25	951	635	0.63
	Soybean			Cassava					
Vinh Phu province									
Annual	3,015	1,993	0.66	12,629	118,369	9.39			
Spring	2,207	1,382	0.63	—	—	—			
Summer	809	610	0.75	—	—	—			
Doan Hung district	81	31	0.39	600	4,915	8.19			
Thanh Hoa district	46	46	1.00	1,277	13,889	10.92			
Lap Thach district	226	128	0.56	1,696	15,730	9.29			

Source: Vinh Phu Province, Division of Statistics (1994).

averages of only 1.7 tons per hectare. Winter crop averages are slightly higher. Maize grain is used for both human consumption and livestock feed.

Sweet Potato Production

Sweet potato is the second most important non-rice crop in Vinh Phu in terms of land area and is the most popular winter catch crop on drained paddy lands. Tuber yields are high, averaging nearly 5 tons per hectare. Land areas planted and yields are both considerably higher for the winter crop. Sweet potato tubers and leaves are used for both human consumption and animal feed. Sweet potatoes are generally considered to be a low-status food by the Kinh.

Cassava Production

Cassava or manioc is an important crop because it can substitute for rice as a staple food when rice production is low. Cassava tubers also provide feed for pigs, and leaves are fed to fish. Soil conservation is seldom practiced in the planting of the cassava crop; soils are rapidly degraded and eroded as a consequence. Due to low soil fertility, cassava production is quite low, about 8–10 tons/hectare/year. Higher yields of 15–18 tons/hectare/year are possible on recently opened land.

Peanut Production

Peanut or groundnut is a relatively new crop in the Midlands but is becoming more important each year. Peanut is grown in many of the homegardens and is a highly valued food. It is rich in energy and protein and could be an excellent complement to the

low-protein diet of today. Peanut is good for crop rotation because it is a nitrogen-fixing plant. The peanut also provides leafy greens, which are a good source of animal fodder and a nitrogen-rich green manure. When interplanted with cassava, peanut aids in soil conservation by providing vegetative cover to the soil prior to closure of the cassava leaf canopy.

Tea Production

Tea is an important cash crop for the cooperatives. The yield of monocultural tea plantations is not sustainable, however. The CRES Project has experimented with a very promising agroforestry system of tea mixed with widely scattered wood trees (e.g., *Cassia siamea*, *Aleurites montana*).⁵ This establishes an upper story and also provides appropriate shade for tea as well as for the farmers tending their fields. Between the rows of tea, the leguminous shrub species *Tephrosia candida* is planted. This increases soil cover, which prevents erosion, retains moisture, and fixes nitrogen.

Tea is harvested starting in March, with the peak season in May and June (see Table 1.8). Harvesting goes on every ten days until the middle of August. Weeding was done once a year on the cooperative farms, but on family farms it may be done as many as three or four times a year. During spring or December, the tea plants are pruned.

Unprocessed tea is sold either to the cooperative or to private merchants, from which the farmer receives either cash or the equivalent value in rice, as the farmer chooses. Tea may be processed by the households, but this is labor intensive. Now, farmers have the option of selling wet tea.

Table 1.14 shows land areas, production, and yields of tea in the study area over a three-year period (1991–93).

Table 1.14 Land area, production, and yield of tea crop (1991–93)

Administrative unit	1991		1992		1993		Average	
	Area (ha)							
	Total	Productive	Total	Productive	Total	Productive	Total	Productive
Vinh Phu province	6,533	4,475	7,047	5,140	7,223	5,406	6,934	5,007
Doan Hung district	573	361	716	560	689	565	659	495
Thanh Hoa district	924	683	1,016	645	1,036	630	992	653
Lap Thach District	14	14	14	14	15	14	14	14
	Production (t)							
Vinh Phu province	1,428		16,484		18,239		16,314	
Doan Hung district	842		1,064		1,045		984	
Thanh Hoa district	1,709		1,980		1,930		1,873	
Lap Thach district	20		16		20		19	
	Yield (t/ha)							
Vinh Phu province	3.177		3.207		3.374		3.253	
Doan Hung district	2.332		1.900		1.850		2.027	
Thanh Hoa district	2.502		3.070		3.063		2.878	
Lap Thach district	1.429		1.143		1.429		1.333	

Source: Vinh Phu Province, Division of Statistics (1994).

Table 1.15 Forestry area of the study area (1990)

Administrative unit	Plantation forest		Natural forest		Barren land		Total	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Vinh Phu province	23,335	11.6	35,763	17.7	140,614	69.7	201,713	100
Doan Hung district	732	13.1	0	0.0	4,842	86.9	5,574	100
Thanh Hoa district	2,104	43.5	294	6.1	2,440	50.4	4,839	100
Lap Thach district	2,462	23.7	3,588	34.6	4,318	41.6	10,368	100

Source: Vinh Phu Province, Division of Statistics (1994).

Forestry Production

Some plantations of *Styrax tonkinensis* and *Manglietia glauca* intended for pulpwood, construction, and carpentry wood are being planted. *Styrax* and *manglietia* are trees indigenous to the Midlands region of northern Vietnam. They are the pioneers in areas where the forest has been cut and burned. They grow mostly in deep soil where there is sufficient moisture. In such conditions, they can yield about 16–18 cubic meters/hectare/year. *Eucalyptus* is a common plantation tree, grown for pulpwood.

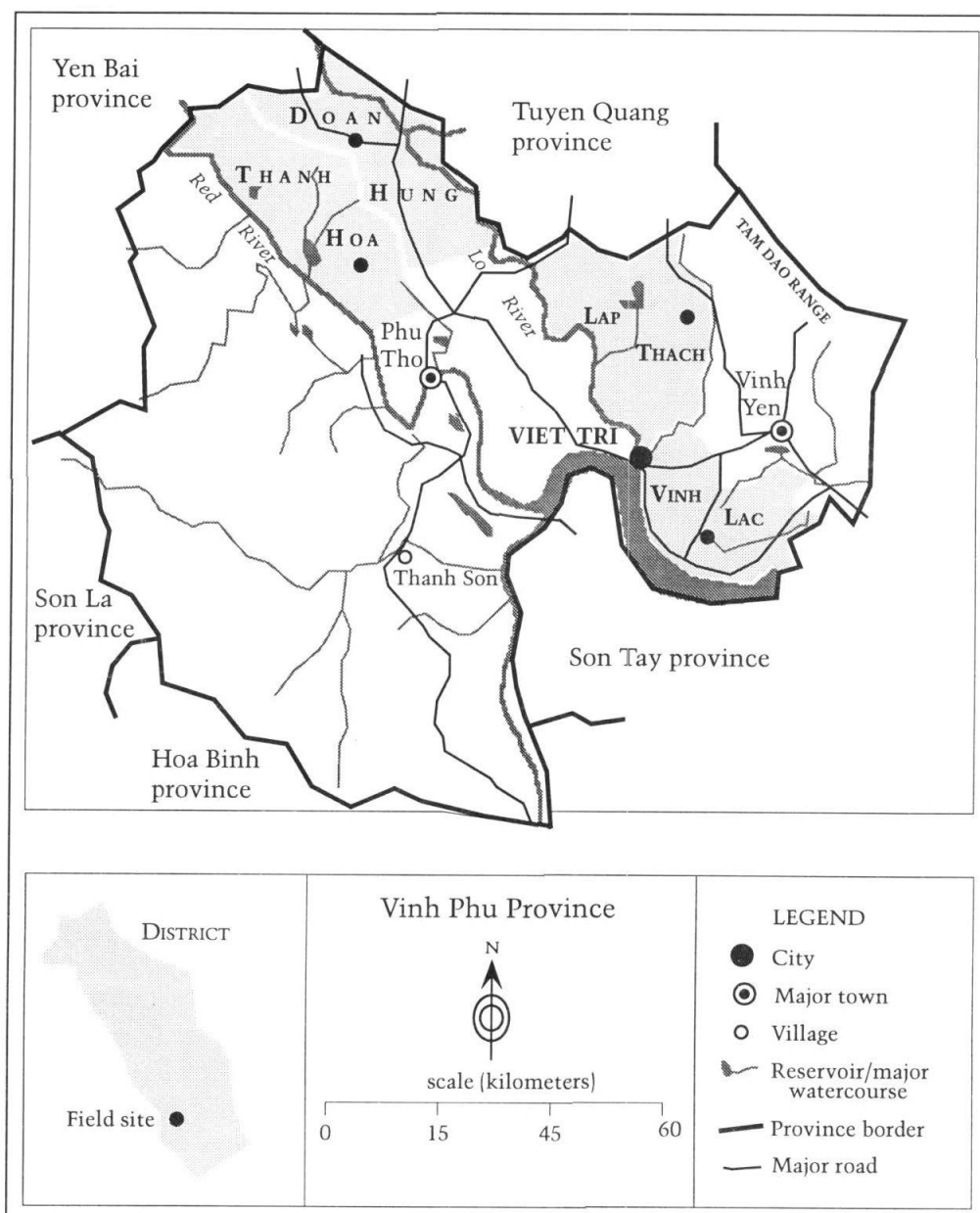
Table 1.15 shows areas of natural and plantation forestry and land classified as barren in the study area.

THE THREE DISTRICTS

Three districts in Vinh Phu province were selected for study as representing the diverse range of ecological and social conditions encountered in the Midlands (Map 1.2). Thanh Hoa, Doan Hung, and Lap Thach districts are located about 150 kilometers northwest of Hanoi. They lie between north latitudes 21°18' and 21°4'. Table 1.16 shows land area, population, and population density for the study area.

Thanh Hoa and Doan Hung districts are located in the northwest of Vinh Phu province, between the Lo and Thao Rivers. The Thao River is in the west of Thanh Hoa district; the Lo River is in the north of Doan Hung. The two districts border on Tuyen Quang (formerly southern Ha Tuyen) province in the north and on Phong Chau district in the south. Lap Thach district is near the center of Vinh Phu province. The Lo River forms its western border and the Day River flows through the district near its eastern border. Lap Thach district borders on Tuyen Quang province in the north, Vinh Yen district in the south, Tam Dao district in the east, and Phong Chau district in the west.

The elevation of the three districts ranges from 15 to 1,000 meters above sea level. Close to 90 percent of the total area of the three districts has an elevation between 15 and 100 meters (see Map 1.3). Territory with an elevation greater than 15 meters is considered Midlands and mountains; by this standard, the greater part of these districts is classified as Midlands. In the north of the three districts are mountain ranges with elevations ranging from 500–1,000 meters. A few such mountains are on the northeast edge of Lap Thach district. Due to the many mountains, hills, springs, and rivers, the topography of these three districts is highly divided. The slope generally exceeds 10 percent. (See Table 1.17 for a summary of the physio-geographical characteristics of all three districts.)

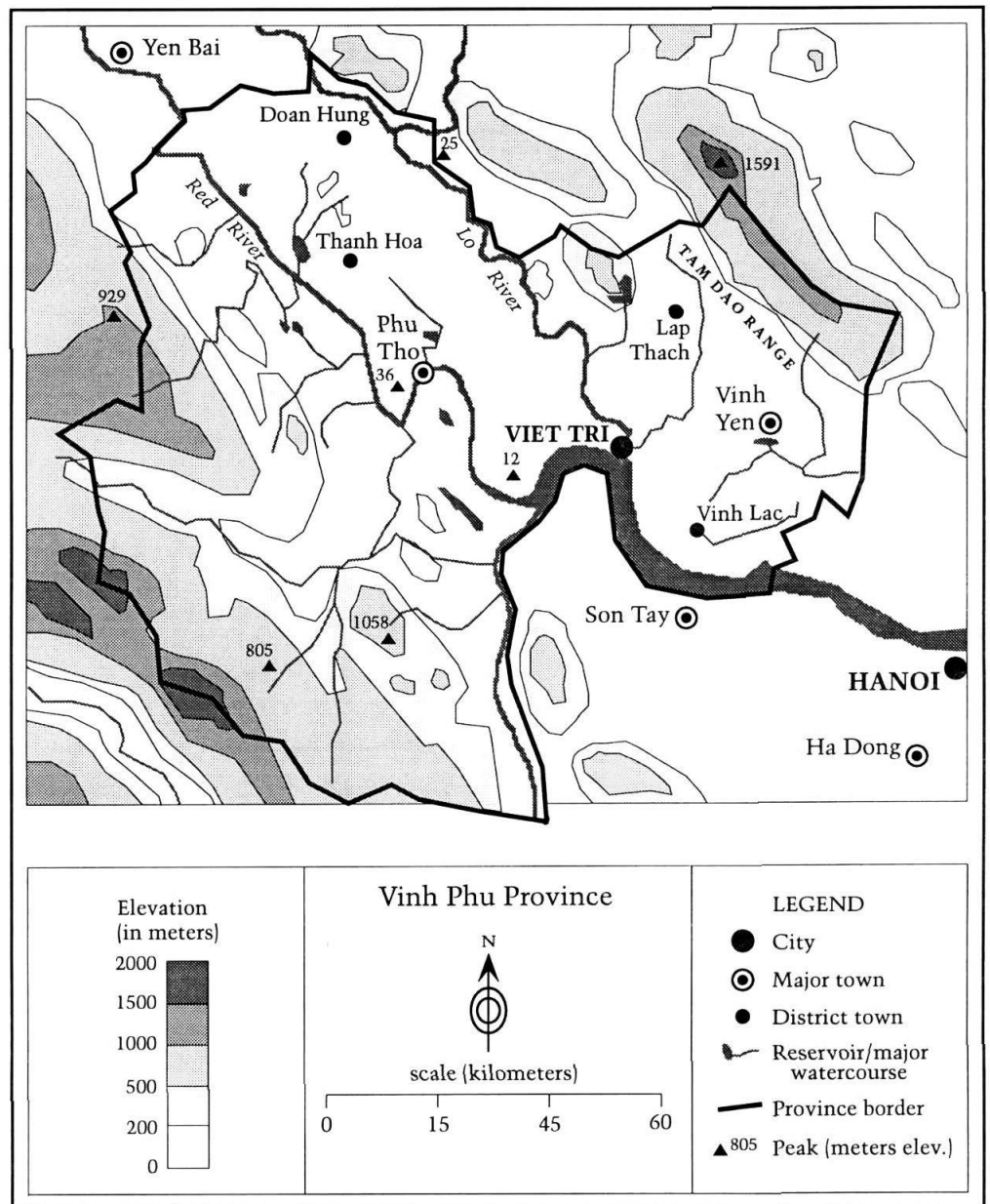


Map 1.2 Vinh Phu province and the three study districts

Table 1.16 Land area and population statistics (as of 31 December 1993) of the study area

Administrative unit	No. of villages	Area		Population				% Increase 1989-93
		km ²	%	1989	1993			
					Total	% of prov.	Density (/km ²)	
Vinh Phu province	414	4,824.8	100.0	—	2,236,319	100.0	464	—
Doan Hung district	27	303.7	6.3	86,700	96,415	4.3	317	11.2
Thanh Hoa district	49	392.2	8.1	164,057	185,557	8.3	471	13.1
Lap Thach district	38	409.4	8.5	189,660	209,611	9.4	512	10.5

Source: Vinh Phu Province, Division of Statistics (1994).



Map 1.3 Topography of Vinh Phu province

The main characteristics of the river system of Vinh Phu province in general and of the three districts in particular are as follows:⁶ (1) The rivers are part of the Red River system; the study area is drained by two major rivers—the Thao and the Lo—that are tributaries of the Red River system, and a third major river—the Day—is a tributary of the Lo River. (2) The tributary rivers have steep slopes, in keeping with the topography; there are some waterfalls and rapids on these rivers and their tributaries, and drainage is rapid, but the rivers are navigable within the study area. (3) The density of rivers is low and irregular among the three districts; this is because of the differing precipitation levels and geological structures in these areas.

Table 1.17 Physical characteristics of the three study districts

District	Annual rainfall (mm)	Soil characteristics	Slopes	Water control	Vegetation
Doan Hung	1,800–2,000	relatively deeper; more fertile and higher organic matter	fewer signs of erosion	fair; conditions poor	extensive forest (plantation or natural secondary)
Thanh Hoa	1,800–2,000	acidic; low fertility	highly eroded	good; favorable for small-scale water impoundment	very little forest (natural or plantation)
Lap Thach	2,000	shallow; rocky; infertile; highly eroded	highly erodible	poor; difficult due to unevenness of topography	some forest at higher elevations

Source: Modified from Le Trong Cuc, Gillogly, and Rambo (1990).

Thanh Hoa District

Rainfall in Thanh Hoa district averages 1,500–1,800 millimeters per year. The hill slopes in the district are highly eroded with acidic soils of low fertility. About 65 percent of the district's surface area is hills. There is almost no natural forest cover, and most hill slopes are either barren or (increasingly) covered by plantation forest. The topography is favorable for construction of small-scale water impoundments and a highly developed system of irrigated rice terraces. Thanh Hoa district also has some larger reservoirs; one of them, Ao Trau, is also being developed as a tourist area due to its beautiful setting.

Thanh Hoa district is an area of old settlement, with a relatively dense population; its 185,600 residents live in 49 villages. The total land area is approximately 39,420 hectares. The main crops, in order of importance by land area, are rice, maize, cassava, peanut, sweet potato, and tea.

Doan Hung District

The surface area of Doan Hung is 30,370 hectares, of which only 8,300 are planted to food crops. About 6,830 hectares are wet rice fields. Doan Hung has the same rainfall (1,800–2,000 millimeters per year) as Thanh Hoa district, but has deeper, more fertile soils with more organic matter and fewer signs of erosion, and relatively extensive areas of forest, both secondary-growth natural forest and artificial plantations. Conditions for control of water in the valleys are unfavorable, however, with rice cultivation carried out under constant threat of flood and drought. The main crops, in order of importance by land area, are rice, maize, cassava, sweet potato, tea, and peanut.

Doan Hung district is a much more recently settled area with a lower population density. The population is 96,400 living in 27 villages. One of the villages we studied, Tay Coc, was occupied in part by people resettled from an area chosen for dam construction in 1966. The government compensated these people for the trees they had planted, transported them to the new site, and gave them new houses.

Lap Thach District

Lap Thach district is the poorest of the three sites. Although it is the most recently settled area, it has the highest population density, with 209,600 people living in 38 villages on a total surface area of 40,900 hectares. It receives about 2,000 millimeters of rain per year. Of the three districts, it has the worst soil conditions, with thin rocky soils of very low fertility and high erosion potential. Some forest remains at higher elevations, but many hilltops are barren rocky wastelands displaying deep erosional gullies. The narrow valleys provide only a small area suitable for cultivation of wet rice. Water control is made difficult by the unevenness of the topography and the consequent variation in elevation of the steeply terraced paddies. In terms of planted areas, the main crops are rice, sweet potato, maize, cassava, peanut, soybean, and tea.

Compared to the other two districts, Lap Thach has a diverse cropping regime. Relatively less of its cultivated land is devoted to rice. Rice yields per hectare are higher in Lap Thach district than in Thanh Hoa or Doan Hung districts, but are still below the provincial average.

NOTES

1. In 1989 and in the present study, we concentrated our research on three of the eleven districts in Vinh Phu province: Doan Hung, Thanh Hoa, and Lap Thach. We consider this setting to be fairly well representative of the diverse range of ecological and social conditions encountered in the Midlands region of northern Vietnam. A more detailed description of the three districts follows the general description of the Midlands region in this chapter.
2. The environmental adaptation of one of these groups—the Cao Lan of Doan Hung district—is well described in Gillogly and Nghiem Phuong Tuyen (1992).
3. Annual population growth rates in the three districts of our study ranged from 2.6 to 3.3 percent over a four-year period (Table 1.17), higher than the national average. We have no data on migration rates and are thus unable to comment on the success of the birth control program in our study area.
4. In contrast to the image conjured by the term, “bare hills” do not generally have exposed soil surfaces that are devoid of vegetation for long periods of time. “Bare hills” is a more specific subset of the Ministry of Agriculture and Food Industries’ classification of “barren land.” Barren land includes (1) steep mountain slopes that have been denuded by human interference, such as shifting cultivation and logging; (2) hilly regions with bush and scrub vegetation, pasture, and high grass; and (3) rocky mountains (MAFI 1993). For a discussion of Vietnamese government policies on barren lands, see Sikor (1995, 143–56).
5. CRES research on rehabilitation of degraded lands in the Midlands is discussed in detail in Chapter 2.
6. Information on the physical characteristics and water resources of the three districts is drawn from an unpublished manuscript titled “Water resources and their use in three districts of the Midlands province of Vinh Phu” by Nguyen Van Tuan, Hydrology Section, Hanoi University (n.d., in Vietnamese).

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Approaches to the Rehabilitation of Degraded Lands in the Midlands of Vietnam

Le Trong Cuc

The Center for Natural Resources and Environmental Studies (CRES) of Hanoi University conducted a project on restoration ecology in the northern Midlands. The project was part of a national research program, the Rational Utilization of Natural Resources and Environmental Protection. This program was created in 1981 to assemble researchers from leading educational and research institutions throughout the country for a review of the state of the environment, identification of critical environmental issues, and the development of appropriate solutions to natural resource management and environmental problems.

The program highlighted forest loss as the most serious factor threatening sustainable productivity of the country. Specific critical issues identified by the program include shortages of fuel and timber, increased incidence of flood and drought, increased damage from typhoons, siltation of irrigation channels and dams, indirect losses to agriculture, loss of genetic resources, and spread of nonproductive wastelands. Degraded lands are mainly concentrated in the Midlands.

The objective of the CRES project was to establish ecological models for rational utilization and improvement of the barren lands in the Midlands, in order to maintain long-term, stable productivity.

This chapter describes some of the major environmental problems associated with land use in the northern Midlands and some approaches aimed at ameliorating these problems. Results of CRES research on improved practices are presented, and some recommendations are offered on land use practices that are seen as technically appropriate to the Midlands landscape. Later chapters will discuss how social and economic changes brought on by recent economic reform policies will affect the potential for implementation of some of these land use practices.

SUCCESSION OF FOREST AND GRASSLAND COMMUNITIES IN THE MIDLANDS

Under pressure from clearing and burning for cultivation and grazing, extraction of timber, and erosion, the forests in Vietnam have largely been destroyed. Figure 2.1 shows a conceptual model of anthropogenic secondary succession of forests in Vietnam. Originally, the Midlands were almost completely covered by forest, but now forests, of varying composition, cover only about 26 percent of the total land area.

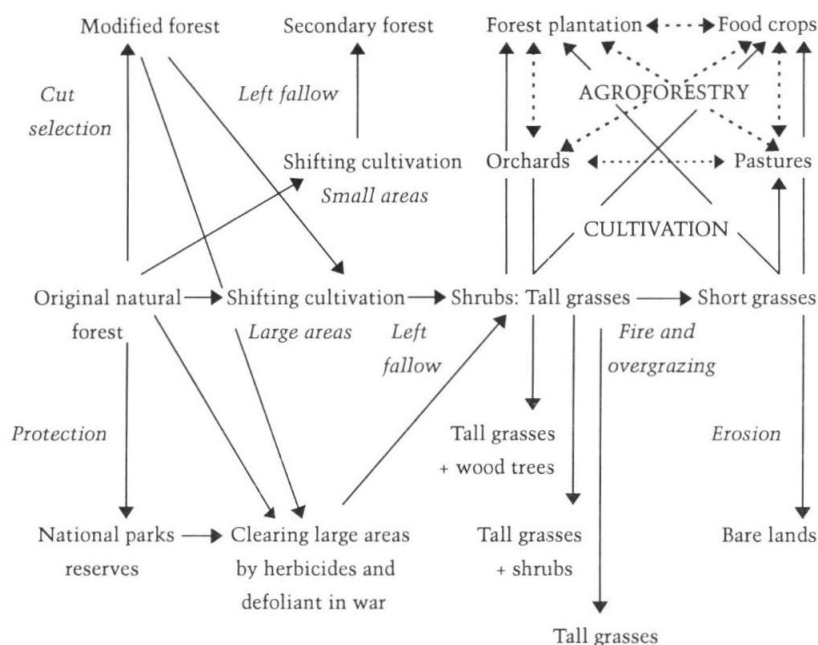


Figure 2.1 Conceptual model of anthropogenic secondary succession of forests in Vietnam¹

Most of the forest types in the Midlands fall into the closed seasonal tropical evergreen category, dominated mostly by species in the families Dipterocarpaceae, Moraceae, Meliaceae, Lauraceae, Fagaceae, Burcetaceae, and Sapindaceae. These mixed forests are rich in species and produce an abundance of valuable resources, including valuable types of timber (*Erythrophloeum fordii*, *Chukrasia tabularis*, *Manglietia fordiana*), medicinal plants, resins and oils, and other forest products. Natural forests provide habitat for birds and other wildlife. They also contribute to regulation of the water regime and prevention of soil erosion.

Most commonly, remaining forests in the Midlands are modified or secondary forests, characterized by bamboo thickets, normally *nua* (*Neohouzeana*) or *giang* (*Dendrocalamus*). Some areas, where the soil retains more moisture and where there is good protection from fire and grazing, are capable of rapidly regenerating into secondary forests with fast-growing species such as *Macaranga denticulata*, *Trema orientalis*, *T. angustifolia*, *Mallotus apelata*, *M. cochinchinensis*, *Rhus chinensis*, and *Manglietia glauca*. At first these forests have a low species diversity and a simple structure, but, if uninterrupted, succession may in time restore them to their original state.

Continued agricultural use that includes burning eventually degrades the vegetation type into grasslands. Under some climatic conditions, particularly in areas with a well-marked dry season, grasses are inflammable in the dry season. If burned repeatedly, the land becomes more-or-less permanently degraded, precluding reestablishment of trees, and the grassy areas are likely to expand. The dominant grass species are *co tranh* (*Imperata cylindrica*), *lau* (*Saccharum spontaneum*), *lach* (*Miscanthus chinensis*), and *chit* (*Thy-sanoleana maxima*). The annual weed *Chromolaena odoratum* (also known as *Eupa-*

torium odoratum) is most commonly the first pioneer species after fire on these sites. In areas that have been heavily used for agriculture, the grasslands are eventually degraded further into scrublands containing low scrub species such as *sim* (*Rhodomirtus tomentosa*), *mua* (*Melastoma candidum*), *Aporosa microcalic*, *Helicteris angustifolia*, and with grass species such as *Imperata cylindrica*, *Chrysopogon aciculatus*, *Eriachne* sp., *Digitaria* sp., *Paspalum scrobiculatum*, and *Panicum repens*. Heavily degraded areas are characterized by a cover of *Dicranopteris* fern. Land that has been completely abandoned for agriculture and grazing is partially covered with either low mat grass such as *Chrysopogon aciculatus*, *Eriachne* sp., *Digitaria violasens*, and *Eragrostis geneculata*, or the plant *Elephantopus scaber*.

On the hill slopes of the Midlands, deforestation has led to serious environmental degradation, including deep gully erosion; loss of topsoil, humus, and soil fertility; and drying up of water sources during the dry season. Not only does degradation result in almost total loss of local productivity, it may also have disastrous consequences in downstream agricultural areas, due to destructive flash floods and siltation of dams, reservoirs, and irrigation canals.

RESEARCH ON PROBLEM FARMING SYSTEMS IN THE MIDLANDS

Cassava Production

Cassava, which is grown on almost all hilly lands in the Midlands, is an important crop in the region's production system as well as a significant source of environmental degradation. Cassava tubers are food for people and feed for livestock, and provide materials for the food processing industry. Realizing the major role of cassava in food production and environmental conservation in the Midlands, CRES conducted research on cassava production to determine efficient cultivation methods with minimal adverse environmental impacts.

Research was conducted on the impacts of different cassava cultivation methods on soil quality, erosion, and productivity (Table 2.1). Interplanting legumes between rows of cassava can produce 2.6–4.4 tons of fresh biomass per hectare, which are then incorporated in situ as a source of green manure to maintain soil fertility. Equivalent amounts of nitrogen per hectare produced by that weight of fresh biomass are approximately 60 kilograms for *Tephrosia candida*, 44 kilograms for peanut, and 42 kilograms for mung

Table 2.1 Cassava productivity and changes in soil properties (averages for three years)

Cropping system	Legume biomass (leaves and stems, fresh)				Soil loss				N balance (kg/ha/yr)	Production (t/ha/yr)
	t/ha/yr	Equivalent NPK (kg/ha)			t/ha/yr	Equivalent NPK (kg/ha)				
		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O		
Cassava monoculture	—	—	—	—	120	122	61	86	−122	5.03
Cassava with <i>Tephrosia</i>	4.00	60	13	60	20	26	6	10	+34	5.40
Cassava with peanut	2.80	44	7	49	30	34	8	13	+10	5.38
Cassava with mung bean	2.60	42	7	50	28	31	7	12	+11	5.31

bean. These amounts of fresh biomass can also supply soils with 60 kilograms P_2O_5 and 50 kilograms K_2O /hectare/year.

Both physical and biological methods have been studied to control soil erosion in the Midlands. Our research has shown that where neither physical nor biological methods are applied (bare, unterraced soils), soil erosional losses are approximately 245 tons/hectare/year from runoff plots with slopes of 15–20 degrees (Le Trong Cuc and Pham Van Thanh 1990).

Soil losses of approximately 147 tons/hectare/year are common from monocropped cassava cultivation systems. When cassava is interplanted with *Tephrosia candida*, a fast-growing leguminous tree species, soil loss is reduced to only 20 tons/hectare/year, compared with 28 tons/hectare/year from cassava interplanted with mung bean and 30 tons/hectare/year from cassava interplanted with peanut.

In addition to the fresh biomass additions that improve soil fertility and soil physical properties and protect the soil from erosion, interplanted legume species provide marketable products such as peanuts, mung beans, and firewood. Interplanting legumes also results in higher cassava tuber yields. Tuber yields increased an average of 15–20 percent over a two-year period.

Our results suggest that cassava cultivation be limited to gentler slopes not exceeding 10 degrees. Cassava should be mixed with legumes such as peanut and mung bean, and planted along contours or preferably on terraced fields. Where soils are poor, legumes interplanted with cassava will produce fresh biomass to improve soil, retain moisture, and prevent erosion. This is a scientific method to meet the demands for fertilizer, retain soil moisture, prevent soil erosion, maintain soil productivity, and increase yields with minimal adverse environmental impacts.

