The General Context of a dynamic agricultural sector in the Red River Delta

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Introduction

Northern Vietnam covers an area of 117,000 km^2, or a little over one third of the country as a whole. It contains Hanoi, the political and administrative capital with more than 3 million in-habitants. From the north, a deep, mountainous hinterland opens out to the southeast onto the 15,000 km^2 of the Red River Delta. This wide, alluvial plain has one of the highest densities of rural population in the world, with 1,400 inhabitants per square kilometre and contains most of the population and the economic activity of Northern Vietnam. Recent history, despite the up-heavals suffered during the wars of the second half of the 20th century, has made it possible to equip the Delta with a considerable agricultural infrastructure, which has in turn greatly encouraged the rapid development of crop production. The Red River Delta is, after the Mekong Delta, the second-largest rice granary of Vietnam, itself the second-biggest exporter of rice in the world. Taking advantage of the country's liberalization in 1986 and its opening up to external markets, livestock production has also developed over the last ten years or so, responding to an increase in urban and foreign demand.

Thai Binh province is located 150 km southwest of Hanoi (Figure 1). It is bordered to the east by the South China Sea, to the west and south by the Red River (Sông Hông) and its tributary the Sông Trà Ly river, and to the north by the Sông Luôc and the Sông Hoá rivers. Divided administratively into eight districts, of which one is exclusively urban, it covers an area of about 1,500 km^2. It contains a large population, of whom 93% are engaged in agricultural work. (1). After the grim episodes of the famine of 1948, this province has always been noted for its rice production thanks in particular to colossal efforts in terms of irrigation. Livestock commodity chains are dominated by pig production. This porcine production is intensifying rapidly and enjoys strong support from the local authorities.