Tea Production

Monocultivation of tea has been the most common type of cultivation system practiced on most of the Midlands hills for many years. Long-term monoculture accelerates land degradation and nutrient impoverishment of the tea crops. Soil tilth has decreased, and soils are gradually getting harder and harder. Pest infestations and diseases often occur. Yields of tea harvested from monoculture in the hills of Vinh Phu and Bac Thai provinces decrease rapidly after several years of cultivation.

Tea cultivation methods greatly influence the concentrations of total NPK found in the soils. Interplanting leguminous trees with tea can produce relatively large amounts of green manure. For instance, interplanting tea with legumes such as *Tephrosia candida*, *Cassia siamea*, or *Acacia auriculiformis* can enhance total N by approximately 44 percent, total P_2O_5 by 40–100 percent, and total K_2O by 50–360 percent.

Intensive cultivation of tea interplanted with leguminous trees is of decisive significance to the enrichment of nutrients available in the soils. Soils are less acidic, with higher cation exchange capacities (CECs), compared to the very low CEC and high acidity of tea

monoculture. Concentrations of extractable aluminum are also higher under tea monoculture.

Results of our research show that highly intensive cultivation of tea interplanted with leguminous trees can increase yields 85–150 percent.

Forestry Plantations

In the humid tropics, trees are the dominant form of natural vegetation. Trees have the ability to produce food and other products on marginal lands under adverse biological and physical conditions. Forest plantations on steep slopes can help regulate the water regime, prevent erosion and floods, and improve soil and microclimate conditions. The success of forest plantations largely depends on the selection of suitable species that adapt to the local ecological conditions, satisfy socioeconomic demands, and ameliorate the environment.

In recent years, a number of forest plantations have been established in the Midlands. The planting of indigenous species such as *Styrax tonkinensis*, *Manglietia glauca*, and the recently introduced species *Eucalyptus camaldulensis* are encouraged in order to provide wood pulp, support timbers for mines, and lumber for construction.

Indigenous Species Results of our research show that styrax and manglietia are fast-growing indigenous species suitable for the Midlands climate. Under prevailing conditions in the Midlands, styrax can yield 120–130 cubic meters per hectare on a 10-year cutting cycle with a stable planting density of 700–800 trees per hectare. Planted on poor soils where only bamboo had grown previously, 15–20 year old manglietia with a planting density of 600 trees per hectare can yield 10 cubic meters/hectare/year over a 10-year period. However, there are many places in the Midlands where soils are becoming increasingly compacted and impoverished and where conditions are not at all favorable for styrax and manglietia growth and development.

Introduced Species Some 600 eucalyptus species are grown on more than 4 million hectares in over 80 countries worldwide, often outside their natural range of Australia and nearby Asian-Pacific countries. The extreme popularity of this genus is attributed to its broad range of climatic and edaphic adaptability, rapid growth rate, and wide range of uses: e.g., sawn timber, paper pulp, fuelwood, and flavoring and medicinal oils. Eucalyptus flowers are also a major source of nectar for apiculture.

Eucalyptus can grow under a wide range of soil and moisture conditions, from dry, infertile, seriously degraded slopes to fertile wetlands. Temperature extremes range from a minimum of 5°–10°C to a maximum of 30°–40°C. Rainfall of 1,500 millimeters per year is adequate for most species.

Eucalyptus wood is hard, firm, and durable. As fuelwood, it has a high calorific value. Eucalyptus leaves contain high concentrations of oils, including cineol (also called eucalyptol), which is widely used to produce disinfectants.

There is considerable controversy regarding eucalyptus impacts on soil conditions. Many people believe that long-term monoculture of eucalyptus will deteriorate soil quality,

reduce soil nutrient content, and deplete groundwater sources. The strong surface roots of eucalyptus vigorously grow deep into the soil to get water.

Shrubs and understory plants beneath *E. exserta* in the provinces of northern Vietnam are quickly eliminated. This is probably caused by the cineol in the leaves. To some extent, cineol poisons not only the vegetation beneath the forest canopy, but also soil microorganisms. The lack of a dense understory in eucalyptus plantations on sloping hillsides can result in severe erosion and gulying, particularly if leaf litter is removed from the soil surface for fuel and compost production.

Long-term cultivation of eucalyptus may result in a decline in soil fertility and soil physical properties, resulting in decreasing crop yields. The yield of an *E. exserta* forest for the first cropping cycle is 8–10 cubic meters/hectare/year. Yields of the second cycle are only 52 percent of yields harvested in the first cycle (Ling 1982; Ministry of Forestry 1983).

Vietnam has imported some 60 species of eucalyptus from Australia. Previously, only *E. exserta* was used for forestation on seriously degraded and barren lands. Due to monoculture plantations, it grew rather slowly. To meet the present demand for timber, fuelwood, and especially pulpwood for the Bai Bang Paper Mill (Phong Chau district, Vinh Phu province), a reforestation program with *E. camaldulensis* as the primary species has been established. The canopies of many of these eucalyptus forests have closed, regreening a large area of barren and degraded lands in the Midlands. An intensive cultivation system is employed, with deep (60–80 centimeter) plowing and application of manure and NPK compound fertilizers. Trees are carefully weeded and tended for the first two years in forest plantations.

Following are initial results from research on the growth of the three species *E. camaldulensis*, *E. urophylla*, and *Acacia mangium*, with observations on some of their environmental impacts. The research was conducted on four cropping models: *E. camaldulensis* monoculture, *E. urophylla* monoculture, *A. mangium* monoculture, and *E. camaldulensis* mixed with *A. mangium*.

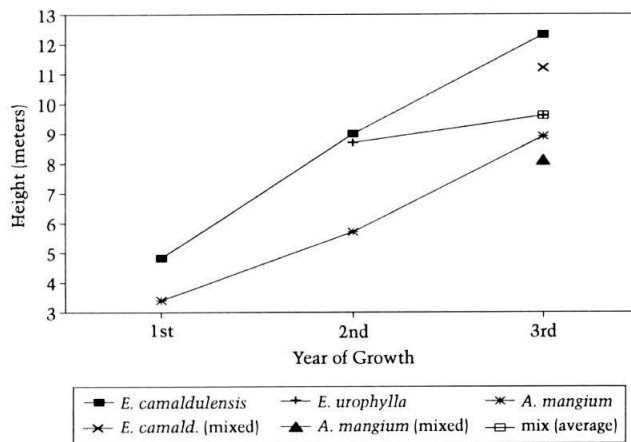
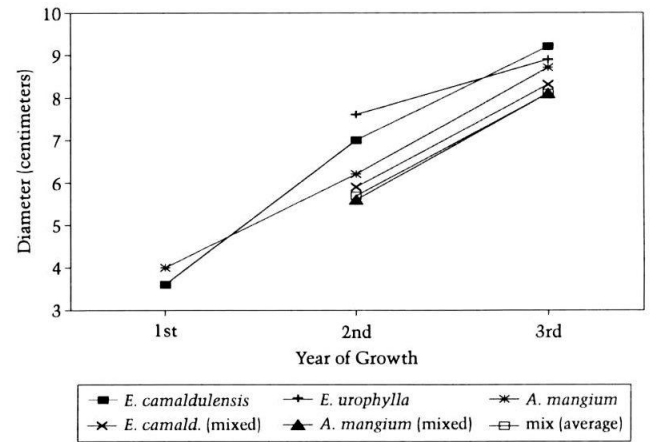
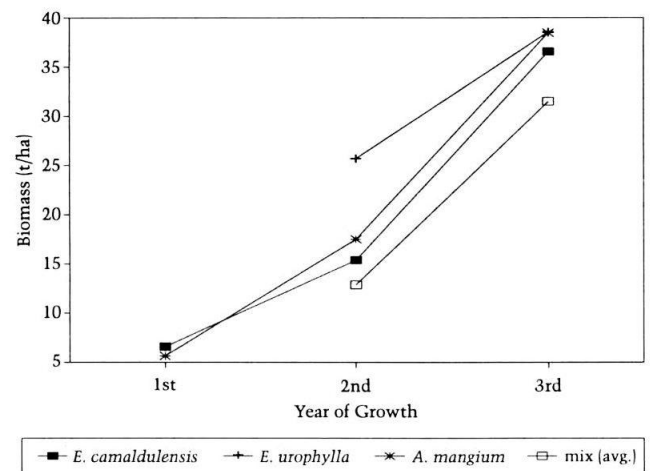
The research was conducted primarily on trial plots at Ho Van Truc unit, Lap Thach enterprise (Lap Thach district, Vinh Phu province). Some other subplots were located in Doan Hung, Thanh Hoa, Phong Chau, and Tam Dao districts. Data on height, diameter, height after thinning, canopy cover, biomass and primary productivity, and litter fall were collected in May and November each year. Statistical methods were employed for data analysis.

Initial Research Results on *Eucalyptus* and *Acacia mangium* Plantations Data on tree height, diameter, and biomass for the three tree species and the interplanted *E. camaldulensis* and *A. mangium* are shown in Table 2.2. These data are shown graphically in Figures 2.2, 2.3, and 2.4.

E. camaldulensis can produce marketable yields within eight years. Originally from Australia, *E. camaldulensis* is now found in most tropical and subtropical Asian-Pacific, African, and American countries. In the experimental plots, trees were propagated from

Table 2.2 Height, diameter, and biomass increase of various plantation forest cropping systems over a three-year period

Tree cropping system	First year			Second year			Third year		
	Height (m)	Diameter (cm)	Biomass (t/ha)	Height (m)	Diameter (cm)	Biomass (t/ha)	Height (m)	Diameter (cm)	Biomass (t/ha)
Monoculture									
<i>Eucalyptus camaldulensis</i>	4.8	3.6	6.588	9.0	7.0	15.388	12.3	9.2	36.524
<i>E. urophylla</i>	—	—	—	8.7	7.6	25.640	9.6	8.9	38.471
<i>Acacia mangium</i>	3.4	4.0	5.611	5.7	6.2	17.479	8.9	8.7	38.429
Mixed <i>E. camaldulensis</i> and <i>A. mangium</i>									
<i>E. camaldulensis</i>	—	—	—	7.8	5.9	—	11.2	8.3	—
<i>A. mangium</i>	—	—	—	5.7	5.6	—	8.1	8.0	—
Average	—	—	—	6.7	5.7	12.890	9.6	8.1	31.474

**Figure 2.2** Height (meters) of various plantation forest cropping systems over a three-year period**Figure 2.3** Diameter (centimeters) of various plantation forest cropping systems over a three-year period**Figure 2.4** Biomass (tons per hectare) of various plantation forest cropping systems over a three-year period

seed and planted at a density of 1,700 trees per hectare. The trees in the Van Truc plot closed canopy after two years. The shape of the tree is slim, and branches tend to lean toward the roots. Leaves are narrow and sparse, enabling the tree to receive more sunlight. Bark is smooth. Branches self-prune early, leaving one-half to one-third of the trunk free of branches. Contrary to the heterogeneity expected from seed propagation, about 60–70 percent of the trees were very close to average height and diameter.

E. urophylla was propagated by stem cuttings and planted at a density of 1,700 trees per hectare. The canopy closed during the second year. *E. urophylla* has a broader canopy, with harder branches tending to grow more upward, thicker leaves, and less smooth and shiny bark compared to *E. camaldulensis*.

A. mangium is a leguminous tree with an indigenous distribution ranging from northeast Australia to Papua New Guinea and Indonesia. The trees generally grow well between the latitudes of 1° and 18° and at altitudes up to 300 meters above sea level. It is grown in Malaysia, Taiwan, Thailand, the Philippines, and Vietnam. *A. mangium* grows in tropical regions, both under monsoon winds and high temperatures, and in humid wetland areas with rainfall between 1,500 and 3,000 millimeters. It can grow on seriously degraded land. *A. mangium* is an evergreen woody tree with a straight trunk and broad leaves on sparse branches, forming a broad, dense canopy. In the experimental plots, trees were propagated by seeds and planted at a density of 1,700 trees per hectare. The canopy closed during the second year. Self-pruning of branches occurs late, after the second year, when branches close to the ground die. About 70–80 percent of the trees were close to average in height and diameter.

Mixed forest plantations have been implemented on only a limited area in the Midlands. Research of *E. camaldulensis* mixed with *A. mangium* was designed to understand ecological adaptability and growth rates under climatic and edaphic conditions prevailing in the Midlands. Trees were planted at a density of 1,700 per hectare, with one row of *E. camaldulensis* grown between every two rows of *A. mangium*. The forest canopy closed in the second year. The community composition was clearly distinguished by two stories. The upper story is *E. camaldulensis*, with a lower story of *A. mangium*. The canopy of the mixed forest was less dense compared to the *A. mangium* forest during the first years of growth, but was denser than the monocultured *E. camaldulensis* forest.

In the second year, *E. camaldulensis* trees in the mixed forest reached a height of 7.8 meters, compared with 9.0 meters for trees in monocultured forests. The diameter of mixed *E. camaldulensis* trees averaged 5.9 centimeters, compared with 7.0 centimeters for monocultured trees. Mixed *A. mangium* trees reached a height of 5.7 meters in the second year, the same height as monocultured trees. Diameter of interplanted *A. mangium* averaged 5.6 centimeters, less than the monocultured trees (6.2 centimeters).

In the third year, height of *E. camaldulensis* trees in the mixed forest reached 11.2 meters, compared with 12.3 meters for trees in the monocultured forest. Average diameter of interplanted *E. camaldulensis* trees was 8.3 centimeters, compared with 9.2 centimeters for trees in monocultured forests. Mixed *A. mangium* trees reached a height of only 8.1

Table 2.3 Chemical properties of Midlands soils under various plantation forest cropping systems after four years

Tree cropping system	Soil depth (cm)	pH _{KCl}	Organic matter (%)	Total N (%)	Available N (mg/100 g)
Monoculture					
<i>Eucalyptus camaldulensis</i>	0–20	5.00	1.75	0.17	21.28
	35–50	5.08	1.03	0.12	14.56
<i>Acacia mangium</i>	0–20	5.26	1.80	0.18	30.24
	35–40	4.95	0.82	0.13	27.44
Mixed <i>E. camaldulensis</i> and <i>A. mangium</i>	0–20	5.12	2.07	0.19	27.36
	35–40	4.90	1.29	0.16	18.44

meters, while that of the monocultured trees was 8.9 meters. Diameter of interplanted *A. mangium* averaged 8.0 centimeters, less than monocultured trees (8.7 centimeters).

On average, the mixed forest reached a height of 6.7 meters and a diameter of 5.7 centimeters in the second year and 9.6 meters in height and 8.1 centimeters in diameter in the third year. These averages corresponded to average biomasses of 12.890 tons per hectare in the second year and 31.474 tons per hectare in the third year for the mixed forests. Biomass in the mixed forests was 16 percent lower than monocultured *E. camaldulensis* forests and 26 percent lower than monocultured *A. mangium* forests in the second year. In the third year, mixed-forest biomasses were 14 percent lower than monocultured *E. camaldulensis* and 18 percent lower than monocultured *A. mangium*.

Soil Properties from Various Forest Plantations Table 2.3 shows some chemical properties of soils sampled from surface and subsurface levels under various plantation forest cropping systems after four years of growth. Samples were collected from plots of similar slopes, located in proximity to each other.

Agroforestry

Agroforestry is a system of land use where woody perennials and either crops or forages (or sometimes both) are grown, either simultaneously or alternatively, with the aim of obtaining maximum output on a sustained basis. There are three main combinations—trees with crops, trees with forages, and trees with both crops and forages:

<u>Agriculture</u>	<u>Animal husbandry</u>	<u>Forestry</u>
Trees with crops (Agrosilvicultural)	Trees with forages (Silvipastoral)	Trees with crops and forages (Agrosilvipastoral)

Agroforestry can be applied to household or other small-scale production systems for self-sufficiency in food, fuelwood, timber, vegetables, animal feed, and other materials. It can help increase yields of many crops and ameliorate ecological and environmental conditions in rural areas. Agroforestry has potential application to land restoration, soil conservation, and sustainable land management.

Agroforestry Practices in the Midlands Many cooperatives and state enterprises in Vietnam have recently found species suited to different ecological zones. These include both indigenous species such as *Manglietia glauca* and *Cinnamomum* spp., and some

exotic species such as *Acacia auriculiformis* and *A. mangium*. Many other species have been used for the agroforestry models using Taungya methods.²

Thai Ha cooperative (in Hoang Lien Son province) intercropped 272 hectares of manglietia with hill rice. Under hill rice shade, manglietia grows better in its earliest stages. At 18 months it reaches 4 centimeters in diameter and 1.6 meters in height, compared with 2 centimeters in diameter and 1.2 meters in height under monoculture. The hill rice can provide an additional yield of 1.2–1.5 tons/hectare/year. When the canopy of the forest closes, it is impossible to grow hill rice under the canopy. Shade-tolerant medicinal plants, including *Amomum echinophora* and ginger, have been suggested to replace hill rice. Many trials have been performed and have achieved initial success.

Vien Son Cooperative (in Hoang Lien Son province) intercropped hill rice with cinnamomum and had good rice harvests in the first years. *Cinnamomum album* is an indigenous fast-growing species. When 10 years old, it can reach 15–17 centimeters in diameter. Its wood is used for building materials, fuelwood, and pulp. In addition, cinnamomum contains essential oils: the bark, 2–4 percent; leaves, 1.8 percent; and the flesh of fruits, 6.5 percent. These essential oils contain 90 percent cinamic aldehyde, which is highly valuable for medicine. Young cinnamomum is intolerant of direct solar radiation. It needs appropriate shade of 50–70 percent. Therefore, it grows better when interplanted with hill rice or cassava in the early years.

Agroforestry by Regenerated Mixed Forest Some areas, where the soil retains moisture and depth after a swidden period and where there is good protection and management, are capable of regenerating into secondary forests containing indigenous species. Succession may start with light-tolerant species, such as *Trema angustifolia*, *Mallotus cochinchinensis*, *M. apelata*, and *Macaranga denticulata*, and then eventually be restored to their original state. In the Midlands, the dominant climax species are *Erythrophloeum fordii*, *Canarium album*, *Garcinia tonkinensis*, *Chukrasia tabularis*, and *Manglietia fordiana*. These species have co-evolved and adapted to the climate and soil conditions, and thus establish a stable, closed tropical evergreen, seasonal lowland forest. Dominant climax trees are large and grow slowly, but their wood is valuable. Their oils and fruits are also often of economic value. Regeneration of this type of forest, with modifications and possible additions of new species, may be a rational and successful conservation and development strategy.

Previously, forests in Dong Tinh (Tam Dao district, Vinh Phu province) were badly destroyed, causing serious erosion and siltation due to the lack of agroforestry experience. Reallocations of cultivated and forest lands has reoriented Dong Tinh farmers to agroforestry-based production.

Erythrophloeum fordii, a legume, is a large woody tree with smooth grain. It is one of the four most-valuable timber species, useful for both building materials and making furniture. Its bark contains much tannin, which is used to dye and process leather. Its leaves contain high amounts of nitrogen (2.5 percent). Nodules in the roots are capable of fixing nitrogen. The canopy is very dense, retaining moisture in the microclimate and effectively preventing erosion. *Chukrasia tabularis*, in the Meliaceae family, is a large woody tree.

The wood is nicely veined and valuable for making furniture. *Manglietia fordiana*, a member of the Magnoliaceae family, can reach 20 meters in height. Its wood is light yellow, resistant to rotting, and used for building and furniture making. *Garcinia tonkinensis* is easily grown. Its wood is not of good quality, but it provides fruits for food and seeds for oil, which has a variety of uses in industry. *Canarium album* is also a large tree, with a rounded trunk and well-shaped canopy. It provides fruits for food, wood of good quality, and resins of similar quality to pine.

The farmers of Dong Tinh have zoned and enriched their forests so that they can increase species of economic value. Under the forest, they plant pineapple, with approximately 3,000 plants per hectare. Pineapple is tolerant of shade, growing well under forest canopy where shade does not exceed 80 percent. The farmers use contour methods of planting the pineapples. Plants are spaced so that there is 1.5 meters between rows and 0.6 meter between plants. With yields of 4–5 tons of fruit per hectare, pineapple is good for commercial purposes within a 50-year cycle of forest rotation.

Homegardens

In tropical areas, homegardens are an important traditional agroforestry system. Agroforestry, in this case, is defined as a land use system with a structure that resembles a forest and combines the natural functions of a forest with those that fulfill people's socioeconomic and cultural needs.

Many areas in the Midlands have good traditional homegarden systems. Homegardens are of great importance to household nutrition. The homegarden system in Vinh Phu is basically built on the VAC model [V = *Vuon*: garden; A = *Ao*: fishpond; C = *Chuong*: livestock pen].³ However, about half of the households do not have fishponds. The existence of a fishpond depends largely on whether a farmer has sufficient land of the proper soil type and suitable topography for a pond. A small difference in some Midlands VAC models is the inclusion of a forest component (R = *Ruong*: forest). Thus, the VAC model here may be referred to as the RVAC model.

In the Midlands, food production is necessarily given primary concern, since land used for paddy rice cultivation is quite limited. Farmers spend most of their labor and fertilizer resources on rice production. Meanwhile, homegarden products are mainly for subsistence and are generally not considered as a source of commodities for cash income generation. As a result, the homegardens are usually not yet well planned and plants are not well tended. Tea is emphasized in homegardens, with greater amounts of labor and other material inputs. Forest trees generally receive little attention. Fishpond development faces difficulties due to inappropriate topography and limited land. Livestock are kept and grazed freely, but primarily for subsistence purposes.

It seems that only when the RVAC model is modified to local conditions and developed to increase productivity and stability can the Midlands agriculture be sustainable and prosperous. The RVAC model should be given priority for research and development because it has proven to be adaptive to socioeconomic and ecological conditions in the Midlands. RVAC homegardens, as small-scale agroforestry systems, are well suited to

current small-scale, individual household management modes. Improvement and development of the RVAC model for soil and environmental conservation are a strategy of decisive significance to the maintenance of ecological balance for both long-term and short-term purposes. Because this model is based on optimal space in conformity between people and the surrounding environment, it can assume a variety of forms depending on natural and socioeconomic conditions.

**RECOMMENDATIONS FOR
LAND USE IN THE
NORTHERN MIDLANDS**

These recommendations are based on our research at the landscape and farming systems levels, including the various functioning subsystems within the Midlands agroecosystems: forest plantations, agroforestry, tea gardens, homegardens, fishponds, and paddy fields.

Hill slopes are the dominant landform in the Midlands. The ecological conditions of the hills, especially the soils, are more-or-less heterogeneous. Thus, planning of cropping systems for each hill is most important. Every hill can be viewed as a fundamental production unit composed of forests, industrial crops, food crops, homegardens, livestock, and fishponds.

A very effective way of preventing soil erosion is terracing. Terracing on hill slopes is widely applied in many countries in the world. Erosion prevention by this method can be up to 90 percent successful. However, terracing is extremely labor intensive, and the infertile subsoils are often exposed, decreasing the productive capacity of soils.

Biological measures depend on vegetative cover to protect the soil from the impact of rainfall and increase infiltration, thus decreasing erosion. Vegetative cover can be provided by forest or agroforestry systems, as described below.

Hilltops

Hill length, height, slope gradient and aspect, and soil quality must be considered when planning hilltop forests, so that the forest can have beneficial impacts on the ecosystem of the hill as well as the surrounding area. Regenerated forests or mixed plantation forests with short cycles (10–15 years) and long cycles (50–60 years) can be grown on hilltops, as in Dong Tinh (Tam Dao district, Vinh Phu province). Short- and long-cycle forests should be interplanted in proximity, so that the long-cycle forest remains to avoid the sudden collapse of ecological balance when the short-cycle forest plantation is cut.

Forests on hilltops play an important role in maintaining the balance of the entire agroforestry system. They can protect the soil against the direct impact of rainfall, reduce evaporation, retain moisture, and regulate the soil water regime for the entire hill. They also provide habitat for wildlife.

Upper Slopes

Depending on topography and soil quality, both industrial and agronomic crops can be cultivated if planted on contours. Tea can be interplanted with *Aleurites montana* and *Cassia siamea*. These trees establish an upper story that can reduce direct solar radiation, providing shade for both the tea and farmers. Trees should be spaced 8–10 meters apart.

A. montana provides shade, timber, and oil extracted from its seeds. *C. siamea* is a woody leguminous tree that grows to a height of 7–8 meters. Its leaves, which often fall in the dry season, are small and easily decomposed and thus contribute a considerable amount of organic matter to the soil. The shrubby legume *Tephrosia candida* can also be interplanted with tea, establishing a lower story. When mixed with tea, *T. candida* fixes nitrogen and increases cover to prevent erosion and retain moisture.

Lower Slopes

Lower slopes and slopes of less than 15 degrees are usually devoted to food crop cultivation. Terracing fields should be pursued where feasible, and strategies for intensive cultivation by interplanting and crop rotations must be widely adopted. These strategies can help to make full use of soil productivity and regreen hill surfaces, so that soils are protected against erosion in the rainy season. Leaves and stems of mung bean and peanut can be left to decompose in the fields, providing the soil with 8–10 tons of fresh biomass per hectare annually to help improve or maintain fertility.

Rows of trees should be grown on the contours as windbreaks. With a dense canopy, the legume *Acacia auriculiformis* is well suited to this purpose and to the soil conditions of the Midlands. It is also drought tolerant.

Base of Hills

The VAC-based model should be widely applied to homegardens at the bases of hills. Species composition in the homegarden is dominated by fruit trees (lychee, jackfruit, longan, pomelo, and banana) and vegetables. Livestock pens and fishponds are also located next to the homegardens on the foothills. Bamboo grown on the foothills prevents soil erosion and siltation in downstream fields and irrigation canals, while providing materials for furniture and handicraft production.

Valleys

In the valleys, reservoirs and ponds can be constructed for small-scale water control, irrigation, and aquaculture, and for temperature and moisture regulation in the area. In a few limited cases, small areas in the upper valleys can be terraced and banded for paddy rice production.

NOTES

1. This diagram is a comprehensive model of anthropogenic secondary succession that includes human disturbances to natural forests in Vietnam. Some components in the model (herbicide and defoliant use during war, for example) are not relevant to the northern Midlands region.
2. The Taungya method is an agroforestry technique developed in Burma characterized by interplanting of food crops between rows of tree seedlings during the first years of tree growth until the canopy closes. This technique is discussed in Le Trong Cuc (1988).
3. See Chapter 5 in Le Trong Cuc, Gillogly, and Rambo (1990) for a detailed discussion of structure and function of homegardens in Vinh Phu.

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National Agricultural Development Policy and Rural Organization

Le Trong Cuc and Thomas Sikor

Since the beginning of the program of economic renovation (*doi moi*) in 1986, the Vietnamese government has pursued an economic policy aimed at creating conditions favorable for rapid economic growth. Government policy has attempted to radically change the organization of agricultural, industrial, and trade activity to facilitate more flexible opportunities for economic production and exchange. Agricultural and rural reforms have proceeded more rapidly than industrial reform, as there are less-formidable institutional barriers to reform (World Bank 1993). Over the past few years, rural organization has been transformed fundamentally from a collective system that emphasized stability, equity, and political control toward a market-based economy.

Rural organization includes all elements of rural society that structure the interactions between rural people, mobilize their shared interests, and act on these collective interests: e.g., the household, community, People's Committee, agricultural cooperative, and district and provincial agencies. Rural organization determines the distribution of resources, information, and power among rural, urban, and international actors. For example, formal credit systems (such as agricultural banks) and informal credit institutions (such as familial networks) shape the patterns of capital accumulation; they shift access to capital between urban and rural sectors, national and international actors, and among rural people. Changes in rural organization reallocate the shares of resources, information, and power held by these actors.

Yet rural organization is unique in any one place, as responses to collective action problems vary with specific local conditions. Consequently, national policy that aims to facilitate changes in rural organization is likely to create highly diverse responses at the local level. The localized outcomes of national policy in turn change the aggregate processes of rural development. Changes in rural organization thus redefine the opportunities for economic growth, social equity, and sustained environmental productivity.

In this chapter, we describe changes in rural organization resulting from economic liberalization policies. More concretely, we examine how national policy has influenced rural organization with regard to four aspects: land rights, the formal credit system, the role of the cooperative, and agricultural taxes. Part Two will then investigate how the changes in national policy, as mediated by changes in rural organization, have affected livelihoods and the rural environment in Doan Hung, Thanh Hoa, and Lap Thach districts.

**NATIONAL AGRICULTURAL
POLICY SINCE
COLLECTIVIZATION**

During the colonial period, most land was privately owned, although some villages retained communal land that was periodically redistributed to their citizens. Rural society was split into landlords, who owned or controlled most of the land; some peasants with sufficient land to generate household subsistence; and a vast majority of tenant farmers, sharecroppers, and landless laborers who worked the fields of landlords on whom they depended for employment. Lack of access to land, exorbitant interest rates, high rates of taxation, and rapid population growth kept the majority of the peasantry in severe poverty (Ngo Vinh Long 1973). After the land reform of 1955–56, estate land was expropriated by the state and redistributed to small farmers. In 1960, two types of land management were established in the north. Most land was put under the management of cooperatives and, except for homegardens, was collectively worked by production brigades. On some land, state enterprises were established to produce cash crops on a large scale.

Collective Agriculture

Under collective agriculture, cooperatives (*hop tac xa*) were the key element of rural organization in Vietnam. The cooperative was an administrative unit located mostly at the village level, having responsibilities for both agricultural production and the welfare of its members. As such, the cooperative management had important economic and social functions. As an economic unit, it periodically distributed paddy land for cultivation, granted land to households for houses and homegardens, organized the work tasks of the production brigades, determined the remuneration of labor, procured agricultural inputs and products, provided information and technical advice, granted loans for special needs, and collected taxes. Social functions of the cooperative included provision of social services (such as the operation of schools, day-care nurseries, and medical services) and maintenance of the social order.

Under the village cooperative, production brigades were organized as teams composed of the working members of between 20 and 40 households. There were two types of production brigades:

1. *Rice brigades* were commonly made up of people from one neighborhood or a few adjoining neighborhoods, and thus localized to a certain area. Among the rice brigades, only some work was real team work (irrigation work, plowing, sowing). The brigade supervised other tasks performed on individual plots.
2. *Specialized brigades* worked on specific activities such as livestock production, forest plantations, brick making, lime processing, or the growing of tea or other cash crops. Seasonal work in different production brigades was also possible.

As the basic unit of agricultural production, the cooperative was responsible to the district and provincial authorities, as well as directly to the national government. Each cooperative made its own five-year plan (as well as a more-detailed one-year plan). This plan was included in the Grand National Plan, which regulated how much of production should be delivered as tax and the amount of necessities such as equipment, fertilizers, and cloth each cooperative should receive at state prices. In fact, each cooperative was a relatively

independent economic organization, provided it delivered its quota of taxes and followed the general policies of the central government.

Specialized agencies at the district, provincial, and national levels provided guidance, technical advice, and funding for large-scale undertakings but did not directly interfere with the internal organization and work of the cooperatives. The cooperative chair was elected by cooperative members and acted as its executive director. Cooperatives also had the authority to decide about the admission of new members or new households.

At the village level, two other structures of state authority complemented the cooperative: the political section of the Communist Party and the People's Committee. The section of the Communist Party was headed by the political secretary, who was elected by the party members of the village. The main duty of the political secretary was to see that national policy was implemented at the local level. He was consulted on and held veto power over all village and cooperative decisions, and reported to the district secretary of the party. According to a linear system, the hamlet cell secretary, party group members, and party members were under the village party level.

The People's Committee was elected by village members and represented by its chair. All village members 18 years of age or older were eligible to vote. The committee handled daily logistics of the village, focusing on the general well-being of the villagers. It also oversaw several mass organizations, including the Elders' (literally "Old Men's") Association, the Women's Association, and the Youth's Union. These associations had a vertical structure from the national level down to the province, district, and local village levels. The associations had important social and educational functions and carried out community service projects.

Decree 100 In January 1981, the national government instituted Decree 100. This policy was an attempt to increase agricultural output by giving peasants concrete incentives to raise yields. Decree 100 allowed cooperatives to contract rice and eventually cash crop production to households on a seasonal basis. Land was contracted to households based on the amount of labor in the household rather than the total number of family members.

Several problems arose in the implementation of Decree 100. Contracting land based on the amount of labor resulted in an inequitable distribution of land and hardship for families with a high number of dependents relative to labor. Another problem was the short-term nature of the contract. With no incentive to take care of the land, farmers mined its soil productivity. Consequently, serious soil deterioration was widespread and resulted in declining agricultural productivity.

Management and investment responsibilities still resided with the cooperatives. As before, farmers were required to market through the cooperatives and to meet production quotas set by the cooperative according to land quality. Production quotas set for the various land classes were quite high, since the cooperative had to support a large staff and provide funds for the operation of social services.

These problems resulted in low participation rates in the contracting program, and consequently a large amount of land went out of production or had very low productivity.

The "Household Economy"

The Sixth Party Congress in December 1986 initiated a fundamental shift in Vietnam's development strategy and economic policy (Vo Nhan Tri 1990). The congress gave priority to the rapid generation of agricultural surplus in order to improve the production of basic food grains and produce agricultural commodities for export. The resolutions of the congress recognized the importance of the private and household sectors for increasing agricultural production. Thus, while previous reforms, including Decree 100, had been intended to strengthen the collective organization of agricultural production, the reforms instituted subsequent to the Sixth Party Congress fundamentally transformed rural organization.

Since 1986, cooperatives have been gradually abolished as the basic administrative unit in rural organization. Government policy has aimed at transforming them into economic units that provide technical support services to peasants. Peasant households were made the basic unit of decision making, and various specialized government agencies, such as a rural credit system and a land management bureau, were created to assist individual producers. Rural organization has shifted from a system that was based on cooperatives as integrated territorial units of governance to a system that consists of a variety of functional institutions. Each of these institutions governs one particular aspect of agricultural production and rural livelihood.

Resolution Number 10 In response to the shortcomings of collectivized agriculture, the government of Vietnam instituted Resolution Number 10 in 1988. The resolution directed the villages to allocate land to households based on the total number of household members and to extend the length of contract periods for agricultural lands to 15–20 years. In addition, Resolution 10 called for a reduction in the number of cooperative staff and the allocation of all but 20 percent of the communal lands.

The allocation of lands to households made the household the basic unit of agricultural production, instead of the cooperative. Households were ostensibly given decision-making power over all management and investment decisions on their land allocation, including cropping patterns and input use.

During the early period of implementation of Resolution 10, the cooperatives sold their livestock holdings to individual households. Production quotas were significantly reduced and fixed for five-year periods. In 1991, production quotas were decreased further and could be paid either in kind or in cash. Thus, the quota was essentially converted into an agricultural tax. For the 20 percent of the land still managed collectively, quotas were generally higher than for the allocated lands, but this amount varied significantly among the villages.

During this period, the cooperative continued to "sell" (to lease with competitive bidding) and contract land and other property such as fishponds, lakes, and water storage reservoirs

to individuals. Additional sources of revenue to the cooperatives were electricity and irrigation contracts with households, as well as the leasing of communal lands.

The 1993 Land Law In 1993 a Land Law was promulgated that clarified the terms of tenure for lands allocated to households and the cooperative's role in agricultural production. Its provisions called for an additional allocation of communal lands to households, reducing the amount of communally held lands to 5 percent. With respect to the terms of land use rights, the Land Law provided for long-term usufruct rights for annual crops and aquaculture (20 years) and perennial crops (50 years). It specified the following rights of the landholding household during the period specified in the terms of land allocation:

1. the right to exchange, transfer, or lease land use rights
2. the right to inherit land use rights
3. the right to mortgage land use rights to Vietnamese banks and individuals
4. the right to receive compensation from the government in case of expropriation

The Land Law further specified village People's Committees as the primary institutions responsible for the allocation of land. Land certificates were, however, to be issued by the district, which would also settle land disputes during the allocation process. The Land Law did not specify any limits on amounts of land that could be allocated to individuals.

Already since 1988, government policy has strengthened the General Department of Land Management as the primary agency to oversee land management issues (Ministry of Forestry 1991). A national directive issued in July 1994 provided for the establishment of Bureaus of Land Management at the provincial level and Boards at the district level. Units at lower levels of government are directly responsible to units at higher levels. At the village level, the decree provides for land management officers, who work closely with the district-level Boards of Land Management. The village officers assume responsibilities for land distribution and management from the Agricultural Bureaus, which were handling these functions. The primary tasks of the village officers are to oversee and regulate land redistribution, land use, and zoning, and to collect information on soils and land use. For example, the boards have the right to allow forest production on land that was originally reserved for cash crop production.

The Credit System Under collectivized agriculture, credit played a marginal role, as the allocation of most land, capital, agricultural inputs, and labor was regulated by the cooperative. Yet as agricultural production has increasingly shifted toward the household and private sectors, the provision of credit to peasant households has become an important element of agricultural development. Vietnam's peasants today require access to credit in order to finance such activities as purchasing agricultural inputs, implementing soil improvements, expanding into new crops, and establishing tree and perennial plantations.

The Vietnamese government has responded to this need by creating the Vietnam Bank of Agriculture. Through financial-sector reforms in 1988 and 1990, the mono-bank structure was transformed into a two-tier banking system consisting of a central bank and several

commercial banks. The Vietnam Bank of Agriculture has emerged as the main formal lending institution in the rural sector. Its main objectives are the provision of short- and medium-term credit to rural public institutions, individual farmers, and the private sector (World Bank 1993).

Due to its broad branch network, the Vietnam Bank of Agriculture is the only bank with the capacity to reach the entire rural sector. In 1993, it was represented in 405 districts and had 210 subdistrict outlets. Though the bank did not offer credit to individual farmers or groups of farmers before mid-1991, the amount of private-sector lending has increased rapidly. Private-sector lending amounted to about one-quarter of the bank's portfolio in 1992. Smallholder credit collection was reported to be an impressive 98 percent. In addition, the bank was able to mobilize public and private savings, with private deposits reaching about 10 percent of total lending at the end of 1992.

Due to the enormous credit needs of the rural sector, the bank was able to provide loans to only about 10 percent of potential private borrowers in 1992; most of these loans were short term. Many loan applications had to be rejected due to the shortage of funds. Despite high interest rates, the bank was thus able to cover only a small share of current demand. Furthermore, average loan size was about US\$62 per household.

Roles of Village-Level Organizations Resolution 10 and the 1993 Land Law considerably reduced the role of agricultural cooperatives in agricultural production. The cooperative was totally stripped of its administrative functions in the allocation of land, capital, agricultural inputs, and labor. Drastic reductions in the staff of the cooperatives were mandated. Tax collection was shifted to the People's Committee. The size of communal land, hence the function of the cooperative in its management, was significantly reduced.

Cooperatives are being transformed into an economic unit that competes with the private sector in the provision of agricultural support services. The Land Law explicitly defined the role of the cooperative as a provider of services, such as supply of fertilizers and other agricultural inputs, pest management, irrigation, and electrification. However, cooperative members are free to purchase agricultural inputs from the private sector if they find prices and quality to be more attractive.

As the cooperative has been stripped of its administrative function, the People's Committee has become the primary government organ at the village level (see Figure 3.1). Its nine-person staff includes the chair, vice chair, financial officer, militia liaison officer, land management officer, statistician, secretary, public security officer, and cultural officer. The People's Committee is authorized to collect contributions from farmers to cover the cost of village services and administration.

The Communist Party maintains two organizers, a secretary and vice secretary. The vice secretary is also the chair of the People's Committee of the village. The duty of the political secretary is to see that national policy is implemented at the local level. He is consulted on all village and cooperative decisions. Each cooperative is a relatively independent economic organization, provided it delivers its quota of taxes and follows the general policies of the state.

Village		
People's Committee	Party (<i>Dang Bo</i>)	Cooperative
Chair, Vice Chair, Secretary, Cultural Officer, Financial Officer, Public Security Officer, Militia Liaison Officer, Land Manager, Statistician	Secretary, Vice Secretary	Chair, Vice Chair, Accountant, Facilities Manager
Associations: Youth's, Old Men's, Veteran's, Women's, Farmer's		
Hamlet		
Hamlet Head	Party Cell (<i>Chi Bo</i>) Party Group (<i>To Dang</i>)	
Household		

Figure 3.1 Rural organization at the village and hamlet levels

Agricultural Taxes Under collective agriculture, government policy attempted to extract agricultural surplus and provide cheap food for urban and industrial populations through the organization of agricultural production and trade in cooperatives. Production and input quotas were the primary instruments of government control over the generation of agricultural surplus. After de-collectivization, agricultural taxation has become the primary instrument for government control over the distribution of agricultural surplus. Agricultural taxes influence the share of urban and agricultural populations in the agricultural surplus. Agricultural taxes also determine the allocation of capital for private investment, such as the supply of current inputs, or for public investment and the provision of public goods, such as water resources development.

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PART TWO

Dynamics of Development in
Doan Hung and Thanh Hoa Districts

Village-Level Implementation of Economic Reform Policies in Doan Hung and Thanh Hoa Districts

Le Trong Cuc, Thomas Sikor, and Michael Rucker

The particular form of rural organization at any place is determined by a multiplicity of local and larger forces. For example, rural organization under collective agriculture was shaped both by national policy, which promoted the formation of agricultural cooperatives, and by specific local conditions. Consequently, at places where national policy and local conditions showed sufficient overlap, agricultural cooperatives closely resembled the cooperatives envisaged by Vietnamese policy makers at the national level. Yet where national policy did not fit local circumstances, cooperatives revealed considerable variations from the prescribed model or existed only on paper (Fforde and Paine 1987). The particular structure of rural organization at any place is thus determined by the unique mix of influences prevailing under specific local circumstances. This uniqueness allows for flexible adaptation to local conditions. Yet the resulting diversity of rural organizational structures also challenges policy making at the national level, as national policies cannot be expected to succeed under all conditions and will result in failure and wasteful outcomes in some places.

During our field research in Tay Coc village (Doan Hung district) and Dong Xuan village (Thanh Hoa district), we investigated how the national policy of economic liberalization had been translated into changes in rural organization in two specific villages. As mentioned previously, we were particularly interested in the land allocation process in both villages, the *formal credit system*, the current state and role of the cooperative after de-collectivization, and agricultural taxation.

LAND ALLOCATION

Our interviews with village leaders about the recent land allocation process showed that the procedure used for allocation was dependent on the various land types: paddy, home-garden, hill, and barren. The general strategy of land reallocation appeared to be to ensure subsistence and to maintain a minimum basis of equity through the distribution of paddy lands. The allocation of hill and barren land, however, reflected a strong concern for facilitating its most profitable use, in terms of generating income for the cooperative/village through the "sale" of land and in allocating it to the more entrepreneurial and resource-rich members of the community. Land for cash crops seemed to fall in a category

somewhere in between: in areas that are land abundant, they are treated more like forestry lands, whereas in land-scarce areas, they may be used for subsistence production.

Control over land allocation was local. We found the village People's Committee to be the primary institution responsible for the actual allocation of land. The district People's Committee was responsible for issuing land use certificates. The leadership of the cooperative had been intimately involved in the land reallocation process. Cooperative leaders were represented on the village People's Committee, and they worked closely with the village officials in the land reallocation process. In our interviews, they were very knowledgeable about the implementation of land reallocation and the production situation of the farmers in their area. Land allocation and the regulation of land use thus seemed to be the primary mechanism of local government control over agricultural production.

Paddy Land and Homegardens

Paddy land and land for house plots and homegardens had been allocated on a fairly equitable basis. Paddy land for rice production had most recently been distributed to households on the basis of household membership in 1991. In Tay Coc Cooperative, every person, regardless of age, received 12 *thuoc* (288 square meters) of paddy land. In Ca Dinh Cooperative, every person was allocated 1 *sao*, 3 *thuoc* (432 square meters).¹ The households at that time received a certificate from the district confirming the contracting arrangement. Village officials expected the district People's Committee to issue the final documents, the so-called "red books" that record the transfer, by October or November 1994.

Paddy land was allocated to households for a period of 20 years in both cooperatives. Despite this stipulation, most households seemed convinced that they would be able to farm the allocated land for more than the specified period. According to the provisions of the 1993 Land Law, paddy land given to villagers could be used for any agricultural use, including fishponds, but not for houses or other construction. Village leaders further confirmed the rights of land users as specified in the 1993 Land Law (see the section on "Household Economy" in Chapter 3). In fact, since the allocation of land in 1991, a growing market for "borrowing" lands had appeared. Significantly, the transfer of land use rights among farmers happened before it was sanctioned by the 1993 Land Law. Some of the poorer members of the community were "lending" their land to others and left to seek work in industry or construction. These transactions were, however, not formally approved by the local government. No formal market for land leases had developed yet, although it was not clear if this was due to the terms of the 1993 Land Law or to other reasons.

Land for house plots and homegardens had already been allocated in 1981. In general, in areas of old settlement, it appeared that households were allocated the homegarden lands that had traditionally belonged to their families before collectivization. However, the size and income-generating potential of the homegarden lands was quite significant in some cases. This raises some questions about the extent to which land allocations are reinforcing traditional elite groups in the village.

Hill Land

While rice lands were uniformly distributed to each citizen, the allocation of hill land was highly variable in the villages visited by the research team. There are several possible explanations for the disparity. The quality of hill lands may vary considerably according to location and past land use and management practices. National policy regarding the contracting of hill lands may be less clear than that for paddy lands, resulting in a greater variety in the patterns of land distribution. Alternatively, the variation may be caused by pronounced differences between villages in the purposes (subsistence, profitability, etc.) for which each village uses hill land. In comparison, paddy land is distributed uniformly as it is generally used to secure household subsistence. Familial and social networks governing village relations may also be able to explain differential patterns of access to hill land and paddy land, as the hill lands allow for the generation of more sizable surplus than do paddy lands.

The procedure for allocating hill land reflected the objective of bringing the land to its most profitable use, both for the cooperative through its "sale" as well as with respect to its future use. First, to guarantee the use of hill land for highest profitability, villages set stringent requirements for its allocation. In general, allocations were made in response to requests by households to the cooperative, which was responsible for land allocation. Households, however, only qualified for shares of hill land if they could prove that they possessed sufficient capital and labor to exploit the allocated hill land in a profitable way. People requested whatever land they wanted on any hill, and the cooperative leadership then decided what land was to be allocated and to whom. The amount of land each household received thus depended on its economic potential and on the number of claims put forward for each particular hill.

Second, the cooperatives charged recipient households for allocated hill land. Charges varied widely depending on the existing vegetation of the land and previous investment by the cooperative in the land. For example, cooperative officials in one village were selling replanted forest lands at 1.4 million–1.9 million dong per hectare and replanted acacia forest for 2 million dong per hectare. Already in 1989, the cooperative had allocated 120 hectares of barren land to private households. The households were given the right to harvest and sell the forest products. The cooperative at that time supplied the tree seedlings, for which the farmers had to pay when they sold the products of the land.

The experience of the allocation of acacia forest in Tay Coc village reveals much about the nature and problems of forest land allocation being encountered by the villages. The cooperative had invested in replanting 60 hectares of hill land with acacia. During the past few years when most land was allocated to households, the cooperative decided to retain the forest plantations to generate income for the cooperative. The cooperative hired laborers to work in the plantations, but ran into problems as the workers neglected their work and illegally removed forest products. In 1994, the cooperative leadership therefore decided to allocate the forest land to individual households. As the cooperative wanted to recoup its initial investment, it offered the use rights for the forest land for 2 million dong

per hectare. The cooperative, however, could not find buyers for the land rights at the given price. Its leadership has subsequently decided to lease the land to households under a contracting arrangement where households receive a 15–20 percent share of the profits from the harvest.

The procedure of hill land allocation has excluded most households from access to hill land. While most households received paddy and homegarden land, very few were allocated significant amounts of hill land. Many households were unable to meet the stringent requirements set by the cooperative or could not afford the required payment for hill land use rights. Some households, however, obtained sizable pieces of hill land. In Tay Coc, landholdings ranged from 0.5 to 30 hectares. As further consequences, the allocation of hill land has produced fragmentation of land parcels and has proceeded much more slowly than that of the paddy land. As allocated plots of hill land did not exceed 4 hectares, farmers with large amounts of land had their plots dispersed over the whole village.

Barren Land

The allocation of barren lands was the most site-specific among the villages visited by the team. In Dong Xuan village of Thanh Hoa district, there seemed to be no more barren land. All land in the area had been allocated. In Tay Coc village of Doan Hung district, some hill land used to be managed by the state forest enterprise. Due to encroachment by surrounding peasant households, much of the land was in fact barren. Some barren land in the more remote areas of the forest enterprise was recently passed on to the cooperative to be allocated to farmers. Despite the allocation of land, the state enterprise continues to exist and control land in more central areas.

The cooperative leadership passed the approximately 80 hectares of barren land on to three resource-rich households, who decided to manage the land jointly. In 1994, the new landholders took out a loan for 15 million dong from the Vietnam Bank of Agriculture to buy 20 head of cattle to be raised on the site. They furthermore built a house for a guardian and a shelter for the cattle. In the coming years, the three households plan to expand their livestock, plant trees on some hillsides, and purchase approximately 2 hectares of paddy land located between the barren hills. Some of the land will be used to build a reservoir.

THE CREDIT SYSTEM

To examine the formal credit system, we met with representatives of the Vietnam Bank of Agriculture, Doan Hung District, Tay Coc Branch. We were particularly interested in the total amount of credit provided to farmers in Tay Coc, lending procedures, repayment rates, and eventual problems that arose in the initial years of operation. In Dong Xuan, we had the opportunity to obtain information on specific credit programs subsidized by the central government.

Credit policy has emerged as the major instrument of central government control over agricultural production. Due to its centralized structure, the Vietnam Bank of Agriculture seems to remain fairly isolated from local concerns. In Tay Coc, resource-rich farmers

received favored access to credit. Yet lending also reflected some local concerns for widespread access to credit. In addition to lending through the bank, some specialized lending programs at subsidized conditions indicate attempts by the central government to guarantee the use of scarce capital according to the government's objectives.

The allocation of credit in Tay Coc was determined by the national policy of tight credit, but also indicated strong local concerns for widespread and equitable access to credit. The credit volume available to bank officials was very limited, loan amounts were quite low and only given for short duration, and the interest rates charged to loan recipients relatively high. The allocation of credit in Tay Coc thus discriminated against larger investment with long payback periods or low rates of return in favor of smaller investment that generates significant returns in the short term. Consequently, bank officials explained to us that a large share of the loans were used for investment into animal raising and rice seedlings, which generate quick returns. The few cases of default on loans seemed to be caused by investment with longer payback periods (e.g., cattle). At the same time, the fact that virtually all households had been given access to credit reflected local concerns for a broad, equitable distribution of access to resources and opportunities.

According to bank officials, the average amount of loans extended to households in Tay Coc was 400 million dong per month. In the first seven months of 1994, the bank approved and disbursed loans for a total of 2.386 billion dong to 1,777 households.² Households most frequently used the loans to buy rice and tree seedlings as well as animals, mainly cattle and pigs.

The amounts lent ranged from small loans of 200,000–500,000 dong to two loans of 9.5 million dong each. The two large loans were granted to two peasants who had obtained large pieces of hill and barren land; required significant investment to develop those; promised secure, high returns to the investment; and were able to put up the required collateral. We did not have the opportunity to examine the causes of this disparity in loan amount in further detail. As bank officials could have granted loans up to 20 million dong, we interpret the limitation of the granted loans to less than 10 million as a further indicator for strong concerns for equitable access to credit in Tay Coc.

Loans can be requested by households by filing a request with the local branch of the Vietnam Bank of Agriculture. Loans up to 5 million dong can be obtained with no collateral. For loan requests exceeding 5 million dong, households are required to put up specific fixed assets, such as land and houses, as collateral. Water buffalo, which were previously accepted by the cooperative as security against a loan, are no longer accepted as collateral as they can be sold easily. The information given by the household is then verified through a visit by a bank officer to the household to check on the suitability of the collateral and screen the household for its ability to repay. If the request is granted, loans are usually given for a period of nine months, which can be extended to twelve months. The loan recipient pays 3 percent interest per month for the first twelve months, resulting in an effective annual interest rate of more than 40 percent. If the loan is not repaid after twelve months, the bank increases the monthly interest rate to 4.8 percent.

Most recipients in 1993 were able to fully repay their loans within twelve months. In July

1994, only 56 households had not fully repaid their loans received in 1993. Outstanding loans totaled 35 million dong. Bank officials explained this failure to repay on time with the fact that some households use the obtained credit to purchase cattle (which require time to grow to market size before they can be sold) or use it for other investments with longer payback periods. In the absence of other income sources, these households are then unable to repay their loans in full when due. Still, most households repaid their loans in full before the loan periods had expired.

The local branch of Tay Coc itself did fairly well under its conditions for savings and credit. The bank offered savings accounts that earned a monthly interest rate of 1.7 percent, significantly lower than the interest rate charged for loans. The branch thus made an average monthly profit of 27 million–30 million dong from the difference between the two interest rates.

In Dong Xuan, three specialized credit programs provided subsidized credit to specific target groups and investment projects. Program funds were subsidized by the central government and administered by a local board headed by the chair of the People's Committee. Two programs were aimed to promote agricultural diversification. They provided medium-term loans at low interest for private investment in tea plantations and home-gardens. The third program provided low-interest loans for poor households and handicapped people.

**ROLES OF THE
COOPERATIVE AND THE
PEOPLE'S COMMITTEE**

National policy aimed to transform agricultural cooperatives from administrative units into organizations that provide agricultural support services to farmers. We therefore wanted to examine how the cooperatives in Tay Coc and Dong Xuan had adapted to their new role. We were particularly interested in the role the cooperatives played in providing agricultural support services. We also wanted to examine what had happened with the social services previously established and operated by the cooperatives.

Our research showed that the cooperatives had lost most of their previous functions to the private sector and the People's Committee. Agricultural production had been shifted to private households. The Vietnam Bank of Agriculture had taken over responsibility for the formal provision of credit. The land management officer supervised land use. The People's Committee had allocated the land, collected taxes, and operated local social services, thus becoming the most important organ of local government control.

The staff and fixed assets of Tay Coc cooperative had been reduced significantly during the past few years. The staff of the cooperative was reduced to four full-time members: chair, vice chair, accountant, and facilities manager. In the district of Doan Hung as a whole, the staff of cooperatives were reduced from 3,000–4,000 to 1,000–1,500. Furthermore, the payment of cooperative staff depended on sales revenues generated by the cooperative. The cooperative had sold all its fixed assets and owned only the house serving as its office.

Cooperative officials explained to us that the new role of the cooperative was the provision of agricultural support services. Electricity, insecticides, fertilizers, and seedlings

were offered to farmers for sale. In Tay Coc village, the cooperative had no function in the management of the irrigation system since the system is rudimentary and requires little maintenance. Because of time constraints, however, we could not further investigate to what degree farmers actually demanded the services and products offered by the cooperative. With the exception of its role in providing electricity, the cooperative competed with the private sector in Tay Coc and surrounding areas.

The cooperative officials said that they also provided technical advice to farmers and offered their services in pest management. They were currently starting a program for agricultural extension. A committee for agricultural extension has already been established at the district level, and they wanted to establish another at the village level. With an agricultural extension system in place at the village level, they expected to be able to offer insecticides and fertilizers to farmers at lower prices. This would be facilitated by external support from international development agencies and non-governmental organizations, which could use the extension system to channel their support to farmers.

The staffing of the People's Committee and the local section of the Communist Party in Tay Coc corresponded to the model prescribed by the national legislation and regulations (see the section on "Household Economy" in Chapter 3). The Communist Party maintained two officials, the secretary and vice secretary. The vice secretary was also the chair of the village People's Committee.

The importance of the People's Committee as the primary organ of local government had apparently been strengthened by the recent reforms. Public goods and social services previously provided by the cooperative were now maintained by the People's Committee. The committee funded the operation of the three primary schools, the secondary school, and two public health clinics, and organized the maintenance of the local road system.

The People's Committee in Tay Coc relied on two different methods to raise the necessary resources for its own operation and activities. Village services and administration were paid for through farmers' contributions. The People's Committee's share in the taxes on agriculture and market activities amounted to 100 million dong per year in Tay Coc village. These revenues barely covered the salaries of the committee's staff and the operation of schools and other services.

The road system, clinics, and schools of Tay Coc were maintained by social labor. Men between the ages of 18 and 45 and women between the ages of 18 and 25 were required to work 24 days for the village each year. Young people between the ages of 16 and 18, men older than 45, and women over 25 had to contribute 12 labor days each year. Villagers could, however, avoid working for the village if they paid a compensation of 1 kilogram of paddy (or about 1,000 dong) for each labor day not worked. Village officials estimated that about two-thirds of the people actually worked their days rather than paid the equivalent in cash or kind. If they chose to work, villagers had to provide their own meals. In other villages, we found even higher requirements of social labor. Each year villagers had to work up to 30 days required by the district and provincial administration in addition to 10 days demanded by the local People's Committee, or had to pay up to 3,000 dong per day if they chose not to fulfill their obligation.

AGRICULTURAL TAXES

During our research in 1989, we had found agricultural cooperatives in Tay Coc and Dong Xuan that maintained tight control over the accumulation of agricultural surplus. With the exception of some homegardens, all land was periodically reallocated to households by the cooperative, and production quotas absorbed most agricultural production. Yet in the same year, some control was loosened as individual households were guaranteed the products of private afforestation on pieces of barren land allocated to them.

In 1994, control over agricultural production and the accumulation of agricultural surplus had shifted to private households. Agricultural taxes had emerged as a new instrument of government control to influence the distribution of surplus. Low agricultural taxes clearly favored the private accumulation of surplus, discriminating against public investments and the provision of public goods. Local People's Committees were starved of funds to maintain local social services and increasingly depended on financial support by the central government. Similarly to land allocation, agricultural taxes for the production of paddy rice differed from the procedure for taxation of hill crops. Taxes on hill crops (forest products in particular) are collected at point of sale and could thus be considered to be a sales tax rather than a production tax.

The new tax policy had just been implemented by the local People's Committee in 1994. The local People's Committee had the responsibility for collecting agricultural taxes directly from the farmers themselves. While 10 percent of tax revenues stayed with the local administration, 90 percent of the revenues had to be passed on to the district.

The tax on paddy rice production had been lowered drastically in comparison with previous production quotas. According to cooperative officials in Tay Coc, taxes were at about 25 percent of their level before the economic reforms. Similar to the production quotas, they were based on land quality and potential yields, not actual yields. Soil quality and the number of crops per year determined the amount of tax to be paid in kind or cash (see Table 4.1 for land tax data for Dong Xuan village). In contrast to the production quotas, which were fixed annually in the late 1980s, land taxes are now fixed for a period of five years, after which they will be reassessed on the basis of current yields. Due to the nature of the tax, tax collection seemed systematic and did not leave possibilities for the users of rice paddy land to evade tax payment.

Table 4.1 Land taxation in Dong Xuan village

Land description	Land classification	Corresponding annual tax rate (kg rice per sao)
Two crops	II	16.6
	III	13.4
	IV	10.2
Winter crop only	V	10.2
	VI	6.5
Spring crop only	V	6.5
	VI	1.8
House plot	V	6.5
	VI	1.8

With respect to the products of hill and forest land, agricultural taxes are levied according to actual harvest, rather than land type as in the case of paddy lands. Farmers with hill lands owe 4 percent of forest products, which is collected by the government as tax. Because it is difficult to collect forest taxes directly from farmers, the authorities collect the tax from merchants who go to the farmer's plot to buy the products for resale at market. We were not able to determine to what degree the People's Committee was actually able to collect taxes on hill crops. Our household interviews also showed that households paid taxes on homegarden land. It was not clear, however, if the tax is levied on the land by land type or by the annual production of the land.

**CHANGES IN SOCIAL
ORGANIZATION AND
IMPLICATIONS FOR
RURAL DEVELOPMENT**

Rural organization in Tay Coc and Dong Xuan appears to closely follow the model envisaged by national policy. The collective system has been dismantled and replaced by a market-based system that facilitates the private generation of agricultural surplus. Land allocation in Tay Coc and Dong Xuan reflected national concerns to secure household subsistence, but it also pursued the goal of maximizing economic productivity by allocating non-rice agricultural land to resource-rich households. The scarcity of credit in the two communes corresponded to the national policy of tight credit. Annual interest rates above 40 percent limited access to capital to only the most profitable investments with the fastest payoffs. Lower agricultural taxes allow farmers to retain larger shares of agricultural surplus while curtailing local government capacity to provide public goods and operate social services. As the functions of the cooperatives have been curtailed, households have become the primary unit of agricultural production and trade.

The change in national policy and rural organization has changed the relationship between central and local government control over agricultural production. Under collective agriculture, cooperatives concentrated economic and political power locally. In 1994, the strength of local government control over agricultural production was particularly visible in the localized nature of the land allocation process. In addition, the broad distribution of credit among households appears to reflect local concerns for equitable access to resources and opportunities.

Yet government policy during the past years integrated attempts to centralize government control over agricultural production. Agricultural cooperatives had to give up most of their economic power to the household and private sectors. Their political power has been transferred to People's Committees, which now assume their administrative functions such as tax collection and the operation of social services, and to specialized agencies at the central government level, such as the Vietnam Bank of Agriculture and the General Department of Land Management. The future role and importance of the cooperatives probably depends on the extent to which they can provide groups of farmers with a comparative market advantage for the purchase of agricultural inputs and the sale of agricultural produce. Effective agricultural extension roles for the cooperatives may only be possible if the central government can provide sufficient educational opportunities for technical training of cooperative staff.

The change in rural organization mostly strengthens central government control over agricultural production. In Tay Coc and Dong Xuan, the centralized system of credit provision seems to be the primary instrument of central government control. However, the land allocation process is controlled primarily at the local level of government. At the same time, the formation of the Land Management Boards at the district level, which respond to the General Department of Land Management at the central government level, indicates a trend toward centralization of control over land policy. Similarly, the organization of public revenue is becoming more centralized. Although agricultural taxes are collected by the local government organ, the village People's Committee must transfer most of the collected tax revenues to the district administration and increasingly depends on financial support from the central government.

NOTES

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| 1. 1 sao = 360 square meters = 15 <i>thuoc</i> ;
1 <i>thuoc</i> = 24 square meters; 1 hectare = 27.7
sao. | 2. The Tay Coc Branch of the Vietnam Bank of
Agriculture serves both Ca Dinh and Tay
Coc coöperatives. |
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Household Ecology and Economy in Doan Hung and Thanh Hoa Districts

A. Terry Rambo, Keith Fahrney, and Laxmi Worachai

Households typically engage in a variety of economic activities. Farm production includes rice, fruit, vegetables, small livestock, tea, field crops, and timber and other forest products. Most households manage fishponds. Landholdings of the various production systems are shown in Table 5.1 for fourteen households that were interviewed in Doan Hung and Thanh Hoa districts.

Non-farm and off-farm activities are important sources of income for many. Although agricultural production is still largely subsistence oriented, all households must engage in some activities to obtain cash that is needed to pay taxes, purchase supplementary food and production inputs, buy consumer goods, and pay school fees and medical expenses. Taken together, these various activities constitute the household economy of the peasants of Vinh Phu's upland districts. Each major productive activity is described in turn below.

Table 5.1 Landholdings of fourteen households (square meters)

District/ household	No. of members	Wet rice		Homegarden and fishpond		Hill land		Total land	
		Total	Per capita	Total	Per capita	Total	Per capita	Total	Per capita
Doan Hung									
A	8	2,448	306	900	113	1,080	135	4,428	554
B	4	1,440	360	1,440	360	30,000	7500	32,880	8,220
C	5	2,520	504	1,080	216	2,880	576	6,480	1,296
D	7	2,880	411	2,160	309	10,000	1,429	15,040	2,149
E	6	1,920	320	670	112	18,400	3,067	20,990	3,498
F	4	1,440	360	2,260	565	432	108	4,132	1,033
G	7	3,600	514	240	34	4,680	669	8,520	1,217
H	5	3,960	792	2,160	432	40,000	8,000	46,120	9,224
Thanh Hoa									
I	4	1,440	360	1,540	385	2,520	630	5,500	1,375
J	6	2,520	420	600	100	10,000	1,667	13,120	2,187
K	7	3,960	566	12,480	1,783	28,440	4,063	44,880	6,411
L	6	2,880	480	1,800	300	11,880	1,980	16,560	2,760
M	4	1,128	282	300	75	2,340	585	3,768	942
N	6	528	88	3,150	525	1,800	300	5,478	913

RICE PRODUCTION

Rice cultivation is the core economic activity engaged in by every household. Production is almost entirely for consumption purposes. About half of the households harvest enough rice to meet their food needs for the whole year; the rest report having sufficient rice for only 6–8 months. Few report having any surplus; those that do said they feed it to their livestock, especially pigs, or sell some of it. The market price is so low as to make commercial production an unattractive option, however. Market prices for rice apparently fluctuate seasonally. The price of rice declines and fertilizer prices increase at harvest time. One farmer reported selling surplus rice as seed. Each crop, she buys foundation rice seed from the district seed station. Because she produces quality grain and the rice is of certain lineage, the seed station buys her surplus rice back to increase seed supplies for use by other farmers. She is able to obtain a better price (2,500 dong per kilogram for seed compared to 1,200 dong per kilogram as unhusked eating grain) for her surplus rice in this way.

All rice is grown in banded flooded fields. Some higher lands are exclusively rain-fed, but most employ irrigation to some extent. Irrigation in Tay Coc village in Doan Hung district is small-scale, with individual households drawing water into their fields from streams. Dong Xuan village in Thanh Hoa district has an elaborate communal irrigation system. Farmers must pay a fee of 1 kilogram of paddy per sao of irrigated land.

Paddy landholdings average 2,333 square meters per household, or 412 square meters per person. Holdings of rice land are quite fragmented. The extreme case is a household having 11 sao (3,960 square meters) divided into 20 parcels. Fields may be as far as 1 kilometer apart and are frequently as far from the house, though most households have at least a limited area of paddy fields close to their house. All paddy fields are under household management, but specific tenurial arrangements are diverse. One poor farmer in Doan Hung district has an eight-year lease with only two years remaining. He said that he does not know what will happen to his land when his lease expires. More commonly, households report 20–25 year tenancy arrangements, with some saying that they have permanent control of their fields.

Two crops are grown on most of the paddies. Only the higher rain-fed paddies and a few low-lying swampy areas are cropped only once per year. Two households reported growing dryland field crops (maize and sweet potato) on their drained paddies following the winter harvest. The spring crop is transplanted in February (first lunar month) and harvested in May. After the first harvest, the soil is immediately plowed and prepared for transplanting the summer crop in early June (fifth lunar month). The summer crop is harvested in September and October. Some households buy rice seedlings at the market in order to avoid tying up a portion their paddies with the nursery crop for one month prior to the summer crop. After harvesting the summer crop, dryland field crops may be grown on some of the higher paddy areas from late September to December.

Cultivation is done by family members, with some households engaging in exchange labor during peak periods. One farmer who is increasingly devoting her efforts to commercial livestock raising plans to hire workers to work her paddy land. Plowing and harrowing are done with buffalo or cattle. If a household does not have a draft animal, either wholly

owned or shared with kin, it can exchange human labor for buffalo labor on a 1-hour to 1-hour basis. In contrast to Thai Binh province in the Red River Delta, where there is an acute shortage of draft animals and humans must drag the harrows themselves (Le Trong Cuc and Rambo 1993), the supply of animal traction is not currently a limiting factor on production in the upland districts of Vinh Phu.

Fertilizer and soil amendment inputs to paddy production for fourteen interviewed households are shown in Table 5.2. Most households collect animal manure and process it into compost by mixing it with green leaves, rice-straw bedding from piggens, and night soil mixed with lime and/or ashes from cooking fires. This manure/compost mixture is applied to paddy fields after the first plowing and prior to harrowing, at an average rate of 7 tons/hectare/crop. Chemical fertilizer is purchased from the cooperative or private traders in the market and applied to the paddies either to supplement organic fertilizers or substitute for them in cases where the household lacks enough livestock to provide an adequate supply of organic fertilizer. Mixed-formula NPK fertilizers were applied by most households, at an average rate of 212 kilograms/hectare/crop. Urea was applied by a fewer number of households and in smaller quantities (averaging 118 kilograms/hectare/crop), reportedly because of its higher cost. NPK fertilizer is typically applied prior to transplanting. Urea is usually applied in split applications, approximately 10 and 30 days after transplanting. Some households reported application of chemical fertilizers to the rice nurseries to ensure healthy seedlings for transplanting. Only two households reported application of superphosphate (278 kilograms per hectare) and lime (278 kilograms/hectare/crop), although we did not specifically ask about application of these amendments.

Table 5.2 Fertilizer and soil amendment inputs to paddy production for fourteen households (kilograms per hectare)

District/ household	NPK	Urea	Manure	Super- phosphate	Lime
Doan Hung					
A	0	0	2,778	0	0
B	139	0	11,111	0	0
C	278	111	0	0	0
D	174	174	3,472	0	0
E	502	753	6,944	0	0
F	0	104	12,500	0	0
G	278	0	11,111	0	0
H	111	0	8,333	0	0
Thanh Hoa					
I	111	0	6,944	0	0
J	56	0	5,556	0	0
K	278	139	5,556	0	0
L	0	56	5,556	278	278
M	833	194	10,417	0	0
N	—	—	—	—	—
Average	212	118	6,944	21	21
Minimum	0	0	0	0	0
Maximum	833	753	12,500	278	278

Superphosphate and lime were applied after plowing and prior to harrowing. Lime was applied because the farmer knew from experience that the soil was acidic. She bought quicklime powder from the market and applied it before every crop.

Rice hills are planted at very close spacing (15 centimeters between hills and rows) to take full advantage of the high soil fertility. There are usually only two, but sometimes three, seedlings planted per hill.

All households interviewed are growing high-yielding rice varieties. Only one household (belonging to the Cao Lan ethnic minority) reported growing a small area of glutinous rice (variety 352) for making cakes for the Tet holidays. The most common variety planted was 203. Other varieties mentioned were the "Chinese varieties" Ai Mai Huong, San Hoa, Chiem Den, and the Vietnamese varieties DH6, DT10, DT13, Bao Thai, and Moc Tuyen. There did not appear to be much difference in yields between the varieties or any apparent seasonal advantage for specific varieties, although one farmer expressed a preference for planting 203 in the spring crop and Bao Thai and Moc Tuyen in the summer crop.

Insecticide is sprayed, typically twice per crop, mostly to control stem borers, brown plant hoppers, and leaf rollers. Brown plant hoppers can be particularly destructive during the spring crop. One farmer estimated a loss of 25 percent of his yield to insects and diseases despite spraying. Most households report spraying small amounts of "Bassa" and "Monitor," costing between 5,000 and 15,000 dong per crop. Apparently only men spray pesticides. One farmer reported using "Butavi" (a locally produced herbicide) to control weeds and noticing higher yields as a result. Most households weed the rice crop once by hand, using long bamboo poles. District officials expressed concern about the high rates of pesticide application in the area. None of the households reported harvesting paddy crabs or fish from the rice fields, and none were observed.

The rice crop is harvested by sickle. The panicle is cut with about 30–45 centimeters of straw and bundled for drying. Rice is threshed either by hand or small motorized mechanical thresher. After threshing, the straw tops are either fed to cattle or buffalo, or used as bedding in pigpens and eventually composted with manure and recycled to the fields. Rice stubble remaining in the fields after harvest is incorporated prior to the next crop.

Rice is stored as unhusked paddy in house attics. Milling is done by private entrepreneurs who visit the households with diesel-powered mills transported on buffalo carts. Their standard charge is 4 kilograms of paddy for each 100 kilograms that they mill. The customer, rather than the miller, retains the rice bran and broken rice fragments for livestock feed.

Productivity of the rice crop (Table 5.3) is high, averaging 3.8 tons/hectare/crop (136 kilograms/sao/crop) and ranging from 1.3 to 5.5 tons/hectare/crop. Some farmers reported lower yields from the spring crop than from the summer crop (attributing this to cold temperatures), while others reported similar yields for both crops. Yields varied according to land class and nutrient inputs. The household reporting the lowest yields was cultivating swampy land of the poorest class. Their lack of livestock for manure supply and inability to afford chemical fertilizer inputs contributed to their low yields. The highest

Table 5.3 Land area, production, and yield of rice crop for fourteen households

District/ household	Land area			Production			Yield per crop	
	m ²	sao	m ² /yr ^a	kg/yr	kg/capita/yr	Sufficiency (reported)	kg/sao	t/ha
Doan Hung								
A	2,448	6.8	2,448	680	85	short 4 mos.	50	1.3
B	1,440	4.0	1,440	1,200	300	short 6 mos.	150	4.2
C	2,520	7.0	2,520	1,000	200	short 4 mos.	143	4.0
D	2,880	8.0	2,880	1,100	157	usually sufficient	138	3.8
E	1,992	5.5	3,984	2,200	367	sufficient	199	5.5
F	1,440	4.0	1,920	750	188	sufficient	125	3.5
G	3,600	10.0	7,200	2,000	286	surplus (300 kg/crop)	100	2.8
H	3,960	11.0	7,920	3,500	700	sufficient/surplus	159	4.4
Average	2,535	7.0		1,554	285		133	3.7
Thanh Hoa								
I	1,440	4.0	1,440	1,080	270	sufficient	135	3.7
J	2,520	7.0	2,520	870	145	sufficient	107	3.0
K	3,960	11.0	3,960	1,400	200	surplus	127	3.5
L	2,880	8.0	5,760	2,960	493	surplus (seed)	185	5.1
M	1,128	3.1	2,256	909	227	short (130 kg husked)	145	4.0
N	528	1.5	1,056	340	57	short (650 kg/sao)	116	3.2
Average	2,076	5.8		1,260	232		136	3.8
Combined average	2,338	6.5		1,428	262		134	3.7

^aDepending on availability of water, not all households produce a spring crop.

yields reported corresponded to moderate-to-high manure applications and high levels of chemical fertilizer inputs.

We were able to compare present rice productivity with productivity in 1989 for two of the households interviewed. In both cases, yields increased: from 150 to 185 kilograms/sao/crop (4.17 to 5.14 tons/hectare/crop) in one case, and from 90 to 107 kilograms/sao/crop (2.50 to 2.97 tons/hectare/crop) in the other. In both cases, the levels of organic manures applied remained about the same or decreased slightly. Increased crop yield during the five-year period appears to be attributed primarily to increased levels of inorganic N fertilizers applied.

Taxes on rice production as reported by respondents are quite variable, although the official tax rate is 7 percent of the target yield for each category of paddy field. Fields are divided into seven classes according to their estimated productivity, and a corresponding set quantity (in kilograms) of paddy is assessed as tax, regardless of actual yields.

LIVESTOCK PRODUCTION

Livestock production is still mostly small-scale and primarily for household consumption, but some households are beginning to engage in commercially oriented production. All livestock are of indigenous breed except for the introduction of some exotic breeds of pigs (Large White) for crossbreeding to improve productivity. Table 5.4 shows livestock holdings of fourteen households interviewed. Inputs and outputs from livestock management by seven households are shown in Table 5.5.

Table 5.4 Livestock holdings of fourteen households

District/ household	Buffalo	Cattle	Pigs	Poultry	Ducks	Dogs	Silk- worms	Bees (hives)	Rabbits
Doan Hung									
A	0	0	0	0	20	0	0	0	0
B	¼	0	2	5	0	0	0	0	0
C	0	0	1	10	0	0	0	0	0
D	½	0	3	0	0	0	yes	0	0
E	1	0	4	50	0	0	0	1	0
F	0	0	2	47	0	2	0	0	0
G	1	3	4	9	0	0	0	0	0
H	2	0	5	100	0	1	0	0	0
Thanh Hoa									
I	0	4	4	200	0	0	0	0	0
J	0	4	4	200	0	0	0	0	0
K	1	3	8	20	2	0	0	0	2
L	1	0	3	60	0	0	0	0	0
M	½	0	3	10	0	0	0	0	0
N	1	0	20	30	0	0	0	0	0

Buffalo and cattle are kept for traction power, manure production, and breeding. Buffalo reach marketable adult age in 4–5 years and can be sold for up to 1.2 million–1.5 million dong. Cattle reach marketable adult age in 3–4 years and sell for up to 1 million dong.

A household that cannot afford the 1-million-dong purchase price of a buffalo may jointly purchase an animal with one or more other households, usually a brother or other close kin. This practice is referred to as owning a “leg” of the animal. Each co-owner cares for the animal for a few days at a time on a rotating basis, stabling it at the household and keeping the manure that it produces. In contrast to the situation in Nguyen Xa village in the Red River Delta where the household responsible for taking care of the animal must weigh its daily ration of straw in the presence of the other owners (Le Trong Cuc and Rambo 1993), farmers in Vinh Phu’s uplands appear quite relaxed about management of jointly owned livestock. Supply of fodder is not currently a limiting factor on production of cattle. In the future, however, reforestation of the hills may reduce the amount of grassland available for livestock.

One well-off farmer in Dong Xuan village owns four cattle. Two cows are for breeding purposes while the male animals are used on alternate days to pull a cart that the farmer rents to his neighbors for 30,000 dong per day for about 100 days a year.

Pigs are raised for sale, for meat consumed by families during the Tet New Year’s holidays, and for manure. One farmer in Dong Xuan village keeps a breeding sow and sells two-month-old piglets for 75,000–100,000 dong each. Pork from adult pigs sells for about 10,000 dong per kilogram. Labor requirements for pig production are rather intensive. Pigs are fed three times per day, and much of their food must be cooked, causing a sizable demand for labor and fuel resources. Households needing to hire the mating services of a boar must pay 15,000 dong per session.

Table 5.5 Livestock management inputs and outputs for seven households (cash values in thousand dong per year)

Household	Buffalo	Cattle	Pigs	Poultry	Dogs
Inputs to livestock					
E	feed; labor		feed (rice bran, banana stem, maize, cassava root, sweet potato leaves)	feed; labor	
F			purchase piglets: 140d	feed; labor	feed; vaccine
G	feed; labor	feed; labor	feed (including rice: 88d); labor	feed; labor	
H	feed; labor		feed; labor	feed; labor	feed
L	feed; labor		feed (cassava, rice bran, vegetables; rice: 240d); labor	feed; labor	
M	feed; labor		feed; labor	feed; labor	
N	feed; labor		feed (fish): 210d; mating: 30d	feed; labor	
Outputs from livestock, including cash					Total
E	manure; draft power		cash: 4,000d; manure	meat (home consum.); manure	4,000d
F			cash: 1,200d; manure	meat (home consum.); manure	1,200d
G	manure; draft power; calf	manure; draft power; calf	cash: 1,000d; manure	meat (home consum.); manure	1,000d
H	manure; draft power; calf		cash: 700d; manure	meat (home consum.); manure	700d
L	manure; draft power; calf		cash: (piglets) 1,500–2,000d, (sow) 2,000d; manure	meat (home consum.); manure; cash: (eggs) 1,200d	5,680d
M	manure; draft power; calf		cash: 2,000d; manure	meat (home consum.); manure	2,000d
N	manure; draft power; calf		cash: (piglets) 3,600d, (meat) 200d; manure	meat (home consum.); manure; cash: 100d	3,900d

Most households keep small flocks of free-ranging chickens. A few farmers raise 100 or more chickens in order to sell meat and eggs. One farmer in Thanh Hoa district reported earning 100,000 dong per month from selling eggs and 480,000 dong from selling chickens for meat. Chickens are fed cassava, rice bran, broken milled rice, and paddy. At 10,000 dong per kilogram of meat, this can be a profitable activity. A few households keep ducks.

One household in Doan Hung district raises silkworms on cassava leaves. The mature worms are sold in the market for 2,000–6,000 dong per kilogram. They can raise only a single crop of 60 kilograms each year because of a shortage of cassava leaves.

One household in Doan Hung district keeps a single hive of local (small Asian variety) bees and reports yields of about ten (750-milliliter) bottles of honey per year. There appears to be abundant bee forage in the area from fruit trees grown in homegardens, and probably from several of the planted forest species (melia and eucalyptus, for example), but heavy pesticide spraying of rice and tea could limit honey production and survival of hives.

Livestock production is potentially quite profitable but is a high-risk activity. Several households reported having lost pigs, chickens, and ducks to disease epidemics. Vaccination services are available but relatively expensive. Only a few better-off households routinely vaccinate their small livestock. The veterinarian from the cooperative in Dong Xuan village charges 1,000 dong per injection to vaccinate buffalo and cattle.

FISH PRODUCTION

More than half of the households in Doan Hung district and all but one household in Thanh Hoa district have fishponds. Fishponds are located near the house and generally below the homegarden, if the house is constructed on a sloping area, as is usually the case. For households with fishponds, the average area per household was 1,666 square meters. The smallest fishpond area reported was 100 square meters; the largest, 11,400 square meters, was actually a reservoir that had been stocked with fish. Households without fishponds were generally poorer and may have been unable to expend the labor required for excavation of the ponds. Three households had excavated their ponds only recently and had yet to harvest fish.

Inputs are limited to pig manure, some rice bran, and grass and cassava leaves. Grass carp, common carp, silver carp, Indian carp, and tilapia are raised in the ponds. Most households raise at least two species, with grass carp being the most popular. Tilapia are relatively rare and limited to households with larger ponds. Fish are commonly stocked at the rate of 2–3 kilograms of fingerlings per 50 square meters. Smaller ponds are used to produce fish for home consumption. Farmers with larger ponds engage in production for the market.

One prosperous farmer in Dong Xuan village has two ponds. He uses the small one to raise fry to stock his large pond and to sell as fingerlings for other farmers to raise. He has recently gained control over a 1-hectare reservoir, a part of the communal irrigation system, that he uses for commercial production. Until this year he only had to maintain the dam but must now pay the village a tax of 200,000 dong per year.

In Doan Hung district, one farmer reported buying fingerlings from fish traders in Cam Khe district. After raising the fingerlings, he would then sell marketable-size fish back to the same fish traders.

One farmer in Thanh Hoa district traded most of his paddy land to acquire 1,800 square meters of fishponds from the cooperative. He then reconstructed the single pond into two ponds: one for raising fry to fingerling size for sale to local farmers, and one for raising fingerlings to marketable-size fish. He said that he would like to learn how to spawn fish

to raise his own fry, but does not know where he can learn. A district agriculture official present during the interview said that in the future, specialists would be invited to the district to train farmers in spawning techniques.

HOME GARDEN PRODUCTION

Every household interviewed has a home garden. These range in area from 170 to 3,600 square meters. Gardens are planted with a high diversity of perennial species, primarily fruit trees but also tea, herbs, and some timber trees. Fruit trees are also sometimes grown in separate orchards located away from the house. One farmer reported having interplanted an old tea field with cinnamon trees. A list of some of the fruit, vegetable, spice, timber, and medicinal species found in the home gardens is presented in Table 5.6.

Vegetables, sweet potato, and cassava are intercropped with the trees where shading is not too severe. Production is both for home consumption and for sale. Several farmers are actively expanding the area planted to fruit trees. *Thao* (Vietnamese apple or jujube) is especially popular as it has an assured market and brings a good price. The trees are

Table 5.6 Various plants found in home gardens

Vegetables		Fruits/fruit trees		Medicinals, spices, timber species, ornamentals, etc.	
Common name	Genus/species	Common name	Genus/species	Common name	Genus/species
<i>rau ngot</i>	<i>Sauropus androgynus</i>	banana	<i>Musa paradisiaca</i>	areca (betel) palm	<i>Areca catechu</i>
<i>rau day</i>	—	papaya	<i>Carica papaya</i>	betel vine	<i>Piper betle</i>
<i>rau muong</i>	<i>Ipomea aquatica</i>	orange	<i>Citrus sinensis</i>	tea	<i>Camelia sinensis</i>
taro	<i>Colocasia antiquorum</i>	pomelo	<i>Citrus grandis</i>	coffee	<i>Coffea robusta</i>
yam	<i>Dioscorea alata</i>	tangerine	<i>Citrus reticulata</i>	galangal	<i>Alpinia galanga</i> syn. <i>Languas galanga</i>
amaranth		lemon	<i>Citrus limon</i>	ginger	<i>Zingiber officinale</i>
spinach	<i>Amaranthus caudatus</i>	lime	<i>Citrus aurantiifolia</i>	kaffir lime (leaf)	<i>Citrus hystrix</i>
malabar spinach	<i>Basella alba</i>	guava	<i>Psidium guajava</i>	xuong song	<i>Blumea lanceolaria</i>
canna	<i>Canna edulis</i>	custard apple	<i>Annona squamosa</i>	rattan	<i>Calamus dioicus</i>
sweet potato	<i>Ipomea batatas</i>	jackfruit	<i>Artocarpus nobilis</i>	bamboo	<i>Bambusa</i> spp.
cassava	<i>Manihot esculenta</i>	apricot	<i>Prunus armeniaca</i>	fan palm	<i>Livistona</i> sp.
chili pepper	<i>Capsicum annum</i>	lychee	<i>Litchi sinensis</i>	melia	<i>Melia azedarach</i>
squash	<i>Benincasa hispida</i>	jujube	<i>Zizyphus jujuba</i>	bo ket	<i>Gleditsia fera</i>
bittermelon	<i>Momordica charantia</i>	sapodilla	<i>Manilkara zapota</i> syn. <i>Achras zapota</i>	tephrosia	<i>Tephrosia candida</i>
sugarcane	<i>Saccharum officinarum</i>			tung	<i>Aleurites montana</i>
edible coleus	<i>Coleus</i> sp.	persimmon	<i>Diospyros kaki</i>	acacia	<i>Acacia mangium</i> ; <i>A. auriculiformis</i>
hibiscus leaf	<i>Hibiscus rosa-sinensis</i>	pineapple	<i>Ananas comosus</i>	eucalyptus	<i>Eucalyptus</i> <i>camaldulensis</i>
long bean	<i>Vigna unguiculata</i> <i>sesquipedalis</i>	longan	<i>Nephelium euphoria</i>	manglietia	<i>Manglietia glauca</i>
onion	<i>Allium fistulosum</i>	water apple	<i>Eugenia siamensis</i>	sam dai hanh	(medicinal lily) <i>Eleutherine subaphylla</i>
Chinese chive	<i>Allium odorum</i>	star fruit	<i>Averrhoa carambola</i>	cactus	<i>Cereus peruvianus</i>
eggplant	<i>Solanum album</i>	sau	<i>Dracontomelon</i> <i>duperreanum</i>	marigold	<i>Tagetes erecta</i>
maize	<i>Zea mays</i>	nhot	<i>Elaeagnus latifolia</i>	rose	<i>Rosa sinensis</i>
		sapote	<i>Lucuma mammosa</i>		
		grapes	<i>Vitis vinifera</i>		
		coconut	<i>Cocos nucifera</i>		

purchased from a state nursery for 2,000 dong each. Because the jujube trees are pruned severely in November or December to force flowering, sweet potato or bean can be intercropped successfully for several months before the canopy closes over and deprives them of light.

Homegardens are worked almost exclusively with household labor. Manure and some chemical fertilizers are the principal inputs. Night soil is preferentially applied to the homegarden by most households. Some chemical pesticides are purchased for use on jujube trees.

TEA PRODUCTION

At present, tea is the principal cash crop in the uplands of Vinh Phu. Many households incorporate fairly large areas of tea into their homegardens. More usually, however, tea is grown in separate monocultural plots higher on the hillsides. In some cases farmers have planted the tea using seedlings grown from seed taken from trees in the older plantations established by the cooperatives. Tea planted from seed can be picked after three years. In other cases, households have purchased the rights to use plots of established tea within the area of the former plantations. The terms under which households acquire control over tea land display considerable variation. One farmer in Doan Hung acquired 3 sao of 30-year-old trees earlier this year at a price of 200,000 dong per sao; he has three years to repay the cooperative with no interest charged. The price to acquire rights to tea plots ranges from 40,000 to 200,000 dong per sao. Leases run for 30–35 years.

Tea gardens are planted along contours of fairly steep hill slopes (20–35 degrees). The low-growing tea canopy, with a grassy groundcover growing between rows, provides good protection against soil erosion as long as the tea is managed properly to ensure healthy plants and dense stands. Tea gardens are usually weeded twice per year, at the beginning and end of the picking season (March and November). This corresponds with periods of low rainfall amounts and intensities, thus decreasing erosional hazards. Grazing is not allowed within the tea garden, as animals would eat the young tea leaves. Fresh grass from weeding is carried off the fields to feed livestock. Tea plants are pruned for shaping at the end of the picking season (November), when the weather begins to get cooler.

During the first year of establishment by seed, tea gardens are often intercropped with annual field crops like cassava and mung bean or black bean. Tea gardens are generally not intercropped with perennial species, although one farmer reported planting *dien thanh* and *muong* (*Sesbania* spp.) in his tea gardens to “keep the soil moist” and as a source of firewood for cooking.

All households apply some chemical fertilizer and pesticides to their tea, but rates vary widely as do levels of output. The least intensively managed tea garden provides two pickings each month for eight months of the year, yielding about 20,000 dong per picking (fresh tea is sold for about 1,000–1,200 dong per kilogram). The most-intensive management yields as many as three pickings for five months and two pickings for three months, with each picking worth 60,000 dong. To maintain production at such a high level

requires inputs of 50 kilograms NPK and 50 kilograms urea/sao/year, and chemical pesticide application three times per month at a cost of 4,500 dong/spraying/sao.

Most households rely on their own labor to pick tea, a job done mainly by women, who are considered faster and more skillful pickers. Some farmers work as wage laborers on other people's tea land. Pickers receive 3,000–5,000 dong per day without food.

Tea is sold by the farmers to wholesalers, who buy it at the farmers' homes. The wholesalers use bicycles to transport the tea to the state factory. The farmers receive a slightly lower price but save the time it would take them to transport the tea to the factory themselves. Even poor farmers generally choose to sell to the wholesalers.

FIELD CROP PRODUCTION

Cassava, sweet potato, and peanut are the main field crops. These annuals are intercropped in homegardens and also planted in monocultural plots cleared on the higher hill slopes. They are also grown as an intercrop in newly established forest plots and tea gardens. In contrast to 1989, when large areas of the hills were covered by cassava fields, plots are now smaller and more scattered. Rather than being permanent fields, they are now often a successional stage in the establishment of new forest. Thus one well-off farmer acquired a block of old, nonproductive tea land from the cooperative, cut the tea trees, and planted cassava. He now plans to replace the cassava with styrax and melia seedlings. Another farmer illegally cleared a cassava field on state forest land but now, after being given a long-term lease, has planted eucalyptus, styrax, melia, and palms on it. The decline in cassava production may reflect the increased availability of rice in the market, so that rice-deficient households no longer have to consume the much less desired root crop. Instead of planting cassava for consumption, they use any available hill land to grow high-value, cash-generating crops such as tea and timber and use the proceeds to purchase rice. This is a great change from 1988 when, during a period of national food shortage, a farmer in Thanh Hoa district was observed by one of the authors uprooting his tea on a steeply sloping plot and planting cassava in its place. When asked why he was doing this, he replied that he could eat cassava but he could not consume tea. At that time 1 kilogram of tea would purchase 1 kilogram of cassava.

Field crops are grown using household labor. Very little manure or chemical fertilizer is used, except by those farmers who raise field crops to sell. One farmer in Dong Xuan interviewed in 1989 told us then that he placed a spoonful of salt in the soil for each cassava cutting that he planted to flush base nutrients from the soil's cation exchange complex and make them more available to the cassava plants (Le Trong Cuc, Gillogly, and Rambo 1990, 87–88). When we re-interviewed him this year, we asked if he still followed that unsustainable practice. He laughed and said that it was no longer necessary because fertilizer was now plentiful and cheap. Now he adds about a spoonful of urea and 1 kilogram of manure with each cutting. He reports the same yield (360 kilograms per sao) as he had obtained with salt.

Cassava and sweet potato are raised mainly for home consumption and livestock feed, although some surplus cassava is sold. Mung bean is also planted, mostly for subsistence,

but yields are reported to be extremely low (15 kilograms per sao). Peanut is raised as a cash crop. The town of Vinh Yen in the lowlands of Vinh Phu has become a major processing center for peanuts from the uplands. The processed peanuts are exported to China and Singapore.

FORESTRY PRODUCTION

Less than half of the households in our sample have obtained access to forest land. Of those who have obtained land, three have very small plots of 1,440–1,800 square meters, while four have acquired quite extensive areas of 10,000–30,000 square meters. The terms for acquisition and the length of tenure awarded are quite variable. Some farmers purchased existing forest from the cooperatives. At the time of purchase, farmers had to pay the cooperative 50 dong per tree for existing trees on the land. They will also have to pay a yet-to-be-determined tax on the value of the timber when the trees are harvested 5–7 years from now. One village cadre said that the tax would be 0.4 percent of the value of the timber, whereas the chair of the Thanh Hoa district People's Committee stated that the first cutting would not be taxed at all but that there would be an 18–20 percent tax on the second cutting. None of the farmers knew how much they would be required to pay. Tenure rights are long term, with some farmers claiming that they could keep the land permanently, others reporting terms of 24–50 years. They do not necessarily possess certificates, but in some cases say that they signed a "red book," kept at the cooperative, in which the transfer of land to them is recorded.

A farmer in Tay Coc village in Doan Hung district said that he had inherited 3 hectares of hill land covered with palms and bamboos from his parents. He claims to have retained the rights to this land during the cooperative period. Now he pays an annual tax of 40,000 dong. Another farmer in Tay Coc village has gained a 50-year lease to a 1-hectare plot that he had illegally cleared five years ago on state forest land. He slashed and burned the area to clear it of bamboo and planted cassava, as the forestry department paid no attention to managing or protecting the forest. Now that he has been given tenure, he has planted palms, melia, styrax, and eucalyptus. He has not yet received a formal certificate nor does he know the level of tax he will pay when he harvests timber. Another farmer in Dong Xuan village, Thanh Hoa district, reported that he obtained long-term tenure to 2,500 square meters of hill land from the cooperative six years ago. He did not have to pay for this land because it was classified as barren. He has subsequently planted the lower level with cassava, sweet potato, and peanut, and has planted seedlings of eucalyptus, melia, and *Acacia auriculiformis* on the hilltop. The 500 seedlings cost him 200 dong each. Other than his labor, they are his only investment in his forest. He says that he will have to pay a tax to the cooperative when he cuts the trees but does not know what the rate will be.

Farmers who have purchased existing eucalyptus forest commonly enrich its diversity by interplanting styrax, melia, and other indigenous species. Styrax is particularly favored because of its fast growth. When planted from seed it can be harvested after 5–8 years. Seed costs 16,000–18,000 dong per kilogram. Melia and acacia seedlings can be purchased from state nurseries for 200 dong each. No other inputs are used. Forest land is generally

worked using the household's own labor. One well-off farmer (not in our sample) in Doan Hung who has acquired 10 hectares employs 10–20 workers to help in his forest garden during peak times.

Many of the plantation forest tree species and bamboo planted in Doan Hung and Thanh Hoa districts are sold to the Bai Bang Paper Mill for pulping. The paper mill, which is located near the district center at Viet Tri, is a joint industrial development project between the governments of Sweden and Vietnam. The paper mill currently operates at less than full capacity because of a shortage of pulping materials, so a steady market for plantation forest species is virtually assured. One farmer said that the trees can also be easily sold as fuelwood.

One Cao Lan farmer in Doan Hung district said that he collects medicinal plants from a small area of naturally forested hills about 2–3 kilometers from his house. He collects the plants both for personal use and for sale. Some plants are sold for up to 50,000–60,000 dong. He said that he knows of more than 200 species of medicinal plants that can be harvested from the area, but they are increasingly hard to find because the area is rapidly being deforested. He learned about medicinal use of the plants from his father and grandfather.

NON-FARM AND OFF-FARM PRODUCTION

Non-farm and off-farm activities provide some supplementary income to almost all of the households. Only a few households engage in non-farm productive activities. One woman in a well-off household in Tay Coc has a sewing machine that she uses to operate a tailoring shop. The children of a poor family in Tay Coc play musical instruments at village funerals, for which they receive 10 kilograms of rice.

Off-farm sources of income play a more significant role in the household economy of most farmers. Two households have members who are employed full time as workers in factories. One woman in Tay Coc contributes 600,000 dong per year to her household from her wages at the tea factory. Members of several households work sporadically as wage laborers doing construction, weeding, or picking tea. A woman from a poor household in Tay Coc earns about 1 million dong per year picking tea and weeding. Four households in our sample receive income in the form of pensions for military service or past government employment. One former soldier receives a monthly pension of 574,000 dong per month. Two retired cadres receive pensions of 170,000 and 208,000 dong per month.

HOUSEHOLD INCOME AND EXPENDITURES

We were unable to obtain detailed information on income or household expenditures. The average per capita annual income in Vinh Phu province in 1992 was reported to be 1 million dong. Annual income in Thanh Hoa district is lower at 800,000 dong per capita, but 25 percent of the households there earn less than 500,000 dong per capita.

Payment of taxes, purchases of food and clothing, and production inputs in the form of chemical fertilizer and pesticides are major recurrent expenditures. Households with

children must fund their education. Purchase of rights to hill land requires large payments in a lump sum. Medical costs place a heavy burden on unlucky households. Any surplus is likely to be used for consumer durables. According to village records in Dong Xuan village, 55 percent of households live in a masonry house, 47 percent have a television, 62 percent a radio, and 21 percent own a motorbike.

FARMER SELF-ASSESSMENTS OF HOUSEHOLD ECONOMIC STATUS OVER TIME

Farmers were asked to assess their current economic status within the community. They were asked to think of the richest household as 10 and the poorest as 0 and then to indicate the place that their own household occupied on the scale. They were then asked to say what their ranking had been during the cooperative period and finally to indicate what they thought their status would be five years in the future. This question is a variant of the self-anchoring ladder scale technique first developed by Hadley Cantril (1965) and collaborators. It is an approach already tested and demonstrated to be effective in eliciting information from hundreds of peasant respondents in Vietnam (Rambo and Jamieson 1970). All of our informants except one were able to respond without difficulty. Table 5.7 presents the distribution of responses.

Respondents' rankings of their present status ranged from 0 to 8 with a mean of 4.3. Farmer self-assessments appear to generally correlate with their observed standard of living. The single exception is a former official who has a nice house and adequate land but ranks himself low (0) because he has lost his position since the reorganization of the cooperative.

Self-assessments of household economic status during the cooperative period were much lower than in the present. The mean ranking was 1.7 with a range of from "lower than zero" to 5. Two respondents, including one who reported her current level as 0, stated that they had ranked "lower than zero" then. When asked how that was possible, both replied that during the cooperative period they had not had enough food to eat. With one exception, that of the cadre who had lost his job, all respondents ranked their present situation as higher than it had been in the past.

All respondents, again excepting the unemployed cadre, thought that their households would be better off in the future than they are now. The average future rating was 6.5, with a range of 0–10. It is noteworthy that more than two-thirds (ten) of the farmers expect to have an above-average economic status in the future.

Table 5.7 Distribution of responses to self-assessment survey

	Ranking											
	<0	0	1	2	3	4	5	6	7	8	9	10
Present	0	2	0	1	2	1	3	3	1	1	0	0
Past	2	3	1	3	3	0	2	0	0	0	0	0
Future	0	1	0	0	1	0	1	3	2	2	1	2

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PART THREE

Dynamics of Development in
Lap Thach District

The Impact of Economic Liberalization on the People and Environment of Lap Thach District

Jeff Romm and Dang Thi Sy

How is Vietnam's turn toward market institutions affecting its rural people, economy, and environment? We explored this question in the Lap Thach district of the northwestern Vinh Phu province five years after a previous visit to the district. We interviewed district officials, members of the People's Committees of four diverse villages, and members of households in a wide range of circumstances. Our preliminary answers, which must be viewed as hypotheses, varied substantially among villages and households, but with sufficient pattern in the variation to suggest the value of further research about the causes and consequences of, and potential responses to, differential trends.

Formal policies inevitably are reshaped by the layers of organization through which they pass before touching those who farm the land. These layers are formed as readily by their diverse needs, abilities, and environments as by the more uniform messages the policies convey. The decline of the cooperative system and the rise of market institutions have created streams of opportunity and stress that flow differently among the diverse social landscapes of Lap Thach. The merger of village economic and political functions in the People's Committees has led predictably toward the localization of judgment and the differentiation of policies among villages.

While redistributions of resources are visibly improving people's livelihoods, they are also creating dynamics of development and differentiation that present new issues. Differences among villages appear to be related to the productivity, diversity, and riskiness of their natural environments and to their capacities to exploit new opportunities in ways that moderate the risks of markets, natural hazards, and social differentiation. Differences among households appear to depend on the patterns of access to capital, skills, and land on which households could draw when the constraints of the cooperative and state enterprise systems were removed. Changes in landscapes depend on the mix of households in a place, the village and market arrangements that affect them, and a larger financial context that favors private relative to public investment and those households

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that can mobilize capital relative to those less able to do so. Some declines in public investment capacity (e.g., in water regime control, education, and social protection) have potentially large future implications.

We begin with a general description of Lap Thach, then follow with a depiction of national reform policies as they appear in the district. The next sections explore adaptations and effects of these policies at village and then household levels. Impacts on agroecosystems are discussed to suggest mechanisms through which household, village, and district scales of activity modify their social and natural environments. We close with speculations about possible trends and issues.

LAP THACH DISTRICT

Lap Thach district extends like a triangular peninsula between the Lo and Day Rivers, from its broad montane north to flood-prone southern lowland tip near Viet Tri, the provincial capital. This situation and structure are the dominating agroecological features of the district. When the Lo and the Day flow lightly, streams and strata of the district drain its water and soils. Heavy flows dam the drains and force floods. Water resource developments, wherever these might be located in the basin of the Red River, exacerbate these impacts. Whether as dams or as irrigation systems, they trap water when it is scarce and release it when abundant, thereby making dry and wet times even drier and wetter in areas that drain into streams that feel these effects. Thus not only is the district characterized ecologically by its hydrological features, but also the dominating levers of human control are the managerial regimes by which these hydrological features are regulated and used.

The district has 210,373 people distributed among 41,500 households and 38 villages. One-third of its 41,500 hectares is agricultural land, another third is forest land; the remainder is split between homesteads and submerged lands. Forests are more prominent in the north, submerged lands in the south. The middle regions of the district hold the highest densities of population and intensities of agriculture.

The district has three large reservoirs in its northern mountains, more than 100 smaller reservoirs in its soft midland hills and valleys, large pumps for diversion of flows inward from the Lo and the Day, a vast distribution system of irrigation canals and drains, and an extensive system of dikes to protect the low-lying south from the Lo and Day in high flow. One-third of the district's agricultural land is irrigated. Households and hamlets maintain the canals to farm fields. Village cooperatives operate the storage, diversion, distribution, and drainage systems within their boundaries. The district hydrologic unit coordinates systems that cross village boundaries. The provincial water company manages the large reservoirs and canals and maintains the large dikes. Along with soil qualities, this highly articulated organization has determined the potential agricultural productivity of sites across the whole district.

About 90 percent of the district population depends on agricultural livelihoods. Rice is the dominant crop, occupying virtually all of the valley lowlands and alluvial plains. Homestead gardens, typically located above the rice paddies, provide virtually all household

vegetables, fruit, and fuelwood; usually have fishponds; and are the centers of livestock production. Submerged lands provide fish as well, on a commercial basis in some areas. Cassava, corn, and sweet potato are grown on higher rain-fed soils. Soybean and peanut replace them where farmers have sufficient capital for the needed inputs. Fruit trees mix with or replace these food crops where farmers have the greater capital these require.

Tea was grown as a plantation crop on higher slopes under the cooperative system, but it is giving way rapidly to food and fruit crops on its lower margin and to forest plantations on the upper edge. Forests occupy the higher slopes. About half of the forest area is deforested. The other half is covered primarily by eucalyptus and, increasingly, acacia plantations. These are replacing the remainder of palms grown for thatch that, with the growth of tile manufacture from paddy clays, no longer is needed. Shifting cultivation occurs on the mountain slopes in the northern part of the district.

In 1993, Lap Thach district produced 51,159 tons of food in rice-equivalents, or 243 kilograms per person. Rice composed about two-thirds of this average, while cassava, corn and sweet potato provided most of the remainder. Rice continues to be the primary measure of production, labor, well-being, and distribution, and many aspects of organization and policy are interpreted in terms of their impact on and through this fundamental currency. The production of food is increasing more rapidly than the 2.1 percent rate of population growth. Livestock—pigs, cattle, chickens—are a significant source of cash income for most households. Fish, turtles, and other aquatic life are sources of income in submerged southern areas of the district.

Lap Thach has no all-weather road nor a bridge to Viet Tri: ferries are used to cross the Lo. Nevertheless, the number of trucks and the movement of goods are increasing rapidly. Agricultural service markets are developing in several towns, where villages have facilitated the absorption of cooperative activities by the private sector. Early stages of vertical integration of agricultural enterprises are visible around these towns. Industry in Lap Thach is otherwise confined to small cottage enterprises (e.g., bamboo products) and to brick and tile manufacture. Off-farm employment typically requires migration to Viet Tri or to montane areas for work in trade, mining, or construction.

Recent economic reforms have accelerated the dynamics of land use in Lap Thach. Although the price of rice is fairly stable, market forces have reduced the relative cost of production inputs—fertilizer, pesticides, herbicides—while the returns to peanut, soybean, and fruit have risen relative to those for rice. The cultivation of corn and sweet potato has greatly expanded for a mix of possible reasons: responses of the poor to rising costs of preparing land for rice cultivation, perhaps rising prices for these crops for food and for feed. The privatization of forest plantations has promoted their harvest and, along their lower margin, conversion to agricultural activities. The maintenance of irrigation systems has become more difficult because of public finance limitations and the privatization of farmers' motives.

As results of such changes, rice production has intensified while the area under rice has contracted; the area under other food crops has expanded at both their lower and upper margins; the number of fruit trees is increasing in the homegardens and on higher slopes;

forest stock and area are contracting. Health problems associated with unregulated pesticide and herbicide use (commonly at twice the recommended levels) are thought to be increasing; those associated with sanitation practices and water, while still pervasive, appear to be responding to health messages on television, now available in most hamlets. Market centers and agricultural industries are beginning to emerge. Average household cash incomes and nutrition levels are increasing, while public finance and the services depending on it—water control, education, health—are becoming more problematic. But these general patterns of change hide their differentiating effects among the regions, villages, and households of the district.

**ECONOMIC
LIBERALIZATION POLICY
IN LAP THACH**

The cooperative system was established in Lap Thach in 1958, four years after Liberation. Village cooperatives (*hop tac xa*) owned all land other than that held by state enterprises. They had comprehensive powers to allocate lands to particular crops, hamlets, and households; to supply inputs; to market outputs; to tax; and to finance. Because of their financial capability, they also supported the full range of public services: transport, education, health, security for the poor. They had access to district and provincial state enterprises (e.g., in irrigation and forestry) and coordinated their local activities.

The cooperatives generally are viewed to have done very well in their first five years but to have begun a slow continuing decline after 1961. The reasons for the decline are beyond the scope of this paper, but it seems likely that the normal dynamics of organizations—toward concentration of power and resources, loss of accountability and voluntary support, increased costs—were exacerbated by the tremendous strains of wartime conditions. Egalitarian distributions, based on average productivity, offered no reward to the diligent and enterprising and are thought to have thereby depressed the average itself, increasing pressures on the cooperative to assume even greater control.

In any case, rural people awaited and expected improvements at the end of the war. When reforms were not forthcoming, their loss of faith in the system expressed itself in declining production, declining household and cooperative income, and increasing food scarcities and other hardships. By 1981, the need for reform had become urgent. The cooperatives began to redistribute rice land among households on the basis of their labor capacity. By 1989, the size of family had become a criterion as well, determining the amount of homestead as well as rice land allotted to each household.

In 1989, the government of Vietnam began its major agrarian reforms, downsizing the cooperatives, placing agricultural production choices in the hands of the farmers and freeing markets as the primary mechanisms for input and output distribution. By 1994, reforms had reached the stage of transferring to households rights in all land held and controlled by the cooperatives and state enterprises.

In Lap Thach district, economic liberalization policies display as their primary characteristics (1) the shift of cooperative functions to private enterprise and the People's Committees, (2) the strengthening of land policy as an instrument of local governance,¹ (3) the strengthening of credit policy as an instrument of central economic control, and (4) the

relative increase of village responsibility for the finance of public services. District governance faces a formidable transition as mediator between new central and local interests and capacities. The implications are interesting indicators of future directions, attainments, and problems in the rural economy of Lap Thach.

The Shift of Cooperative Functions to Private Enterprise and the People's Committees

Prior to liberalization, village economic and political structures were relatively distinct. Political functions, operating through the People's Committees and the Communist Party, were tied closely to central decisions. Economic functions were relatively decentralized. Cooperatives had comprehensive powers in resource allocation, production, and marketing. They produced a rural landscape of sharply bounded entitlements and prescriptions that embedded a clear visual display of priorities. Multi-village and district organizations served specialized function (e.g., in planning, marketing, and irrigation), producing complex overlays of general and specialized institutional boundaries.

Liberalization sharply confined the cooperatives to particular specialized functions. The clearest of these are in electricity supply and irrigation management. The more general functions were released to private control (e.g., crop choices, forest holdings), placed in largely unsuccessful competition with private enterprise (e.g., input supply, production finance, marketing), or absorbed by the People's Committees (e.g., land allocation, public finance and services).

Reforms split formal authorities that previously had been coordinated, leaving vacuums that different villages are beginning to fill in different ways. For example, the allocation of land and water is now split between the People's Committee and the cooperative. As the productivity of land depends on its water regime, and the productivity of water on where and when it is available, the split introduces tensions between household resource use and the productivity of irrigation systems. Similar tensions may arise between household crop choices and village agricultural plans. These issues are less apparent where the committees are strong, subordinating and sustaining the cooperatives, than where both are weak. The cooperatives have declined in Lap Thach, even for their retained functions like irrigation, but the impact depends on how well the People's Committees have integrated prior cooperative functions.

The merger of economic and political functions within the People's Committees has increased the economic content of their considerations and their responsiveness to local relative to central interests. Capacities and policies have become more diverse among committees, ranging in Lap Thach from weak and diffuse to strong and coordinated. The variability may be one reason for new central initiatives to strengthen a uniform influence.

Land Policy

Economic liberalization has included the privatization of landownership. We expected this would have led to growth of land and labor markets and to increased concentration of landownership and migration of people. While we have been told this has occurred

elsewhere, there is little evidence of it in Lap Thach. The liberalization of land policy in Lap Thach has not meant that holders of land have gained the formal right to sell it. It has meant that farmers rather than cooperatives now choose which crops to grow on land allotted to them and potentially reallocated to others. To some extent it has meant that households can sell their rights of use—the permanence of such sales is a matter of highly diverse expectations—with the approval or acknowledgment of the People's Committee, the district, and, recently, the province. Few households in the district have done so.

The scope of the local community's power for land allocation has increased rather than declined because the concentration of local economic and social leverage in this instrument is expanding the rationale for its exercise. The following presents our understanding of the actual applications of the liberalized land policies in villages of Lap Thach.

Rice Land Rice land is allotted to households on the basis of their number of members and their labor capacity. This power is used to redress imbalances in household relations between labor and land, using the allocation of land to accommodate rather than to displace labor. In effect, land allocation policy now forms the "safety net" that the demise of the cooperatives had eliminated.

The exercise of this policy varied among the villages we visited along several dimensions: (a) the proportion of land that villages retain to allocate for future household formation and development needs (from 5 to 20 percent); (b) relative weights placed on labor capacity and household need in determining allotments (one, the other, and various mixes); (c) the extent to which non-farm employment reduced parcel allotments (from no reduction to total reduction); (d) area per capita (from 15/16 sao to 2 sao per person); (e) the acceptability of using rice land for other crops (acceptable to unacceptable); (f) the ease of renting rights of use (from not possible to easy); and (g) the frequency of and conditions for reallocations (from the government-specified terms to virtually ongoing evaluation). Given the social importance of the policy, the diversity and flexibility in its application is not surprising.

Non-Rice Agricultural Lands Non-rice agricultural lands of the former cooperatives are allotted to achieve maximum economic productivity. The allocation favors those groups that, through access to familial labor networks, capital, or political influence, are in position to achieve the economic outputs the People's Committee may wish to encourage. In effect, policy toward allocation of non-rice land now forms the instrument to regulate crops and cropping patterns that the cooperatives previously determined by plan.

Non-rice land allocation policy also varied among villages, although in terms that were less explicit and more difficult to identify than for rice land. Some villages obviously added an equity criterion, e.g., favoring smaller allotments for cassava and corn where households with capital were bargaining for a larger allotment for more remunerative crops. Villages varied in the hill land they retained for future allocation for diverse reasons, e.g., social flexibility, postponement until financial returns to the village would be greater. One village planned to create non-rice land from rice land in one area, and to convert non-rice to rice land in another, in order to increase the economic efficiency of its irrigation systems. There was little uniformity among parcel sizes and cropping patterns

on equivalent qualities of land; the degrees of departure from "maximum economic productivity" differed among villages.

Forest Lands Forest lands have become subject to distribution by the People's Committees. There were two classes of forest land. One class was held by the cooperative. The other class was held by the state forest enterprise. In general, cooperative forest land was poorer than enterprise land. Committee powers for land allocation now include the capacity to distribute cooperative and state enterprise forest land to private users.

Distributions of household shares in cooperative forest lands began in 1986, when contracts were established for household care of cooperative lands. Contracts were formed for the anticipated length of a rotation (typically five years) for an average of 2 hectares, and provided the caretaking household a 15–20 percent share of the harvest value. Contracts signed originally with the cooperatives have now been transferred to the villages.

In 1993, the central government allowed longer-term (20–50 year) transfers of former cooperative forest land to households. Despite central government stipulations of acceptable terms for forest land transfers, these terms are negotiable in Lap Thach. Transfers depend on capacities to achieve maximum economic output as well as on implicit committee policies toward social distribution. Equity is a consideration in some villages. In others, the allocation of forest lands may be replacing the capacity to award favored access to the benefits of cooperative and state enterprises. In at least one village, the length of contracts is negotiated at least partially to achieve a mutually acceptable balance between private and village control.

The villages have three primary forms of contractual arrangements, depending on the quality of forest condition and the extent of retained control. They continue to sell contracts to households for care of trees already on the land, with the household receiving 15–20 percent of harvest value. They charge 50,000–70,000 dong per sao for time-bound transfer to households of harvested areas with regeneration, the household then paying a yield tax on harvest. They charge 0–30,000 dong per sao for time-bound transfer of barren lands to households. The actual price for transfer contracts depends on such factors as forest and land productivity, village distribution policy, household capacity to pay, reinvestment provisions, and contract length.

State enterprise arrangements are different. They contract usufruct rights for 20–30 year periods, provide and require payback of investment in the forest, and maintain state control of land use and harvest procedures.

In both village and enterprise arrangements, landholders can plant agricultural crops on parts of the forest land. These crops typically are peanut, soybean, and vegetables on the (better) enterprise land and cassava and corn on the village lands. Opportunities are available to people outside the village in which the land is located. The criteria for determining who gets forest land include labor availability, investment capacity, management capability, and distributive considerations.

Village forests in Xuan Hoa village, for example, have been distributed in parcels of 1–20 hectares. The average "hill" is 20 hectares. In most cases, the hill will be held by 3–6

households. In one case, a hill is held by one person who is described as "daring" to borrow and willing and able to hire others, principally from among relatives and neighbors.

One hill of 11 hectares of communal eucalyptus forest was distributed after harvesting to four households. One of the four had taken care of 10 hectares from the time of planting to harvest at five years, earning 5 million dong as its 20-percent share of the net income. This household then "purchased" 2 hectares of the regenerating forest at 1.5 million dong for a period of 15 years. In effect, it paid the village 1.5 million dong for the right to enjoy the full income stream of the plantation for a period of three rotations, assuming full responsibility for the care of the plantation in the meanwhile. Regular parts of its income stream were sales of branches and thinnings to brick makers for their kilns. (We did not determine the extent to which the village shared in such preharvest sales.) The household continued as well to care for 4 hectares of retained village acacia forest in exchange for the 20-percent share of its harvest yields.

Forest arrangements are more negotiable than the formal terms suggest. Negotiations proceed between the household and the land management unit of the People's Committee. Considerations include, for example, (a) interpretation of household capacity; (b) size, condition, and price of parcel; (c) assumed pattern of forest management; (d) possible alternative allocations; (e) village policy toward retention and distribution; and (f) products accountable to the village. The negotiability of arrangements suggests that the policies of villages depend on the composition and stance of the board, the social and financial conditions of the village, and the characteristics of the household and its relations to others.

Irrigation In densely populated villages composed predominantly of rice land, the People's Committees appear to dominate the residual irrigation functions of the cooperative, using water rather than land allocation as the primary means to govern cropping patterns. Irrigation control is being exercised as land policy to replace cooperative production plans in land-scarce circumstances.

In Lap Thach, the liberalization of land policy does not mean the full privatization of landownership, but rather the increasing use of land allocation to govern the local social and economic consequences of the decline of the planned economy and the rise of the market. As the balance and significance of these consequences are location-specific, the actual use of land policy varies greatly among villages in the district. While central policy specifies the frequency and terms of reallocations for different categories of land, we found substantial divergence from central provisions as well as diversity among village policies.

If central policy developments are indicative, the diversification among village policies is not confined to Lap Thach. In July, the National Council resolved to establish the Department of Land Management as a line agency from national through provincial and district to communal structures. This line agency is intended to unify functions of land inventory, allocation, and planning that previously had been diffused among a number of different central departments. The district will be responsible for support of the organizational staff

at the village level. Each village will have one staff member to the district-level Board of Land Management; this person will also be a member of the village People's Committee. The district board will provide advice and support on such matters as soil mapping and land classification, allocations of land among different classifications, redistributions and new allocations, record keeping, conflict resolution, and a host of other possible functions that the communal boards assume. The dynamics of accommodation between central, agency, and village land policies may illuminate potential consequences of shifts from generalized political toward specialized technocratic state institutions in other fields.

Land classifications determine tax status, and communal changes in classification must gain district approval. Although this sounds rigid, there is substantial flexibility in how villages choose to define and apply particular classifications, i.e., the extent to which departures from their prescriptive uses are allowed, negotiated, and ignored. Taxes are tied to harvests to the extent possible, so shifts in harvest pattern values on a piece of land may stretch and ultimately break the financial basis of the class. But classifications are also intended implicitly to secure reasonable equity and to promote economic growth, as well as to finance government. In a large sense, land policy is used to mediate the diverse pressures for social equity and stability, economic growth, and relations between public and private sectors: it regulates resource use as a consequence.

Finance Policy

Vietnam is supporting agriculture through the freeing of markets and production choices and through increased effort to promote knowledge of technological improvements. Liberalization has largely eliminated farmers' costs of cooperative administration as well as the security of administered investment. Market forces increasingly determine the quantity and direction of investment flows. The government has greatly reduced subsidized rural credit, letting interest rates reflect competitive demands for capital throughout the economy.

Interest rates are at about 36 percent per year for agricultural loans. The rates are set by competitive demands for capital, limiting access to capital for uses that do not produce competitive rates of financial return. Such a policy favors new activities that penetrate significant niches of unexploited opportunity, most of which are in the emerging urban/industrial sectors. It generally works against farmers, although not necessarily against privileged agricultural activities and groups. While industrial development is the primary objective of the policy, experience elsewhere and observations in Vietnam suggest that the urban real estate, finance, and service sectors, where the windfalls of liberalization are most obvious, are significant sources of pressure on agricultural rates.

The "tight credit" policy assumes that agriculture, with access to improved technologies and flexible markets, will generate sufficient growth on its own to maintain the rural population, dampen food prices, and supply foreign exchange in support of a policy of high-opportunity investment. As the assumption applies to agriculture in the aggregate, and therefore to average conditions within the rural population, it tends to downplay the policy's large differential impacts on different segments of the population.

In general, a tight credit policy constrains access to farm production capital and puts long-term rural investment needs at a serious disadvantage for the following reasons:

1. Tight credit increases inequalities within rural populations and between them and their urban counterparts. Our household interviews provided support for this expectation. Households' access to capital differs immensely. At some point, the extent of rural inequality can begin to defeat the intent of the policy that produces it.
2. Tight credit shifts investment from public toward private enterprise. This affects levels of investment in such endeavors as water control, education, and road systems—investments that are easily deferred but essential for sustained rural economic growth and equity. Our village surveys suggested a growing scarcity of public capital as well as a shift of responsibility for its generation to the villages. The villages had yet to develop responses: all were seriously concerned about the future of their public infrastructure and services.
3. Tight credit encourages short-term exploitation of natural resources such as forests and soils. People who hold these resources, who must borrow to use them, or who can lend the financial returns they yield are pressed to transform natural capital—trees, soil fertility—into current yields (e.g., as commercial wood or cassava). The effect is to reduce long-term productivity and increase future costs of rehabilitation and recovery.

These dynamics are visible in Lap Thach.

Public finance in Lap Thach is in the midst of a challenging transition. The cooperatives had the capacity to capture and concentrate economic surpluses and to then allocate them to a range of local and district needs for capital. The market system has the capacity to generate greater economic surpluses, but also to make them less visible and to move them elsewhere. The villages and the district now must find means to capture shares of increasingly diverse and unaccountable flows that are guided more by interest rates than by collective governance, and they must do so in a climate of privatization that has reduced household readiness to pay taxes and fees. Such problems become particularly apparent at the district level, which has responsibility for large-scale infrastructure, such as water control, on which most households depend but none feels the capacity to affect.

The 1994–2000 development plan of Lap Thach district is directed toward increasing incomes and reducing poverty and unemployment primarily by increasing the economic productivity of agriculture. Its capital requirements are an estimated 35.1 billion dong:

- 16.2 billion dong for irrigation (13.5 billion) and flood control (2.7 billion)
- 13.8 billion dong for roads (9.3 billion) and a bridge (4.5 billion)
- 5.1 billion dong for agricultural diversification, with particular emphasis on fruit production in homegardens and on slopes now under cassava and tea

Prior to reform, the district had relatively independent financial sources through the public enterprises, such as irrigation, that were under its control. These resources included irrigation charges as well as a corvée labor tax for maintenance of canals and dikes.

But the functions and resources of the district enterprises now have shifted toward the province and the villages, increasing dependence of the district on both.

The following sources of locally derived finance suggest the increasing dependence the district now has on higher and lower levels of capital generation.

- *Agricultural land tax*

90 percent of receipts to central government; 10 percent to village People's Committee

The tax varies with land classification and is calculated on the basis of a set taxable yield associated with each class rather than on actual yield. Villages affect the magnitude of the tax through their influence on land classification, on the taxable yields assigned to the classes, and on the form and strength of tax collection. Villages we visited collect the tax as a share of the crop or as the cash value of that share. Economically aggressive villages preferred the latter; those with distributional concerns may prefer the former.

- *Irrigation charges*

Provincial free-flow: 9 percent of crop or cash-equivalent to provincial irrigation enterprise, up to 2 percent to village cooperative

Provincial pump: 10.5 percent of crop or money-equivalent to provincial enterprise, up to 2 percent to village cooperative

Village free-flow: 2–7 kilograms of rice per sao, varying among villages

Village pump: additional 2–3 kilograms of rice per sao, varying among villages

Percentage charges are calculated on the basis of a set taxable yield for each land class rather than the actual crop. The percentage varies, depending on whether irrigation is wholly free-flow or requires a pump, and whether the pump is owned by the provincial irrigation company or by the village. Villages can vary their share below 2 percent, and decide whether to collect in cash or kind. Collection is an increasing problem. Every village told us that the village share no longer suffices to cover actual operations and maintenance costs. Decline of canal systems is a general concern.

- *Labor tax*

80 percent to province; 20 percent to village

Each village and working group is required to supply five days of labor per person (18–50 years old) per year, or crop- or cash-equivalents, for irrigation and flood control maintenance. We heard in at least one case that this tax is increasingly difficult to collect.

- *House tax*

100 percent to government; the house tax is assessed by the amount of land in the household plot. It is the same for all plots. Thus there is no tax pressure on the household choice of balance between house and garden size.

- *Forest receipts*

100 percent to village

Sale of village concessions to forest land, price depending on forest quality and productivity, and on village policy:

degraded: 0–30,000 dong per sao

healthy: 50,000–75,000 dong per sao

Sale of products from village forests: sale revenue less 15–20 percent share to caretakers if such agreements have been formed

Yield tax: private holders of forests will be taxed on harvests rather than on land. The tax share of yield will be set on the basis of average yields over areas classified as having similar productivity, then charged on the basis of concession size. As the land classification has not been accomplished, the tax share of forest yields has not been established.

- *Land transfer tax*

100 percent to government, plus variable additional amounts to the village for approvals and procedural costs; those who wish to sell or rent rights of land use to others must pay 5 percent of the value of an initial transfer, plus additional village requirements, and higher rates with subsequent transfers.

- *Market tax*

Permanent traders: 100 percent to government; tax is based on kinds, volumes, and values of goods sold.

Occasional traders: 100 percent to village; tax is charged for a site in the marketplace on a daily basis, irrespective of the goods sold, and variable among villages.

- *Homegarden tax*

100 percent to village; in at least two villages, there appeared to be a tax on the value of homegarden products sold.

- *Livestock slaughter tax*

100 percent to village; owners of livestock pay a tax for every animal slaughtered. The tax is higher for bovines than for swine, and varies among villages, some of which charge no tax.

Market taxes are the easiest to collect and the best revenue source for villages with significant market activity. Enterprising villages have sought to strengthen their market advantage through improvements in site, access, and distribution.

District and village capacities to collect irrigation and labor taxes have declined, as have the conditions of canals and dikes. The decline constitutes an implicit policy that will gradually reduce collective systems of irrigation and flood control. In the absence of

sufficient compensatory government finance, the combination of institutional reforms and market forces seems likely to contract the area of intensive rice production, possibly releasing labor and increasing the richness of non-rice and specifically horticultural cropping systems for those with the capital and labor to undertake them.

The cost of farm-level pumps, now about 500,000 dong for a pump of good quality, is coming within reach of increasing numbers of households. Pumps may become attractive to farmers who want to produce higher-value non-rice crops or to sustain rice production where canal systems no longer suffice. We found water table depths to be shallow, even on relatively high hill sites; none exceeded 5 meters. Pumps free farmers from fixed canal sources. They would tend to diversify and disperse cropping systems that were rather uniform for a given landform and hydrologic regime prior to liberalization.

The public finance implications of markets and water obviously differ among villages in different circumstances and will exert selective effects among the villages and households of the district.

EFFECT OF ECONOMIC REFORMS ON VILLAGES IN LAP THACH

We visited five villages of Lap Thach district and had the opportunity to interview village officials in four of them. The five represent different portions of the agroecology and economy of the district.

Dong Ich is the southernmost village and nearest to Viet Tri. Most of its land is submerged during the wet season. Among the villages we visited, it has the least hill and forest land, the greatest reliance on off-farm income, the greatest wealth, and the poorest health.

Xuan Loi, slightly northward, is quite prone to drought-flood swings and insecurities. Substantial portions of its rice land have increasingly been submerged and uncultivable during the main growing season. A transition toward off-farm employment has just begun.

Thai Hoa is a northeastern village that has extensive irrigated lowlands and a comprehensive system of irrigation and drainage facilities. It lacks hill and forest lands, which have provided scope for reallocation in other villages, but is developing an agricultural market sector.

Xuan Hoa is a central village, the seat of Lap Thach district administration, in the midst of rolling hills and valleys, with approximately equal thirds of residential, agricultural, and forest lands. Although it is the most urbanized village, through development of market as well as administrative services, it also has retained the largest share of unallocated forest and hill land.

Van Truc is a northern upland village of montane forest and shifting cultivation, hill-valley mixes of irrigated and rain-fed cultivation, and a large reservoir and its fishery. Although we did not have the opportunity to interview village officials, the privatization of rights of resource use appears to have favored interests outside the village with access to the required capital.

The five present distinctive patterns of socioeconomic and agroecological response to policy changes. The four where we interviewed officials display the kinds of differences among village policies that are arising with merger of economic and political functions in the People's Committee and growth of market institutions for resource allocation.

The differences of response among villages to economic reforms appear to be tied to their characteristics along several key dimensions.

- *Land.* The first is the relative abundance of land and its balance among lowland, upland, and forest types: villages with relatively little hill and forest lands have less opportunity to use land reallocation as an instrument for economic growth and equity than those with larger amounts.
- *Population.* The second dimension is population density relative to opportunities for non-farm employment and upland crop cultivation: reallocating rice lands to secure minimum livelihoods is reducing farm sizes toward eventual minima in villages short of opportunities for other forms of economic expansion, while the growth of such opportunities in other villages strengthens the potential use of land policy as well.
- *Water control.* The third dimension is the kind and degree of water control required for the agricultural production conditions in the village: large investments are required in villages that suffer chronic submergence of cultivable land or that must maintain large canal systems.
- *Market integration.* The fourth is the degree of market integration and its road requirements: villages with reliable and diversified market access show greater economic diversification, and greater discretion in land policy, than those without it.

Along all of these dimensions, access to capital offers potential compensation for constraints based on land and site characteristics. The nature and severity of need for capital vary with village characteristics.

Village Profiles

While our profiles simplify the complex realities of each village, they give some sense of the diversity among proximate villages and their differential sensitivity to reform policies. Table 6.1 highlights some indicators of the condition of the villages and differences among them.

Dong Ich Located at the tip of the Lap Thach "peninsula," Dong Ich represents one extreme of ecological and economic conditions in the district. About two-thirds of its land is agricultural. There are 14.3 people per hectare of agricultural land, and the population is growing at a rate of 2.6 percent, the highest among the villages we visited. Virtually all of the agricultural land is submerged and uncultivable in a normal wet season. This creates difficult living conditions and styles of livelihood that are adapted to them. Waterborne illness is endemic, and health issues are a main focus of village activities. Only 8.4 percent of the land is allotted for houses and homegardens, where all vegetable and livestock production occurs. Only 3.7 percent of the land is in forest, all of which has been planted.

Table 6.1 Indicators of village conditions, Lap Thach district

Characteristic	Village			
	Dong Ich	Xuan Loi	Thai Hoa	Xuan Hoa
Land area (ha)	1,178	693	703	1,770
Population				
Size	11,000	5,364	6,703	13,813
Density/hectare cultivated land	14.3	14.7	20.7	30.7
Land types				
Home/agricultural/forest (%)	26/71/3	24/53/23	5/76/19	40/31/29
Agricultural land				
Hectares	768	366	290	450
Irrigated/non-irrigated (%)	—	50/50	85/15	33/66
Flooded/non-flooded (%)	30/70	30/70	—	20/80
Rice area/capita (m ²)	720	432	510	312
Rice production/capita (kg/yr)	300	320	435	—
Rice yield (t/ha/crop)	3.0–4.2	2.1–5.4	4.2–6.0	4.5–4.9
Irrigation cost (1,000 dong/ha)	300–350	170–220	320	135–245
Forest area (ha)	40	158	70	424
Households allocated forest land (%)	0	18.4	100	80.2
Houseplot area (ha)	99	93	324	338
Poor households (< 50,000 dong/capita/yr)	107	230	37	—
Education (pupils)				(no illiteracy)
Primary school	1,125	—	1,015	50% finish
Secondary school	677	—	577	20% finish
High school	—	—	—	10% finish
Health				
Clinics	1	1	1	1
Doctors	1	0	0	0
Doctor assistants	3	3	3	3
Economic structure	livestock; fisheries; off-farm	agriculture	agriculture; marketing	divers. agric.; marketing; administration
Capital constraints	flood/drain	flood/drain; irrigation	irrigation; agric. diversification; manufacturing	agro-industry; education; roads

Agricultural production averages 140–150 kilograms/sao/crop (3.0–4.2 tons/hectare/crop) in an environment that limits the number of crops more severely than in other villages. Average agricultural income in rice-equivalents is 280 kilograms/person/year, but this is not a good indicator of household income. Households engage in livestock production—each has 1–3 cows—as well as fishing for rather specialized valuable products, turtles and snakehead fish for example. In addition, many households engage in off-farm activities, including cottage industries in bamboo products, brick making from submerged lands, and trade that is thought to be organized in Viet Tri. The household cash incomes of the village are the highest among the villages of the district. The visible signs include 600

television sets and 200 motorcycles. Despite the high rate of population growth and the viability of non-agricultural activities, there has been virtually no transfer of land and no rental of labor, perhaps because prospects for cultivation are too poor to compete with other opportunities. The village has withheld only 3 percent of agricultural land for future allocation and as yet has not distributed its 40 hectares of forest plantation.

The People's Committee displays a distinctive targeted orientation toward problems of flood control, health, and security for the poor. It requires 4,000 working days per year for maintenance of roads and canals in the village, and 6,000 working days per year for district and provincial flood control works. Its clinic has the only medical doctor in the district. It operates a credit fund for poor households, estimated at about 5 percent of the population.

Xuan Loi A southerly village, Xuan Loi is quite prone to drought-flood swings and insecurities. More than half its land is agricultural; less than a quarter is forest. Ninety-five percent of the population depends on agriculture for livelihood. There are 14.7 people per hectare of agricultural land; the population is growing at 2 percent per year. The average income is 320 kilograms of rice/person/year. Non-agricultural activities include brick making and, in other districts, gold mining. These activities typically involve poor households that lack the capital to survive in agriculture; the outside income helps them subsist but does not achieve the capital that sufficiency in farming requires. Poor households are estimated to compose 15–20 percent of the population.

The absence of capital is particularly severe in this village for several interacting reasons. The environment of the village requires larger infrastructural commitments than is true in other villages, except Dong Ich, to reduce agricultural production risks to average levels. The riskiness of agricultural production keeps private generation of capital below average, promotes excessive expenditures on fertilizers and pesticides by those who can afford them, and seriously disadvantages those who cannot. The tendency toward non-farm migration and informal land exchanges as survival strategies seem stronger in this village than in the others we visited. An estimated 30 percent of households have experienced migration to towns, mines, and mountains for work. An estimated 50 percent of cash income is thought to be derived from livestock production and off-farm endeavor.

The People's Committee displayed the least integration of economic and political functions, and the cooperative the greatest autonomy, among the villages we visited. The committee has slight scope for use of land policy: from 1981 to the present, the land under village control has dropped from 50 percent to 5 percent of the village area. Agricultural market services have not developed, perhaps because opportunities are too limited, other villages have moved more aggressively to develop them, or the integration of committee and cooperative functions is relatively incomplete. The village's tax revenues currently cover only one-third of its 91-million-dong operating costs; the government provides another third; the remaining third is a source of great concern. Households must pay increasing amounts for the education of their children.

The village development program is directed primarily toward agricultural diversification that increases the value of crops and livestock currently grown on hill and homestead

lands. The lack of capital for drainage and flood control structures is viewed as having become a dominating constraint on future prospects. Water-related construction also is viewed as the primary potential source for off-farm employment.

Thai Hoa A northeastern village, Thai Hoa is extensively irrigated and drained and has no flooded area. Its land is primarily agricultural, about half in rice and half in crops like peanut or soybean, and 85 percent of its agricultural land is irrigated. In addition to being highly productive in crop cultivation, village households gain substantial income from livestock production (5 billion dong in 1993 for the whole village) and agricultural market services, taxes on which provide 70 million dong of village revenue. The village population is 20.7 persons per hectare of agricultural land and is growing at a rate of 2 percent per year. The average annual income is 435 kilograms of rice-equivalent per person.

Since economic liberalization, the most dramatic changes are the growth of brick making; intensified rice production; the spread of peanut, soybean, and fruit cultivation; expanding livestock production; and the growth of a vibrant agricultural services sector. The village development plan focuses on means to accelerate these trends.

The People's Committee displayed the strongest direct control of economic strategy among the villages we visited. This included the use of irrigation priorities to affect land allocations among crops, specifically the shift in one region from irrigated rice to unirrigated soybean production, as well as direct operation of non-agricultural enterprises, e.g., brick making and service stations. Although irrigation is a residual function of the cooperative, the committee clearly controlled irrigation policy.

Capital was viewed as the most serious constraint in the village's agricultural (diversification, irrigation, and road systems) and non-agricultural (manufacturing) development activities. The village has retained control of 70 hectares of eucalyptus plantation, about 10 percent of the village area, and 5 percent of agricultural land. It planned to harvest and sell the eucalyptus, then allocate the land for fruit production on lower slopes and acacia production on higher slopes. It already had followed this approach in the conversion of 82 hectares from village palm plantation to household fruit production. The village maintains a 4.5-million-dong fund to provide credit to poor households. Ten percent of village households, which earn less than 500,000 dong/person/year, currently draw capital from this fund. If households are not eligible for the fund but lack collateral for obtaining loans from the government bank, the village will underwrite the loan.

Xuan Hoa A central village and the seat of district administration, Xuan Hoa is situated in a landscape of rolling hills and valleys. Intensive rice cultivation occurs in the valleys, diversified commercial crop production on the lower and smaller hills, and wood production on the more expansive or distant slopes. Only 30 percent of its land is agricultural, 30 percent of which is irrigated by canal and 70 percent of which is "hill"; another 30 percent is forest. Houses and homegardens compose 23 percent, while most of the remaining land is in roads and canals. All households produce pigs, cows, and chickens for sale, and 70 percent of them have fishponds. The village has rich hillside gardens as well as fine forest plantations, emerging vertically integrated agricultural production, and marketing activities in the town.

The village population density is 30.8 persons per hectare of agricultural land. The population, which is about double that of Thai Hoa or Xuan Loi, is growing at a rate of 1.7 percent. It is concentrated in and around the town. Although we did not obtain income figures for the village, its general economic vitality is apparent.

The most obvious changes since economic liberalization are in the distribution of forest and hill lands from cooperative and state to private control and in the development of relatively large-scale agricultural production, processing, and service enterprises, i.e., a multitiered private economic structure. Among the People's Committees we met, Xuan Hoa's displayed the most strategic "light" approach to the integration of its economic with its political functions. Scarce capital, again the key issue, was felt particularly in needs for roads and schools.

Van Truc Van Truc is a northern montane village where we did not have the opportunity to meet village officials. We include it to provide a sense of the full range of agroecological and demographic conditions in the district. Rice fields represent a relatively small proportion of the agricultural land, occurring in the small-order reaches of valleys, and agricultural land is a relatively small proportion of the whole area, which is predominantly forest. The density of the population is low when compared with the other four villages, and tends to be concentrated along the edges of valleys in houses surrounded by tree gardens that form an almost continuous chain of horticultural forest. Cash income sources include cassava, corn, soybean, peanut, and livestock, as well as fish from the large reservoir located in the village.

Although all of the villages we visited cited capital scarcity as their dominating constraint, the nature of the constraint varies with village characteristics, particularly those that shape agricultural opportunities. Xuan Loi needs capital to control floods and thereby create productive land, of which there is currently not enough to secure adequate food for all households. Thai Hoa needs capital to maintain its irrigation systems and to accelerate growth of non-agricultural enterprises to absorb excess agricultural population. Xuan Hoa needs capital to enhance the quality of its road and education systems. These different perceptions of need indicate how villages respond to reform policies toward local governance, the allocation of land between household and commercial agricultural sectors, and the allocation of capital toward private non-household enterprises.

EFFECT OF ECONOMIC REFORMS ON HOUSEHOLDS IN LAP THACH

We interviewed nine rural households in Lap Thach district, and talked to others to gain some sense of their situation. As the following profiles indicate, every household differs in ways that seem bound to be expressed in diverse responses to changes in policy and in market conditions. The differences among households can be characterized as differences among apparent strategies of household livelihood. In addition to the capabilities of household members, strategies of livelihood appear to express the capacities of social networks within which households are embedded. Poverty, for example, appears to be related to social isolation, and wealth to the centrality of a household's position in an extensive and diversified network.

While the profiles carry their own message, a preliminary statement may help to explain the distinctions that are made between households and their responses to liberalization policies. These policies can be viewed in both economic and social terms.

Economically, liberalization policies enlarged the distinction between (a) lands for rice and gardens, which are allocated on the basis of labor capability and household need, and (b) lands for cash and forest crops, which now are allocated on the basis of household capacities to mobilize capital. Rice and garden land allocations secure some minimum for almost everyone, while cash crop and forest land allocations expand opportunities for growth in income for those who can make the necessary investments. In economic terms, the liberalization policies have sharpened the differences in possibility between those who have and do not have access to capital.

Socially, liberalization policies weakened cooperative structures of access that had at once equalized opportunities for those lacking other social sources of support and confined opportunities for those possessing extensive relations and the potential capacity to obtain their resources. Liberalization policies thus have permitted primary social patterns to rise to the surface, to the benefit of those with dense relations and to the disadvantage of those without social relations on which they might rely.

These economic and social attributes of liberalization help to illuminate the differences among households we interviewed in Lap Thach and the economic strategies they pursue. The primary difference arises between households who do and do not have capital.

Households with capital differentiate by the kinds of social networks, thus the capacity for resource mobilization, within which their capital is obtained. We distinguish between those who follow three strategies, listed in increasing order of their capital requirements and the extent of household mobilization to satisfy them.

1. *Intensification*—the increased investment of capital in agricultural production—depends on household-based mobilization of capital. It contains substrategies that households combine in different degrees: intensified production of the same crop and crop diversification on the same land.
 - *Crop intensification*: Households who pursue crop intensification in Lap Thach typically have access to limited short-term production credit through informal and formal sources.
 - *Crop diversification*: Households pursuing crop diversification typically generate capital through their own savings at different successional stages of intensified investment in the same piece of land, including benefits from earnings and networks in non-farm employments.

One household may pursue both approaches on different land.

2. *Resource diversification*—the diversification of land types and tenures under household management—is an expansive strategy of land control. It appears in our interviews to depend on extensive family networks that flexibly mobilize both labor and capital to support members' needs and endeavors.

3. *Vertical integration*—the development of relatively capital-intensive activities at secondary levels of agricultural production, processing, and marketing—has capital requirements that exceed household and familial capacities. Households pursuing it in Lap Thach have large capacities for capital mobilization and typically have been engaged in related state enterprises in which their skills, savings, and networks were developed.

In the households we interviewed, capital requirements ranged in magnitude from short-term loans in the range of 500,000 dong for crop intensification, 1 million–5 million dong for crop diversification, 5 million–15 million dong for resource diversification, and up to 20 million–30 million dong for vertical integration.

Households without capital differentiate between those who can and cannot exploit non-farm employment opportunities.

1. Those *with skills and health* for non-farm employment are likely to commute or pursue various strategies of *migration*.
2. Those *without skills and health* pursue strategies of *survival* within severe household resource limitations.

Such distinctions are first approximations based on the most tentative of data, but they do suggest the value of assessing household strategies as expressions of both the household itself and the sets of social relations on which it relies. Economic reforms have affected household motives and capacities directly as well as indirectly through their changes in social opportunities.

Profiles of Households with Capital

Intensification: Household Capital Accumulation We interviewed three households that have gradually increased and diversified their homegardens through hard work, careful planning, and some support from access to knowledge and salaries obtained in professional civil service positions. They also have intensified crop production on rice land in varying degrees. In all three cases, one can observe successional development of at once an economic and ecological kind—a humanly achieved expansion of the productive capacity of the system.

Mr. Lan is a retired teacher. He and his wife live in Xuan Hoa, a village in Son Loy in southern Lap Thach. The area is highly vulnerable to cycles of drought and flood. Households become particularly vulnerable to the extent that they lack diversified opportunities for livelihood that can carry them through different climatic situations.

Mr. Lan is 62 years old; his wife is 66. They have three sons and one daughter, all of whom are married, living elsewhere, and employed in professional and technical positions. Mr. Lan was born and raised in the same place.

Mr. Lan and his wife have only 1 sao of rice field because they no longer have the labor capacity, and perhaps the financial need, to operate the normal two-worker household allocation of 7–8 sao. They grow vegetables for home use on the 1 sao. They have 8 sao of

homegarden around their hillside home and 200 square meters of fishpond. Fish are consumed in the home. The garden contains mandarin, jujube, lemon, lychee, longan, rattan, pineapple, pomelo, betel leaf, cassava, melia, banana, various bamboos, and other plants we surely missed. Mr. Lan and his wife have diversified and enriched it through long years of hard effort. This beautiful system yields an income of several million dong each year, through sales both in the market and to market brokers.

Mr. Lan is a sparkling and smart person who takes great pride in his garden. He plans to improve it if he can obtain a water pump. A pump currently costs 800,000 dong. Water in his well rests at depths of 3–5 meters. Pumping would permit him to replace his cassava with mulberry-silk, an enterprise that existed in the area prior to 1954 but disappeared thereafter. Lan is convinced that mulberry-silk can be a lucrative product for the area. His interest in it seems more that of an innovator than a businessperson. His orientation is to increase the productivity and value of the garden by overcoming capital constraints to water control, an interest that is expressed more generally throughout the district.

Mr. Lan talked somewhat about changes he has observed in the village over his life. In earlier times, he said, there would be only one rice crop and one or two rice varieties. Now, there typically are two crops of rice and one cash crop, and a greater diversity of rice varieties. In homegardens, he has observed a shift from perennial to fruit trees, which have become the real income generators in the area. Although his own children have left the village, he does not see this as a pattern. Almost all children stay, although he suggested the situation might be otherwise if they had skills.

Mrs. Huyen's household is located in Thai Hoa village, an area in which canal irrigation is highly developed. Her husband had been in the army during the French war, retiring from the army to serve in the Ministry of Transportation for the remainder of his career. His travels matched his curiosity about crops in different places, and permitted him to bring home samples of crops he thought might grow there. The results are now apparent in a system of management that seems quite capable of continuing to increase the crops it produces in economic quantities.

The household has eight members. It has 7 sao of rice land, grows two crops of rice, and averages a yield of 200 kilograms/sao/crop, or 5.4 tons/hectare/crop. Corn, its third crop on rice land, averages 100 kilograms/sao/crop, or about 2.7 tons per hectare. The household sells about 300 kilograms of pork per year, through those who sell in the market, using its grains as feed. It has 288 square meters for vegetables, largely consumed by the family. It has 5–6 sao for the homegarden. Its fishpond generates an income of about 1 million dong per year.

The homegarden is a special operation. It produces lime, orange, apricot, and cinnamon in commercial quantities. It is producing bonsai ornamentals that are expected to yield about 2 million dong per year. The apricot, cinnamon, and ornamental enterprises are indicative of the spirit of innovation that the household displays. The movement to such specialty crops is akin to Mr. Lan's proposal to produce silk, a step beyond fruit production for the market. Despite the high quality of household grain production, the bulk of

household income comes from the garden and the livestock. The garden yields an income of 7 million–8 million dong per year.

This growth in income generation needs to be placed in a temporal context. Ten years ago, the household had little but grain to sell because it lacked the capital needed to produce and diversify surpluses. Over time, it has built its capital in livestock, in perennial crops, and perhaps now in monetary form. Changes in land and agricultural policy have, for this family, improved capacities for capital investment even more substantially.

Mrs. Huyen appreciates the changes in land policy for several reasons. The changes greatly expand the range of choices the household can now enjoy in managing its resources. They also ease the household's tax burden, particularly in the form of its obligation to the cooperative. The household still uses the cooperative's technical services, but pays the technician directly for his services rather than indirectly and more expensively through general support for the cooperative.

Mrs. *Phuong*, her husband, and two children live on the hill slopes of Xuan Hoa village, where hills rise steeply from the flat irrigated rice land and are covered in rich growths of gardens and forest plantations. Her husband is an engineer with the provincial water corporation. His family originated on this site but were resettled in 1945. They returned through the upland settlement program in 1982 and were able to claim their ancestral location. The family was able to keep the same land in the reallocation of 1989.

The family has 6.5 sao of rice land, on which they grow two crops of rice and one crop of soybean. Their average rice yields are 260 kilograms per sao. They have 1 sao to grow sweet potato for livestock feed. They also have 1 *mau* (3,600 square meters) for home-garden, and this is the real heart of their story.

The story is of a family that has built up sufficient capital at one stage of production to move on to another more economically productive stage. Mrs. *Phuong* began with a small livestock operation, gradually building up the size, quality, and financial yield of her stock. She currently sells about 150 kilograms of pork and 100 kilograms of chicken each year. The gains from this enterprise allowed the family to build its large and elegant house in 1988.

Meanwhile, Mrs. *Phuong* had also begun growing tea and adding various fruit trees to what she has come to call her "tree garden." The earnings have been carefully saved and then reinvested in the garden, which is a veritable forest of tea, jackfruit, eucalyptus, banana, lemon, lime, orange, pomelo, cinnamon, and other perennial crops. Although still young, the garden is earning 1 million dong per year. Mrs. *Phuong* has now planted 600–700 cinnamon seedlings and expects them to eventually replace the tea, for which the market price has been halved from 15,000 to 7,000 dong per kilogram. She expects to earn 500,000–1 million dong/tree/year after the 10–15 years that cinnamon requires to reach commercial maturity. Given the quality of planning she has demonstrated in her "successional strategy" thus far, there seems good reason to expect that her judgment this time is right, too.

Mrs. *Phuong*'s household has benefited from recent changes in land policy. The household

tax burden has declined from 100,000 to 20,000 dong per year as a consequence of reclassifications and rate changes designed to promote settlement of new classes of land. Such influences presumably will increase the concentration of agricultural motive and effort on upland slopes with reasonable water supply.

Resource Diversification: Family Capital Mobilization Mr. Phuc's household is located next to Mrs. Phuong's. His house is substantial but unassuming. He gives the initial impression of a strong and hardworking man. Only as our interview proceeded did we gain a sense of the broad strategy he uses either to guide or to rationalize his very complex pattern of land use activity.

Mr. Phuc has a wife and five young sons. He has eight brothers. He is a veteran who came to the area in 1981, when allocations were made to encourage upland settlement. With two family workers, he was given more than 1 mau of paddy at that time. This year, the amount was halved in a redistribution by the village to give new families the standard rice area. The household also has about 6 sao for homegarden, livestock rearing, and related upland activities. He has three buffalo, which he loans to others, as well as pigs and chickens raised for commercial sale. The homegarden has commercial pineapple, bamboo, tea, and cassava, yielding an income of 2 million dong per year. The household has 1 sao of fishpond, from which it earns about 500,000 dong per year in sales.

This is the beginning of Mr. Phuc's story. From 1985–86, he cared for more than 10 hectares of communal eucalyptus plantation on the usual arrangement of a 20-percent share of the harvest value. That share yielded 5 million dong on harvest in 1991. The privatization of forests opened the opportunity to obtain the harvested but rooted forest for the standard amount of 70,000 dong per sao for a period of time set in the transfer agreement. Mr. Phuc purchased the rights to 2 hectares for a period of 15 years, or three rotations. Although he wanted to purchase the full 10 hectares, he says he did not have sufficient money to do so. He walks the area each day, but it otherwise has little labor requirement. People from neighboring villages collect leaves for fuel, and he sells branches to brick makers for fuel.

The story goes further. Mr. Phuc still cares for 4 hectares of communal acacia plantation, presumably on the same 20 percent understanding that existed for eucalyptus. We did not learn whether such an arrangement includes the opportunity for caretakers to sell branches and other transitional by-products.

Mr. Phuc has now proposed to the village the purchase of a "hill" (approximately 6 hectares) of cash crop land for the purpose of establishing cinnamon plantations. Mr. Phuc would establish irrigation facilities, presumably by pump, to achieve the necessary water control. He would plant peanut, corn, and fruit trees along the lower reaches of the hill, enabling him to obtain a regular income until the cinnamon is ready for harvest in 10–15 years.

The hill currently is under cassava cultivation. The village's land management unit, which includes the chair of the People's Committee (a participant in our interview), is considering the proposal. Its approval would displace the current cassava producers and

presumably require a substitute placement for them elsewhere. Given the scarcity of land, doing so seems likely to require a reclassification of land from a forest to a cash crop category, a matter of some significance for the terms of an agreement and the basis for taxation.

Although Mr. Phuc had been unable to purchase the 8 hectares of eucalyptus forest, he is certain that he and his eight brothers can pay for the hill.

We were not denied any information we sought, and were given a great deal of financial information, but there must have been much information we could not imagine, did not seek, and therefore did not obtain. Mr. Phuc is adventurous. By our account, he is managing land in at least six different tenures over a wide range of locations and soil qualities, and appears to be generating incomes even he does not count. There is little in the lifestyle of the family to suggest wealth, and a great deal to suggest affection for hard work on the land. There is some evidence that Mr. Phuc sustains a network of social and familial relations through his enterprises, but none that he values his diverse activities primarily for the incomes they generate.

Mr. Phuc also produces honey on a commercial basis.

Vertical Integration: Network Capital Mobilization Two of the households we visited are seeking explicitly to develop niches in emerging secondary and tertiary stages of the agricultural sector. One is producing forest seedlings for sale to farmers. The other is operating an intensive livestock complex with increasingly systematic links to feed suppliers and consumer markets. Both households essentially are creating, in the private sector, agricultural service and organizational functions previously exercised by cooperatives and state enterprises. Both households are headed by men who had been employed in the cooperative and enterprise activities they are now seeking to establish, who understand their businesses thoroughly, and who have well-established networks with sources of information and finance in their emerging industries. Former colleagues in their public enterprises have pursued similar paths in the aftermath of privatization.

Forest Nursery The former head of a village forestry unit, *Mr. Khanh* has long and extensive experience with reforestation agencies and programs. His nursery is located in his homegarden and uses about 1 sao of land. He began it with the idea of generating income from available household labor. He now employs six part-time workers for seedling transplanting and cultivation. This year, he sold 60,000 eucalyptus and 13,000 acacia seedlings at 100 dong per seedling. Demand outran his supply at that price.

Mr. Khanh obtains his seed from the Ministry of Agriculture and Forestry, the most reliable source for high-quality seed. The price of eucalyptus (27,000 seeds per kilogram) and acacia (4,000 seeds per kilogram) seed is 320,000 and 300,000 dong per kilogram, respectively. Other nurserymen who sought cheap sources suffered low seed viability. He uses chemical fertilizer rather than manure in order to avoid fungal infections.

Mr. Khanh has identified a production niche for provision of nursery services to farmers who are beginning to grow trees. The niche matches his comparative advantage in access to the networks that will support such an enterprise. He seems desirous of expanding his

operation if he can obtain the capital to do so. While he suggested that capital was his main constraint, he did not seem as concerned about it as have farmers in the primary stage of agriculture.

Livestock In Thai Hoa village, Mr. Thuc has established a large poultry and pig operation. He is retired from the Planning Division of the State Poultry Enterprise. He has invested about 50 million dong in intensive poultry and pig operations, which employ six members of his family. He currently carries 15 pigs and 600 chickens and sells 2 tons of pork and 4 tons of chicken each year. He markets his livestock products through the state enterprise. His net income from livestock last year was 15 million dong. He plans to expand his chicken flock to 1,000 birds if he can obtain the capital to do so. He calculates that he needs 20 million–30 million dong for expansion. Pigs are less profitable but provide manure that he uses for crop cultivation.

The economies of an integrated operation are apparent in the layout of the production area. There are economies in the purchase and storage of feed, in the construction and maintenance of facilities, in the establishment of markets, and in the management of wastes and diseases. Mr. Thuc stores 1 ton of fishmeal, 500 kilograms of soybean, and what appeared to be at least 1,000 kilograms of kernel corn, which can be used for both pigs and chickens. Livestock manure is used to fertilize the household's 6 sao of paddy, its 1 sao devoted to seed vegetables, and its 2 sao used for peanut and corn.

Although Mr. Thuc depends on family—his wife, father, two daughters, and two sons—there is substantial labor exchange as well as land borrowing at the rate of 10–20 kilograms per sao, excepting relatives.

Fisheries Although we did not have the opportunity to interview the person who now has the concession from the provincial water company to manage the fishery of the Van Truc Reservoir, the signs suggest that a profile of his household may fit in this category. The irrigation reservoir has a surface of 19.2 square kilometers. The water company opens the concession of exclusive fishing rights to competitive bid on an annual basis. It is being paid 20 million dong this year. Each of the six households then pays the concession holder 12 million dong; each household harvests an average of 3 tons. An annual investment of 46.6 million dong (stocking, protection, fees, other capital) produces a profit of 75.9 million dong in market sales. From observations of fishermen on the reservoir, it would appear that the six households hire portions of their labor.

Profiles of Households Without Capital

Household Capacity for Off-Farm Employment: Migration In Xuan Hoa village, we visited the home of Mrs. Thai and her two daughters. We spoke with Mrs. Thai. Her husband was down with malaria contracted as a gold miner earlier this year. He had worked as a gold miner in Cao Bang for three months because the family had “sold” much of its rice land to build their spacious new house. They found out too late that they could not make a living on their remaining 1,200 square meters of rice land and could not obtain credit without land collateral. They faced a tax of 100,000 dong per year and 9,000 dong for irrigation per sao per crop. They have no forest or cash cropland. With the decline

in the cooperative system, school charges had risen, as had the cost of and requirements for production inputs. The family is able to afford about 60 percent of the inputs required to achieve attainable levels of production. The family has no buffalo and trades labor for draft services. It has some livestock for household consumption.

Mrs. Thai's husband received 100,000 dong per month as a gold miner before his illness. He worked through a contractor from another district. Mrs. Thai does household work for neighbors for 4,000 dong or 2 kilograms of rice per day.

The tragic ironies of this story are visible in the situation. After privatization, the family exchanged an important share of their land to build a fine house. Now that they have the house, they do not have the means to sustain themselves, and eventually may not be able to keep the house itself. Mr. Thai's initial migration to the gold fields seems likely to have been the first in a series of moves that pull them farther from their home place in the search for livelihood. His illness reduces their daily income to 4,000 dong.

Households with Weak Health and Skills: Survival Mr. *Nhin* and his family live near and slightly above Mr. *Lan* in Xuan Hoa village. *Nhin* is 37 years old and a veteran who returned from service with physical problems that appear to be chronic and severe. His wife is 35 years old, vivacious and interested. They have a daughter 6 years of age, a son 3 years old, and another daughter 1 year old. The children appear to be malnourished. Indeed, the whole feel of the home is impoverishment and depression.

Mr. *Nhin* returned from service in 1979. He worked for the village for some time, although spending extensive periods in the hospital, and was not entitled to land. He was born in the village but does not seem to have relatives or to be part of other associations and networks. The household received its grant of land in 1985 after *Nhin* lost his job with the village. It has 3 sao of residential land and 3 sao, 12 *thuoc* (1,368 square meters) of rice land. Normally, this would be enough land to plant two crops of rice and one crop of corn and sweet potato, but the land is entirely flooded this year. Rice yields are average, about 100 kilograms/sao/year.

The family has three rabbits, one pig, and three piglets. It earns about 86,000 dong each year from the sale of pigs. This appears to be the only source of cash income. Rice production does not suffice for family needs, and the family usually must borrow rice from neighbors, at an exchange of 1.5:1 kilo, toward the end of the year. The family is entitled to more rice land than it has, but Mr. *Nhin* says it cannot work more land without obtaining a buffalo. He apparently is not able to borrow, buy, trade for, or share the buffalo services that would enable the family to cultivate a full 7–8 sao. A buffalo would cost 1.5–2.0 million dong to purchase.

The homegarden is a classic survival garden. Every plant has potentially direct use to feed the family or its livestock. The garden contains banana, papaya, cassava, morning glory, and some eucalyptus for fuel. It is relatively sparse. It contrasts dramatically with the market-oriented intensive garden of Mr. *Lan* some meters away. If credit were available, Mr. *Nhin* says he would buy a buffalo and expand cultivation of sugarcane and banana in the garden area, probably reducing the cassava. Between the *Nhin* and *Lan* gardens, one

gains some sense of the ladders of investment and intensification that are possible in these upland parts of the area.

Summary of Household Survey

Our circle of interpretation has taken us from the prosperous succession of Mr. Lan's garden to the sad circumstances of Mr. Nhin's family next door. The households we interviewed displayed a range of livelihood strategies that are impressive in the extent to which they synthesize the capacities of the household and the social networks in which the household is joined. The economic condition of a household appears to be related directly to its access within social networks that are replacing functions previously satisfied by the cooperative and public enterprise systems. Where households lack such access, the loss of protection afforded by the cooperatives appears to have increased their vulnerability. Where households have such access, the gain in flexibility and discretion has catalyzed an optimistic growth in prosperity.

Households in different circumstances have responded differently to the same policies. The full impact of these policies presumably represents the net balance of the distribution among household types, social networks, and the household strategies and consequences they produce. We have no way to judge the extent to which our household interviews represented the distribution of households in Lap Thach and its villages, and have reason to believe they were not representative. Nevertheless, the repetition of certain patterns, particularly in strategies of diversification and integration, suggests there is some validity to these patterns. Further exploration of the apparent dynamics would help to explain how and why different households, villages, and districts respond to new circumstances and policies as they do.

EFFECT OF ECONOMIC REFORMS ON THE AGROECOSYSTEMS OF LAP THACH

Liberalization policies are beginning to change the systems of ecological relations, the agroecosystems, within which the people of Lap Thach live. We have discussed impacts of liberalization on the "peninsular" water regime and associated land uses in the district agroecosystem as a whole. Other changes are apparent at the village and household agroecosystem scales.

Four dynamics seem particularly important: (1) diversification of cropping systems and fragmentation of previously homogeneous crop and vegetative patterns, (2) intensification of certain agricultural activities and the expansion of extensive ones, (3) increasing differentiation in the sustainable productivity among resource uses and the quality of livelihoods among households, and (4) weakening regulation of inflows and outflows of household and village as well as district agroecosystems. In effect, the privatization of motive is casting much more diverse human activities and resource conditions over a landscape that previously was partitioned into a few relatively simple systems of human organization and biophysical form; the modes of regulating interactions among systems no longer suffice or even exist.

Prior to liberalization, homesteads were family centers of subsistence fruit, vegetable,

fish, livestock, and fuelwood production. They linked to the rice fields below them by downward flows of labor, water, soil, energy, and manure and upward flows of staple food. They were linked to adjacent homesteads by the virtually continuous canopy of the homegardens and the chain of home fishponds and wells in a common hydrologic regime. Households managed their allotted rice fields, but worked in cooperative groups to control irrigation water supply, prepare land for cultivation, obtain production inputs, harvest, market surplus production, and invest receipts in collective activities. They supplied labor for cooperative cultivation of plantation crops on slopes above the homesteads and paddy fields.

The cooperative managed the slopes above the homesteads for commercial crops, such as tea and cassava, drawing on household labor at a uniform prescribed rate. State enterprises typically managed forests above these plantation crops, linked to the activities below by flows of water, sediment, and human effort. Although intermediate zones might display a mix of the motives and resources operating at levels above and below them, the landscape system as a whole was visibly partitioned by the division of opportunities, obligations, and constraints between the household, the cooperative, and the state enterprise.

Liberalization policies have removed the prior partitions and changed the motives and opportunities for flows between them. The scale, content, and critical flows of the system are beginning to change in ways that depend on the characteristics of the households involved and of the villages in which they live, but possible tendencies of a more general sort are set forth below as illustrative speculations.

New Motives and Opportunities in Homestead Production Systems

The opening of market opportunities and the release of area constraints on homestead modes of production are encouraging households to produce homestead horticultural and livestock products for sale rather than for subsistence. Homestead enterprises thus become more competitive with other household activities for nutrients, purchased inputs, water, and labor, and presumably proceed more actively if these are relatively available. Homestead activities affect other parts of the household agroecosystem to the extent that they (a) produce nutrients that substitute for chemicals and perhaps labor in the rice field, (b) initiate capital formation for purchase of rice inputs, (c) support further intensification of horticultural and livestock production, or (d) enable purchase of rights to hill and forest land. We observed all of these developments in our household visits. If horticultural and livestock products increase in importance, homestead activities may draw an increasing share of the overall attention paid to water supply, perhaps encouraging increased investment in fishponds, wells, and pumps.

Such changes would be expected to intensify, diversify, and expand homestead modes of production among households who are able to do so, possibly in competition with those who are not. We observed, for example, emerging competition for hill lands between households who use them for corn and cassava and those who would use them for horticultural crops, which require more capital and will generate more income and public revenue in the long term. Displacement of poorer households from sites of relatively high economic potential is pushing them toward more marginal sites near or in the forest,

diminishing the sustainable productivity of these sites and increasing flows of sediment toward the ponds and canals below.

Strengthened homestead modes of production may reduce the share of household labor allotted to rice production and its supporting water control activities, either because the returns are greater or because more productive rice cultivation techniques reduce labor requirements or provide substitutes for the quality of water control. These tendencies are apparent in the dramatic reduction in the labor requirements of rice cultivation and the increasing difficulty of obtaining household labor for irrigation maintenance.

New Organization and Techniques for Rice Cultivation

Rice cultivation now is governed by household rather than cooperative arrangements and scales of technique. Inputs are purchased and outputs are sold by households on a competitive basis rather than administered through the cooperative. Input use and output sales have increased. Labor requirements have dropped in some cases from 15–17 days to 8–9 days per sao of crop despite increases in production per sao. These changes appear to arise both from the greater flexibility in labor allocation than was possible under the cooperative system and from greater use of chemicals for fertilization and weed and pest control. Indeed, the use of chemicals appears to be excessive from production and economic standpoints and is certainly excessive from a health perspective. Reduced labor time may be at the expense of family health and the vitality of effort ultimately available for other household endeavors.

Household and market displacement of the cooperative system, while increasing the flexibility and efficiency of rice production, has had other effects that may be more or less desirable for different households. The loss of cooperative economies of scale has caused the replacement of mechanized land preparation with animal power. This increases the feed requirements for rice cultivation, perhaps at the expense of homestead and hill production; it disadvantages households without buffalo and the means to obtain one. In such cases—we observed several—sustaining adequate rice production for family needs requires more rather than less labor than under the cooperative system. We were told that increased farm labor by women of poor households is thought to be reducing the nutritional levels of their children. As private mechanized agricultural services develop, they will reduce dependence on buffalo, substitute imported fossil fuels for local biological forms of energy, free land and labor for other activities (including education and leisure for the children who herd buffalo), and regain economies of scale the cooperatives achieved.

The decline of the cooperative system has also eroded the moral and organizational basis for collective water control. Irrigation charges and labor obligations have become increasingly difficult to collect. Rising maintenance costs—three People's Committees told us that the village charge no longer covered these costs—suggest a decline in collective responsibility for water conditions. Either rice productivity does not require the quality of water control that farmers previously enjoyed, farmers have other ways to regulate water conditions in their own fields, the impact of chemical inputs has compensated for the loss, or farmers have found preferable uses for their effort.

Increased livestock production may begin to generate sufficient organic fertilizer to substitute for chemicals, but its feed requirements strengthen motives to cultivate corn and cassava on upland slopes at the expense of increased canal siltation, higher maintenance costs, or declining water control. We found evidence of all of these tendencies. The question of balance among them is unanswered.

New Flows Between Forests, Upper Slopes, and Households

Control of cooperative and state lands has been transferred to households that have the capacity or the need to make them productive. This has opened flows of household labor and capital to these lands, and flows of material and capital from them to the households. It has increased opportunities for household income and competition for household resources. As production and marketing choices are now the household's rather than the cooperative's, the choices determining crops and resource flows are governed increasingly by the relative value among farm alternatives with reference to market prices. In effect, reforms have expanded the household-centered agroecosystem by dividing the larger-scaled systems previously under cooperative and enterprise control, and they have embedded household agroecosystems in the much wider web of the market.

We offer a few illustrative speculations about the potential consequences of these changes.

Once-uniform hillside vegetation will become more fragmented, diverse, and variable in quality, the pattern depending on the characteristics of the particular households involved. The security of private control will promote intensified investment by some households, and higher and more sustainable productivity. The opportunity to withdraw capital for current income and for other uses will encourage households in other circumstances to disinvest (e.g., to not replace soil nutrients or harvested trees), leading to productivity declines over time. The loss of production scales attainable under cooperative and enterprise organization renders some plantation crops uneconomic (e.g., tea), while the gains in household interest make new crops profitable (e.g., various fruits and spices) that otherwise could not have been so.

The diversification of hillside patterns already is apparent in the upslope shift of corn and cassava into former tea and forest plantations despite downslope contraction of these crops, the spread of fruit and spice orchards from homestead gardens toward higher slopes, and the intensified protection and care of privatized forest holdings. On balance, the biological productivity of hillside resources is likely to increase, but their economic productivity will rise or fall depending on the markets in which they have become embedded and the social displacements they absorb. The environmental and economic effects of fragmentation and variation eventually may encourage new forms of cooperative activity.

New Village Mechanisms to Influence Agroecosystem Dynamics

The replacement of the cooperative system appears to have weakened social capacities to influence village- relative to household-scale agroecosystem dynamics, but the new structure of villages offers other potential modes of influence. These include the land

management unit of the People's Committee and its uses of land policy; village and district commitments to agricultural diversification, particularly toward horticultural crops; special credit funds for poor households; and increasing involvement of the People's Committees in matters of irrigation and water control. In other words, the villages are seeking means to replace prior advantages of the cooperative system with means that affect households' motives and opportunities rather than control their choices.

The pursuit of such means is challenging: villages are so different that general solutions are not easily found. While the previous hypotheses seem to suit Thai Hoa village and its emphases on land policy and crop diversification, for example, Dong Ich (livestock/fish/off-farm centered households with weak rice and upland production possibilities) and Xuan Hoa (irrigated rice plain with some uplands in soybean and peanut and a burgeoning market for agricultural services) have different agroecosystem dynamics, priorities, and strategies. The People's Committee of Dong Ich is emphasizing livestock and waterborne disease aspects of its agroecosystem, while the Xuan Hoa Committee is emphasizing water control, rice intensification, and market enterprise. The impacts of reforms on agroecosystem flows will differ in these environments, as do the strategies villages are testing to improve these flows on a village scale. Comparisons among villages should help to improve general approaches to the villages' new problem of mediating the landscape interactions between household and market dynamics.

New Boundaries

The sustainability of agroecosystems depends on the balance and quality of inflows and outflows as well as on the viability of their internal relations. Agroecosystems are prone to net losses to urban areas. Reforms have removed the controlled boundaries of the cooperative system, replacing them with market channels that open agroecosystems to the risks of uncontrolled flows.

The villages of Lap Thach are attempting to balance these flows in interesting ways. Thai Hoa, for example, has an education tax on agricultural flows, retaining a portion of its export of energy and nutrients for investment in children. Dong Ich retains its small forest in village ownership to support educational and health activities. The yield tax on forest harvests is another means to retain shares of exports of natural assets in order to balance the loss with internal improvements.

But the larger boundary problem in Lap Thach is at the scale of the district as a whole: the rises and falls in the Lo and Day Rivers are regulated by actions beyond the district in the larger region of the Red River. The main part of the district's 1994–2000 investment plan is directed toward means either to block these external forces (e.g., with dikes) or to accommodate, through drainage and irrigation facilities, to the internal water conditions they create. Provincial and regional approaches may be needed to achieve hydrological conditions that provide more favorable agroecological balances in the district.

**IMPACTS OF
LIBERALIZATION
ON THE PEOPLE
AND ENVIRONMENT
OF LAP THACH**

Economic liberalization has expanded households' production, marketing, and investment opportunities. It also has removed "safety nets" that had protected households, and perhaps villages, lacking the capacity to use these opportunities. People of Lap Thach are cautiously optimistic that their growing prosperity will carry those who are unable to contribute to it directly and who find themselves in more vulnerable circumstances. Land policy has emerged as the primary instrument, exercised at the village level, to manage the balance between growth and distributional needs. Means to manage the balance among advantaged and disadvantaged villages are less apparent.

Economic liberalization has reduced relative access to capital for public investment, building a market that favors capital flows toward private enterprises with the highest anticipated financial returns. Reform policies also have shifted responsibility for public capital mobilization and investment toward local levels of governance. These changes are having differential effects on the villages we visited.

The differential effects depend on the relative reliance of village economies on public investment and the differential capacities among villages to satisfy their investment needs. Particularly vulnerable are villages, such as Xuan Loi, that have large needs for infrastructure to sustain agricultural production, weak opportunity for alternative livelihoods, and little scope for transfer of land rights as a source of finance. Villages with transferable hill and forest land, such as Xuan Hoa, are in better circumstances now, but seem likely to confront a future drain of capital as hill soil nutrients and forest stocks are transformed into agricultural and wood products, their sales receipts are invested where returns are greatest, and the productivity of local soil and forest assets declines. Such a process may begin quickly if borrowed money is being used to purchase land rights: high interest rates press landholders to deplete natural capital in order to relieve their debt obligations. Current financial solutions may be at the expense of future productivity unless means are developed to capture and invest current capital gains locally.

Shortages of public capital may have other differentiating effects. In Thai Hoa, for example, financially driven reductions in the reach and reliability of canal irrigation systems may disadvantage certain local populations and promote pump irrigation by those who can afford it. Such processes would increase intra-village differentiation among cropping systems and among farmers who are able or unable to obtain pumps. While economic productivity may increase for the village as a whole, spatial and social differentiation of agricultural opportunity will alter the issues with which the village must deal.

Weakened support for public education also will have differential spatial and social effects. These effects may be felt more by hinterland villages than by central ones and more by households who cannot afford private education for their children. If education creates capacity for non-agricultural employment, and if it becomes distributed toward families who already possess this capacity relative to those who do not, it may encourage migration of people with locally scarce talents rather than those who need basic capacities to escape dire circumstances.

Such dynamics can be expected to modify the landscape of Lap Thach. Assuming the

absence of adjustments that counter current trends, we would predict the following changes in land use over time:

- The production of non-rice commercial crops will increase on the hills and will penetrate current rice and forest lands. The area in intensive rice production will contract as a result of crop diversification in irrigated areas, increased complexity of irrigation management, price rises for non-rice crops and rice production inputs relative to rice, the development of pump irrigation in hill areas, and loss of land to submergence.
- Forest stocks will decline at an accelerating rate. This will occur partially through agricultural expansion at forest margins but primarily through the pressure of interest rates to convert growing stocks to wood products and to reinvest the receipts in other forms of assets.
- Employment will grow in secondary and tertiary areas of agriculture—services, processing, transport, marketing—and will moderate pressures for reallocations of land to secure minimum livelihoods, but growth will be distributed unevenly among villages and social groups for three reasons: (1) differential economic dependence on resource extraction, (2) differential capacities to mobilize capital and create skilled healthy people, and (3) differential scope for land reallocation. In these terms, Xuan Hoa and Thai Hoa are in relatively favorable positions for secondary and tertiary economic development that will intensify land use while reducing agricultural dependence. Dong Ich will become increasingly integrated within the Viet Tri regional economy, relying on its opportunities for unskilled labor and reducing agricultural dependence without developing local economic structure. Xuan Loi faces potential stagnation in the absence of increased capital subsidies. Van Truc will decline unless current exports of resource capital are reduced. Less-favored villages will experience sharper social differentiation and consequently greater variability in the quality of land use practices.

The environmental impacts of such changes depend on the conditions of the households and villages through which these changes occur. The expansion of hill agriculture, for example, will deplete soil fertility if it is in the form of crops like cassava, but will enhance soil quality if it employs various tree-based horticultural systems. The direction taken depends on the balance in hill land allocation among households with different resource endowments and in different household-, familial-, or network-based systems of capital mobilization and investment.

A similar distinction applies to forest lands and reservoir fisheries: the balance of pressure for conversion and conservation of growing stock depends on the degree of local and extra-local control of capital sources and investments. Thus, village land policy is a means through which the long-term impacts of private land uses can be influenced. Where the scope for its exercise is small and uncompensated by capital subsidies, we would expect increasing stress in the forms of sickness, environmental degradation, and social dissension.

Environmental stresses arise particularly at margins between different groups that depend on the same resource systems but respond to different pressures. If survival households farm at the edge of capital-driven forest holdings, for example, both sides can be expected to deplete natural resources more rapidly than if they adjoined parties in similar circumstances. If households cultivate rice near others that can afford to cultivate peanut and soybean on paddy land, the margin again is likely to be characterized by cultivation and water control practices that diminish productivity for all. The margin between agriculture and town settlement is the most visible example of this phenomenon. A small factory can have huge impacts on the water regimes of adjacent farms. Village governance assumes more of a mediating than a coordinating character in these circumstances and, as has already occurred, will develop distinctive approaches for its people and place.

ISSUES

Lap Thach's optimistic transition thus far has distributed its benefits widely. With the centralization of capital policy, villages have relied on their land policies to regulate the balance between economic growth, distribution, and environmental aspects of change. But land allocations distribute opportunities among different systems of social relations that have no obvious reason to complement one another. Results will depend on the nature of relations they form on the ground, and on the approaches that villages develop to govern these relations. This aspect of the market experiment has just begun.

Other issues deserve discussion. The net outflow of natural capital and skilled people to higher-paying opportunities in the cities is predictable. This process has occurred in the rural areas of every market economy in the world. It impoverishes rural people and resources while creating increasingly unequal distributions of rural wealth and power. Of possible interest are means to link the capital and skill that originate locally to the means to use these resources for sustained local progress. Examples of means currently used in Lap Thach include the retention and management of village forests to support teachers and schools, and the use of market taxes to provide credit for local enterprises. Other approaches are needed; the forces to which they must respond are quite strong. Opportunities may also exist at district and regional scales (e.g., in water control, education, credit, and enterprise creation) to shift the balance between inflows and outflows in ways that reduce rural losses for benefits elsewhere.

A final issue is the nature of relations between government and village that can compensate for market tendencies to drain and destabilize rural areas. There is good reason for government to not diminish the adaptive flexibility with which the villages currently reconcile economic growth, social equity, and environmental quality, but to complement and strengthen village functions. This can be accomplished directly through the development of specialized line agency assistance, as in the new Department of Land Management, or indirectly through comprehensive district and regional approaches, in the Upper Red River Basin for example, that improve the general conditions in which villages and households must respond to the dynamic transition ahead.

NOTE

1. In Doan Hung and Thanh Hoa districts, village-level land management officers responded to the district and central government level Department of Land

Management (see Chapter 3). This may indicate a trend toward more centralization of authority in the land allocation process.

PART FOUR
Conclusions

Rural Development Issues in the Upland Agroecosystems of Vinh Phu Province

A. Terry Rambo and Le Trong Cuc

Since our first study in 1989, there has been impressive improvement in both the state of the environment and the rural economy in the upland districts of Vinh Phu province. The evidence of change is striking: what were barren hills in 1989 are now forest covered. Rice yields have increased considerably. Virtually everyone, farmers and officials alike, reports being economically better off now than during the cooperative period. In the short term at least, implementation of Resolution 10 has achieved unqualified success. But the process of rural development in the Midlands is not perfect or problem free. If development continues on its current trajectory, some very serious new problems may be generated. In this chapter we address some trends and possible problems with regard to the key agroecosystem properties of productivity, sustainability, diversity, and equitability.¹ Our discussion is based on development trends observed in Doan Hung and Thanh Hoa districts. Trends observed in Lap Thach district were generally in accordance with those, but are not integrated here.

PRODUCTIVITY

The change from collective to household management has resulted in increased biological and economic productivity in all agroecosystem components. Wet rice yields have increased. Homegardens, fishponds, and livestock, which in 1989 were primarily subsistence oriented, now often yield a surplus for sale to the market. Hills that were barren are now covered with trees that will soon begin to reach harvestable size. A formerly stagnant rural economic system has become quite dynamic. Households that had existed on the very edge of subsistence are now active participants in an expanding market economy. The central question is whether this observed increase in productivity represents a one-time leap based on peasant households simply capturing a larger share of assets formerly siphoned off by the cooperative system, or does it represent the beginning stages of a self-sustaining process of economic development? What are the constraints to continued growth in productivity in the upland districts of Vinh Phu province?

The present improved productivity may be explained, in part, by the better care and management of crops by households and improved access to yield-enhancing inputs. However, potential yields of paddy rice, for example, are likely to level off at yields near those at present, and the rate of further increase is likely to diminish with each increment

of added input. Improving or sustaining high yields by the increased supply of inputs could also result in adverse environmental consequences.

In response to our questions about obstacles to development, most farmers cited lack of capital and shortage of labor. Lack of land was also mentioned by a few farmers, although this was usually mentioned in terms of not having sufficient capital to acquire land. Officials at all levels of government, and farmers who were retired officials, frequently asserted that lack of modern technical knowledge on the part of the farmers was a major problem. Farmers themselves did not perceive lack of knowledge as an important constraint, however. We will examine each of these constraints in turn.

Lack of Capital

Although shortage of labor is perceived by the farmers as an important limiting factor on their productive activities, shortage of capital is seen as a much more serious constraint. A number of respondents said that they would like to obtain additional hill land to plant tea or forest trees but that they lacked the capital to make such an investment.

Loans are available from the state agricultural bank for acquisition of hill land. The interest rate is 3 percent per month on a one-year loan. If the loan is not paid in full within one year, then the interest rate increases to 4.8 percent. The actual cost of capital to poorer households that lack substantial collateral and do not know how to deal with the banking system is considerably higher. They must obtain their loans through the services of an intermediary agent. In one case the agent is a former village chair who takes out loans either in his own name or using the ID cards of others. He charges a 4,000-dong fee for each 100,000 dong borrowed plus an additional fee of 3,000 dong for each loan. The agent's services amount to a total charge of approximately 7 percent, but repayment can be made over more than one year. He collects the monthly payments from the borrower and pays the bank directly.

Households also make some use of informal sources of credit to meet short-term cash shortages. One very poor woman in Tay Coc reported that she used to have to borrow rice from her neighbors to be able to feed her children. After six months she paid the loan back at a rate of 13 kilograms for every 10 kilograms borrowed.

If additional capital were available, most farmers say that they would employ it in ways intended to increase long-term productivity. Acquisition of hill land to plant tea and forest trees and development of homegardens, fishponds, and livestock raising were the most common responses. Some farmers said that they would invest extra money in education for their children. Only a few households said that they would use extra money for immediate consumption purchases.

Lack of Labor

Under present conditions in rural Vietnam, where mechanization is almost nonexistent and all work is performed using human or animal power, availability of labor can be a critical constraint on the productivity of individual households despite an overall surplus

of labor in the society as a whole. This labor shortage is most apparent during periods of peak labor demand, such as during rice transplanting and harvest.

Demands for agricultural labor have been significantly increased by the transfer of many functions from the cooperatives to the households. Soil preparation, which was in the past done by specialized teams using tractors, must now be done by each household using buffalo and human labor. The opening of opportunities to market homegarden produce has also created new demands for household labor.

Households are relatively small, ranging from 4 to 8 members with a mean of 5.6 members. Because most households cannot afford to hire extra labor despite its seemingly low cost (only 3,000–5,000 dong per day), their productive capacity is limited by the number of able-bodied workers they possess. The number of full-time agricultural workers ranges from 1 to 5 with a mean of 2.5. The average dependency ratio is quite high, with each worker having to support an average of 2.3 persons. The most-favorable dependency ratio is a household that has 3 workers for 4 members; the least-favorable ratio is 2 workers out of 7 members. Young households with several small children are particularly disadvantaged because of their high dependency ratios.

There is a complex division of labor by sex and age. Table 7.1 describes the division of labor for seven households. It is clear that women already carry an extremely heavy share of the farm work and also are likely to be engaged in off-farm activities to earn extra cash.

Lack of Technical Knowledge

The actual extent to which lack of technical knowledge is a constraint on household productivity is unclear. Farmers make ready use of modern inputs such as chemical fertilizers and pesticides, with capital the main limiting factor in their application. Pesticides may be used in unsafe ways, however, because the only source of information on usage is the instructions on the bottles. Farmers have readily adopted practices of enrichment planting of forest land, supplementing existing eucalyptus with several indigenous species. Reports of losing livestock to disease and the infrequency of using vaccinations to protect these resources suggest that lack of knowledge may be important in this specialized sector of production. Lack of cash to pay for veterinary services may be as important as lack of knowledge, however.

SUSTAINABILITY

Growing tree crops and timber is ecologically a great improvement over the previous practice of planting cassava and other annual field crops on steep, highly erodible slopes. Properly laid out tea gardens and multispecies forests suffer far lower rates of soil erosion (although monocultural eucalyptus plantations may not). If litter is left in place, the slow process of regeneration of a topsoil layer may begin. If this process continues, a generation from now the hill ecosystems may be in much better condition than they are today. If, however, the pressure of meeting high interest costs on capital encourages farmers to overexploit their forests to maximize short-term cash flow, such improvement in upland conditions may be illusory.

Table 7.1 Division of labor in seven households

Activity	Household			
	Tay Coc village, Doan Hung district			
	E	F	G	H
Paddy				
Land preparation	wife & children	wife	husband & wife	husband & 2 sons
Transplanting	wife & children	wife	wife	husband & 2 sons
Weeding	wife & children	wife	husband & wife	husband & 2 sons
Harvesting	wife & children	wife	husband & wife	husband & 2 sons
Fertilizer application	wife & children	wife	wife	husband & 2 sons
Pesticide spraying	wife & children	wife	husband & wife	husband & 2 sons
Livestock				
Pig raising	wife	wife	wife	husband & 2 sons
Cattle raising	none	none	in-laws	husband & 2 sons
Buffalo	wife & children	borrowed from in-law	daughter	husband & 2 sons
Chickens	wife	wife	wife	husband & 2 sons
Manure collection	wife	wife	wife	husband & 2 sons
Tea gardens		none		
Planting	wife & children		husband & wife ^a	2 sons
Picking	wife & children		husband & wife ^a	2 sons
Fertilizer application	wife & children		husband & wife ^a	2 sons
Pesticide spraying	wife & children		husband & wife ^a	2 sons
Pruning/weeding	wife & children		husband & wife ^a	2 sons
Homegardens				
Planting	husb., wife, & childr.	wife	husband & wife	husband & 2 sons
Fertilizer application	husb., wife, & childr.	wife	husband & wife	husband & 2 sons
Harvesting	husb., wife, & childr.	wife	husband & wife	husband & 2 sons
Weeding	husb., wife, & childr.	wife	wife	husband & 2 sons
Fishponds		(currently under construction)		
Construction	cooperative (1954)		husband	cooperative (1954)
Fingerling production	husband		husband	husband & son
Feeding	wife		wife & husband	husband & son
Harvesting	husband & wife		none yet	husband & son
Marketing	husband & wife		none yet	husband & son
Forests	none	none		
Planting			husband & wife	2 sons
Fertilizer application			husband & wife	2 sons
Harvesting (fuelwood)			husband & wife	2 sons
Non-farm activities	none	tailoring: wife	none	none
Dong Xuan village, Thanh Hoa district				
	L	M	N	
Paddy				
Land preparation	son	wife & daughter	wife & oldest son	
Transplanting	wife	wife & daughter	wife	
Weeding	wife	wife & daughter	wife	
Harvesting	wife	wife & daughter	wife & son	
Fertilizer application	wife	wife & daughter	wife	
Pesticide spraying	son	wife & daughter	wife & son	

^aWith help from daughter & father-in-law.

Continued on next page

Table 7.1—Continued

Activity	Household		
	Dong Xuan village, Thanh Hoa district		
	L	M	N
Livestock			
Pig raising	wife	wife & daughter	wife
Cattle raising	none	none	none
Buffalo	children	in-laws	son
Chickens	wife	wife & daughter	wife
Manure collection	wife	wife & daughter	wife
Tea gardens		none	none
Planting	wife		
Picking	wife, daughter, & labor exchange w/neighbor		
Fertilizer application	wife		
Pesticide spraying	wife		
Pruning/weeding	wife		
Homegardens			
Planting	wife & children	wife & daughter	wife, husb., & childr.
Fertilizer application	wife & children	wife & daughter	wife, husb., & childr.
Harvesting	wife & children	wife & daughter	wife & son
Weeding	wife & children	wife & daughter	wife
Fishponds		none	
Construction	—		husband
Fingerling production	wife		husband
Feeding	wife		wife & husband
Harvesting	wife & son		husband
Marketing	wife		husband & 2 children
Forests		none	none
Planting	entire household		
Fertilizer application	wife		
Harvesting (fuelwood)	wife & children		
Non-farm activities	none	army pension (husband)	none

Despite current improvements in the land use pattern, the flow of materials between uplands and lowlands remains highly asymmetrical, with most nutrients moving down-slope. In the case of tea, chemical fertilizer is employed, although it is uncertain whether this is sufficient in the long term to replace the nutrients exported in the tea leaves. Growth of forest trees is almost wholly dependent on nutrients already in the hill soils, natural soil-weathering processes, and atmospheric nutrient deposition. In the case of the Midlands, where lightning frequency is high, this last factor may be a significant source of nitrogen. To the extent that nitrogen-fixing trees are incorporated into forestry planting, they may add large quantities of nitrogen as well. Replenishment of other important nutrients is less readily achieved, however. Thus, it is uncertain how many harvest cycles can be supported by this limited nutrient reservoir before productivity declines. The

farmers continue to remove understory vegetation and litter to use as green manure in their paddy fields and as fuel and fodder. Upland grazing of cattle, which then deposit their manure in the lowlands, further contributes to the removal of nutrients from upland ecosystems.

Current high levels of productivity of tea and wet rice systems reflect the heavy application of chemical fertilizers and pesticides. The recent trend toward intensification of homegarden production for the market economy is having similar effects. Some farmers recognize the possible dangers to health of unrestricted pesticide use. One woman told us that she did not spray the tea meant for consumption by her family although she employed heavy doses of "Monitor" on the tea that she markets. Contamination of groundwater with pesticide residues and nitrates may be a danger. Most households draw their drinking water from relatively shallow wells (3–9 meters).

DIVERSITY

Biological diversity has increased quite dramatically. This is especially apparent in the case of the agroecosystems on the hill slope lands. However, current gains in diversity, particularly in homegardens and hill land, may be undermined in the longer term by the increased involvement of households in the market economy. Farmers, attracted by good prices, may plant larger areas to single species such as jujube and apricot. In a subsistence situation, however, each household attempts to keep a few of all useful species with no dominant species to ensure access to the full range of useful plants.

Wet Rice Fields

Only a few varieties of rice are planted; 203 is the dominant variety, with most farmers planting it exclusively in both crops. Some farmers plant smaller areas with Moc Tuyen, an improved variety released some years before 203, and San Hoa, Ai Mai Huong, and Chiem Den, which are Chinese improved varieties. One farmer plants a locally improved variety of the traditional Bao Thai variety on highly acidic soil in a swampy paddy.

Few fish or crabs are found in the paddies. They were never abundant because of the high levels of acidity in most fields, but farmers say that use of chemical fertilizers has further reduced these populations.

Homegardens

Farmers have expanded the area of homegardens and intensified management of these highly productive agroecosystems. In some cases, species diversity has increased, but a trend toward monoculture of high-value market crops, particularly fruit tree cultivation, was noted in homegardens of some wealthier households.

Tea Gardens

Tea gardens are almost pure monocultures. Only a single variety is planted, with farmers collecting seed from older trees to start new gardens. Some gardens have a few *Cassia*

siamea and *melia* trees scattered at random among the rows of tea bushes to provide shade. Many of these trees were illegally cut during the cooperative period, however, and have not been replaced. One farmer who does not have shade trees in his tea garden said it was too late to plant them because the tea bushes were too large now.

Field Crops

In contrast to 1989, cassava and other field crops are less-commonly grown as monocultures and are more-commonly planted as an intercrop between fruit trees, palms, or forest trees. Monocultural plots themselves are frequently the first stage in a succession to forest.

Forest Land

In 1989 forest land was almost by definition monocultural planting of eucalyptus. Today, privately managed plots tend to display much greater species diversity, with farmers enriching their stands with bamboo, *styrax*, *melia*, *acacia*, *manglietia*, and other commercially valuable species. Several of these species are indigenous. Particularly important is the formation of a multistory plant community in contrast to the relatively high and thin canopy of same-age stands of eucalyptus. This optimizes capture of solar energy and provides better protection of the soil surface against the erosive impact of rain and leaf drip. Single-story tree plantations may actually increase rates of erosion because of the severity of impact of large drops falling from leaves high above the ground surface.

The Landscape Level

In 1989 diversity at the landscape level was low. One saw rice paddies in the valleys, small homegardens and tea gardens around the houses, large areas of cassava and tea on the hill slopes, and sparse plantings of palms or spindly eucalyptus saplings on the hilltops. Today the landscape is much more of a mosaic environment.

The landscape diversity of the Midlands offers an optimum situation for the formation of a rural society characterized by high productivity, reasonable sustainability, and a high level of equitability. In principle, each peasant household should enjoy access to some land in each land use category. The area of paddy and homegarden land, although small in absolute terms, is sufficient to meet the basic nutritional needs of each family. The area of hilly land, if distributed on an equitable basis, would be sufficient to give every household the land base on which to develop tea and forest as a sustainable source of cash income. In contrast to the Red River Delta, with its excess population and minuscule amount of land per capita, and the high mountains, where poor soils and topography limit the possibilities of developing viable household economies, the Midlands are the ideal situation for successful rural development based on smallholders. Unfortunately, however, the current process of development, despite its undoubted success in increasing productivity, sustainability, and diversity, may not be as successful in maintaining a high level of equitability.

EQUITABILITY

One of the major consequences, one perhaps not fully intended or anticipated by Vietnamese policy makers, of the implementation of Resolution 10 and the 1993 Land Law is the emergence of a greater degree of social and economic stratification in upland agricultural communities in Vinh Phu. In contrast to the cooperative period, when all households had more-or-less equal access to productive resources and all lived in a state of (relatively) equally shared poverty, today considerable variation in control of resources and standard of living is evident. In contrast to the variation among households that we observed in 1989, which to a large extent reflected differences in the stage in the normal development cycle of different households (new households with small children and an insufficient supply of labor were poorer, mature households with several young adult workers were better off), the current variation in wealth appears to represent the initial stage of a process leading to more permanent differentiation. This differentiation may have important implications for the future trajectory of rural development in the Midlands.

Differentiation is evident in living standards as measured by nutritional status, quality of housing, and possession of consumer durables, and in control over productive resources.

Differentiation in Living Standards

Perhaps the most important measure of household status from the standpoint of the farmers is adequacy of nutrition. According to officials in Dong Xuan village in Thanh Hoa district, for example, about 20 percent of village households are classed as poor and almost 5 percent of households are classed as "hungry." We were not permitted to interview any households in these categories in Dong Xuan and thus have no direct information on their situation. In Doan Hung district, however, we interviewed several poor households that were unable to raise sufficient rice to meet their consumption needs. None said that they actually went hungry, but at least one informant said that if she won the lottery she would use some of the money to buy better food for her children.

Great variation is evident in the size and quality of houses, furnishings, and consumer durables. The poorest families dwell in small (50-square-meter), often-ramshackle houses with one main room and a small partitioned end space for the women, constructed with rough earthen floors, clay and wattle walls, and palm thatch roofs. Furnishings consist of only one or two cheap wooden beds, a table and a few stools, and a crudely made chest. The more fortunate have a single low-wattage bare light bulb hanging from a wire from the ceiling beam, while others still rely on the small kerosene lamps popularly referred to as *den hoa ky* (American lamp). The houses of the richer families are large (200–300 square meter) multiroom and sometimes two-storied brick structures with concrete floors and tile roofs. They are furnished with elegant wooden tables, arm chairs, and armoires, and have several beautifully polished wooden plank beds. In addition to electric lights and fans, all have large radios, and some have color televisions.

Differentiation in Access to Productive Resources

In the fourteen-household sample of households in Doan Hung and Thanh Hoa districts, there is considerable variation in the area of land controlled by different households, as revealed in Table 5.1. Total holdings range from 3,768 to 46,120 square meters with a

mean of 16,278 square meters. As Figure 7.1 shows, however, most households (nine) have holdings below the mean, which is skewed by a few very large holdings. The area of land available on a per capita basis ranges from 554 to 9,224 square meters with a mean of 2,984 square meters. Again, as is shown by Figure 7.2, most households (ten) have a lower amount of land per capita than the mean amount.

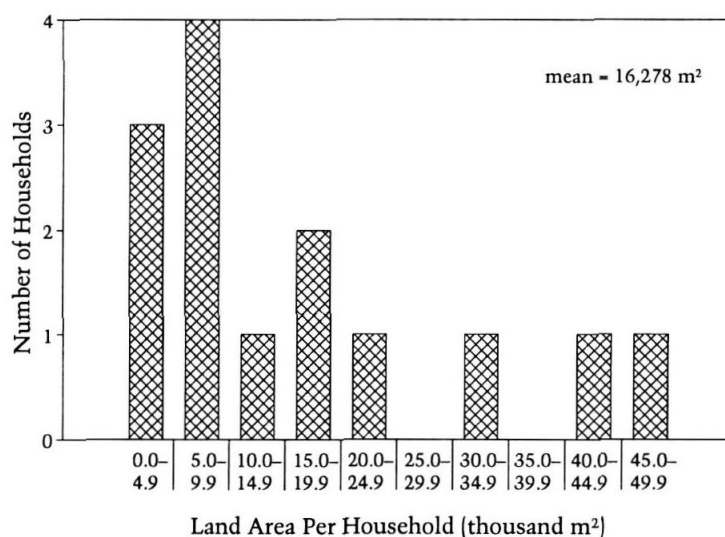


Figure 7.1 Range of landholdings by household

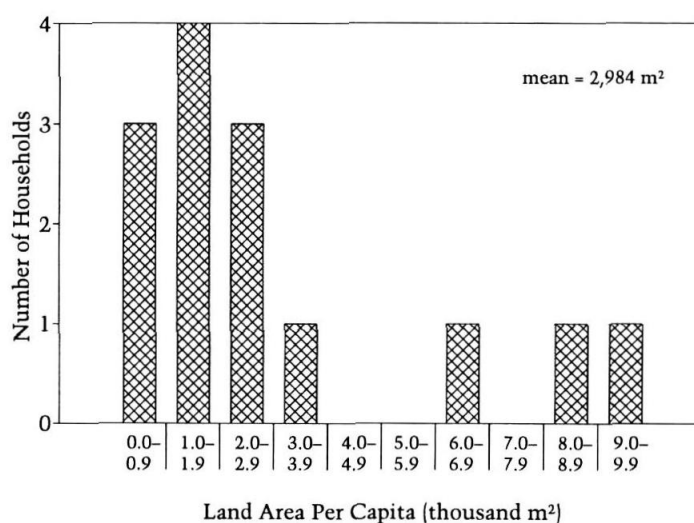


Figure 7.2 Range of landholdings per capita

Wet Rice Land Distribution of wet rice land appears relatively equitable, ranging from 528 to 3,960 square meters, with per capita holdings ranging from 88 to 792 square meters. The existence of very considerable differences in the quality of this land may magnify the differences in productivity among households. For example, one household has 306 square meters per member and reports a yield of only 50 kilograms of paddy per sao, while another household has only a slightly larger per capita area of 360 square meters but reports yields of 150 kilograms of paddy per sao. Not surprisingly, the first household produces only enough rice to meet its needs for eight months each year; the second household produces sufficient rice for the whole year.

Access to wet rice land is an important determinant of household economic status in that those households lacking sufficient land to produce an adequate supply of rice to meet their consumption needs must engage in other activities to earn the cash needed to buy extra rice. Those households self-sufficient in rice can devote their extra labor to activities that increase their current living standard, as well as engage in longer-term investments (e.g., planting hill lands with tea or forest trees). In some cases, highly successful households may actually lower their involvement in rice production once their cash flow from other activities is sufficient to purchase their grain requirements. In any case, given the low market price of rice, once a household can meet its subsistence requirements, further intensification of production for commercial purposes is not a viable strategy. It is probably fair to say, however, that variation in access to wet rice land in itself is not the critical factor in the emergence of social stratification in these communities. Differences in access to hill slope lands appear far more important.

Hill Slope Land Perhaps the most important consequence of Resolution 10 was the conversion of the large area of hill lands from a common property resource into private property. Virtually all of the tea and forest plantations formerly managed by the cooperatives or state forest enterprises have already been allocated to individual households. Unquestionably this has led to dramatic improvement in the management of these lands. It also means that households that did not obtain control over hill slope lands no longer have access to resources such as firewood and fodder that were formerly freely available to them from the lands of the cooperative. As revealed in Table 5.1, the current distribution of hill lands is highly inequitable. One household has only 432 square meters of hill land, seven have plots of under 5,000 square meters, while three households have plots of 25,000 square meters or larger. In one case, three Doan Hung households not included in our detailed sample have gained control over 80 hectares and are operating it as an integrated farm enterprise.

Hill lands include a number of different land use types. Areas for field crops, tea gardens, palm groves, and forest are the most important uses. Of these, tea and forest lands cover the largest area and have the highest economic potential.

Tea land is obtained in two ways. Some households plant their own trees, gradually converting areas formerly planted to field crops into small tea gardens. In other cases, households take over blocks of already-producing trees in plantations that had been established and managed by the cooperatives. In the latter case the household must buy

the trees from the cooperative, thus also obtaining long-term rights to use the land. Existing tea land has the advantage of providing immediate returns to the purchaser.

Forest land is acquired in similar ways. In some cases, households plant trees on hill lands that they are already using for field crops. In other cases, they acquire long-term rights to forest land by purchasing the trees, usually eucalyptus, that have already been planted there by the cooperative. Often they then engage in enrichment planting to supplement the existing eucalyptus with faster-growing species such as styrax. Forestry requires households to wait for several years before receiving any return on their investment. Thus, in order to obtain long-term control over large areas of hill land, households must have access to significant amounts of capital in order to finance the purchase of the existing tea or forest trees and to provide the inputs needed to plant additional trees. This system of land allocation clearly favors economically better-off households that have some surplus that can be employed for long-term investments. In the longer term, it will operate to further increase differentiation as households with large areas of forest land begin to harvest timber on a regular basis, thus reaping the returns on their initial investment.

The Dynamics of Social Differentiation

When asked why certain households were poor, local officials displayed a tendency to place the blame on the victims, saying that their "lack of knowledge" was responsible. Bad luck in the form of accidents or ill health was also sometimes mentioned as a cause of poverty, sometimes by the officials, more commonly by the poor themselves. Illness is certainly an important factor in causing and maintaining poverty. We interviewed one household that had been forced to sell a half-share of their buffalo to kinsmen in order to get money for medical treatment. Several other poor households said that they were unable to work very hard because of ill health, a situation that is reinforced by their poor living conditions, inadequate diet, and greater exposure to environmental risks and disease. In two cases, poor individuals admitted that they liked to drink and that had contributed to their poor health. Lack of access to productive resources appears to be the strongest factor contributing to poverty, however. Unable to make an adequate living from their limited land base, poor households are forced to supplement their income by working as wage laborers for more prosperous families. Their meager earnings permit them to survive but never to accumulate sufficient capital to break out of the cycle of poverty in which they are trapped. They are also unable to support extended attendance at school by their children, who are thus denied the opportunity to gain the higher education needed to advance themselves. Thus the cycle of poverty may be perpetuated in future generations.

The causes of prosperity may be more complex. Willingness to work hard and to defer consumption in order to accumulate capital are certainly important. Superior educational levels and technical knowledge may also be important, although we did not collect information on these factors. Size of the household labor force and its dependency ratio are major determinants. Young households with several small children and only one or two adult workers are in a particularly difficult situation. Access to capital is clearly

critical. To obtain bank loans, poor households may resort to the services of an intermediary agent, whose fees considerably increase the cost of borrowing. One very poor woman whom we interviewed had borrowed 800,000 dong in order to purchase 4 sao of tea land; she had to pay 35,000 dong outright to the agent in addition to paying the standard interest of 3 percent per month to the bank. When asked if she could go to the bank directly, she smiled sadly and said that she did not know how to do so. Wealthier individuals, who have more collateral and who are more likely to be personally familiar with the operations of the banking system, are able to obtain loans directly. It is this kind of specialized knowledge, and the personal connections to sources of power within the system that is possessed by officials and former officials, that gives some of them a great advantage in gaining control over productive resources and is thus a key causal factor in social differentiation in the uplands. In the case of the 80-hectare holding by three households referred to earlier, all of the owners are in this privileged category.

Future Trends in Differentiation

The social system of the upland areas of Vinh Phu is at a critical point in its development trajectory. Since 1989 a considerable degree of socioeconomic differentiation has emerged. This reflects the fact that, as one former village official in Thanh Hoa actually remarked, economic differentiation among households in a free market economy is the result of the working out of a "law of society." Sadly enough, given the existing institutional structure for resource allocation in the uplands of Vinh Phu, he is correct. Indeed, given the unequal starting positions of the households, the lack of a level playing field for competition for land and capital, and the absence of effective institutional checks on private accumulation of property, one can predict with some confidence that the extent of differentiation will continue to increase in the future.

It need not be thus, however. The "law of society" to which the retired cadre referred is not an invariant natural law but instead is a social construct that is only valid within a specific institutional setting. Advice from foreign economic advisors to the contrary, Vietnam does not have to adopt market economy institutions that replicate those of England at the time of the enclosures. The choice is not limited to that of either collective institutions that produced the shared poverty of the cooperative period or a totally free market system that inevitably concentrates wealth in the hands of a few large landowners. But what are the alternatives?

An initial response is to suggest setting some upper limit, say 10 hectares, on the amount of land that can be controlled by a single household. That is the conventional strategy adopted in land reform measures throughout the developing world. Long experience of such measures in Vietnam, going back to the Le dynasty, suggest that legal restrictions on maximum holding size are largely ineffective.² The wealthy always find ways to evade such regulations, e.g., by formally dividing their property among children and other kin while actually retaining effective management over the entire holding.

Another strategy that might have been employed is to allocate hill land to households following the principle of giving every individual an equal-sized share. This was the principle that guided the allocation of paddy land and resulted in a relatively equitable

pattern of distribution of that limited resource. Unfortunately, the opportunity to employ this approach has already passed; most of the desirable hill land has already been distributed to households. What remains under control of the communes is largely very poor quality barren hills. To develop such areas requires more capital than individual poor households can mobilize, even if they can obtain access to this land.

A more effective strategy may be to draw on the growing body of knowledge about management of common property resources to develop institutional mechanisms to facilitate acquisition and development of blocks of barren hill land by small groups of poor households.³ The already-demonstrated ability of small groups composed of kin and close neighbors to co-own buffalo suggests that similar small face-to-face groups might also be able to successfully manage tracts of hill land held as common property. Loans might be given at preferential rates to such groups, for example. If organizational methods similar to those pioneered by the Grameen Bank in Bangladesh were employed, the default rate on such loans might be lowered to an acceptable level.⁴

CONCLUSIONS

Changes in rural resource management in the Midlands of Vinh Phu province following implementation of Resolution 10 have resulted in major environmental and economic improvements. So dramatic are the environmental changes, especially the regreening of the barren hilltops and the replacement of eroding cassava fields with tea and other perennials, that members of our team who had participated in the 1989 survey frequently had trouble in recognizing areas that we had visited then. We were also impressed by the evident improvement in the standard of living of the farmers. Households that had been considered well-off in 1989 because they possessed a small battery radio and an old bicycle now boast color televisions and motorbikes. Their houses, built of wood and thatch before, with perhaps a concrete floor, are now substantial masonry structures, often of two stories. Even poor households are likely now to have electricity, radios, and bicycles, although the quality of their housing is still very low. Everyone we interviewed, well-off and poor alike, said without hesitation that their lives are better now than they were during the cooperative period. As evidence of this improvement, the wealthier households point to their new opportunities to earn income, and the poorer farmers say that now at least they have enough food to feed their families.

If the process of development in the Midlands could be stopped at this point and rural social and environmental conditions held constant as they are now, then one would have to say that the economic reform policy changes under *doi moi* have been an unqualified success. As we have seen, productivity has increased, land use patterns have become on the whole more sustainable, diversity has been enhanced, and virtually everyone is better off economically, even if some have benefited more than others. But the process of development will not stop; it will continue, and most probably the pace of change in the Midlands will continue to accelerate. The environmental and social outcomes of future development may not be so favorable as has been the case to date, however. On the environmental side, maintenance of biological diversity and the sustainability of natural resource use may be adversely impacted by increased involvement of households in

commercial production for the market. On the social side, increasing economic differentiation among households may threaten the long-term stability of rural society. Looming over all other processes is the continued rapid increase in population.

These potentially adverse outcomes need not occur, however. The development trajectory of the Midlands has not been predetermined by natural law. Instead that trajectory is subject to modification by implementation of appropriate policies. Changes in policies to ensure more-equitable allocation of barren hill land, improvement of the system for providing credit to poor households, and development of an effective extension service to provide farmers with technical assistance to support more sustainable resource management practices might produce a far happier outcome than is likely if current trends continue without such interventions. In 1989 the process of development in the Midlands was at a critical choice point; the correct choice was made and implementation of Resolution 10 successfully transformed a declining economy into a rapidly growing one. Now, five years later, development in the Midlands has reached another point at which critical policy choices must be made. It is our hope that this study will contribute to the formulation of policies that will lead to more favorable development outcomes than might otherwise occur.

NOTES

1. For a discussion of agroecosystem properties as an analytical concept see Conway (1984, 25-38); Rambo and Marten (1988, 263-85); and Rambo (1991).
2. In implementing the 1993 Land Law, Decree 64/CP (which took effect on 27 September 1993) set limits on land areas held by households. Ceilings on annual croplands were set at 2 hectares nationwide, except for sixteen provinces in the Mekong Delta and the southeast. Ceilings on perennial croplands were set at 30 hectares in mountainous areas and 10 hectares in the lowlands. Ceilings on barren lands and newly reclaimed land were to be decided by the provinces. Households that held more than the limits before the 1993 Land Law were allowed to keep their land, but had to pay additional taxes on the excess.
3. Ostrom (1990) provides a conceptual and theoretical framework for design of sustainable common property regimes. Case studies of application of the common-property approach to forest resource management in Asia are found in Fox (1993).
4. The Grameen (meaning "rural" or "country-side") Bank is a highly successful and widely replicated model of a rural development credit union that was initiated by Muhammad Yunus in 1976. Wahid (1993) describes the origins, organization, management style, and performance of the bank.

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Schedule of Activities

6–20 August 1994

6–7 August (Saturday–Sunday): Arrival in Hanoi
8 August (Monday): Opening meeting for all research groups (West Lake, Hanoi)
9 August (Tuesday): Research preparations (West Lake, Hanoi)
10 August (Wednesday): Travel to Vinh Phu province

Doan Hung and Thanh Hoa Group

10 August (Wednesday): Meeting with district and cooperative officers, Doan Hung district
11–13 August (Thursday–Saturday): Research in Doan Hung district—interviews with households and with village and cooperative officials
13 August (Saturday): Travel to Thanh Hoa district
14 August (Sunday): Meeting with district and cooperative officers, Thanh Hoa district
14–16 August (Sunday–Tuesday): Research in Thanh Hoa district—interviews with households and with village and cooperative officials

Lap Thach Group

10 August (Wednesday): Meeting with district and cooperative officers, Lap Thach district
11–16 August (Thursday–Tuesday): Research in Lap Thach district—interviews with households and with village and cooperative officials

Both Groups

17 August (Wednesday): Travel to Tam Dao
17–19 August (Wednesday–Friday): Team meetings, report writing, presentations (Tam Dao)
20 August (Saturday): Travel to Noi Bai Airport; depart Vietnam

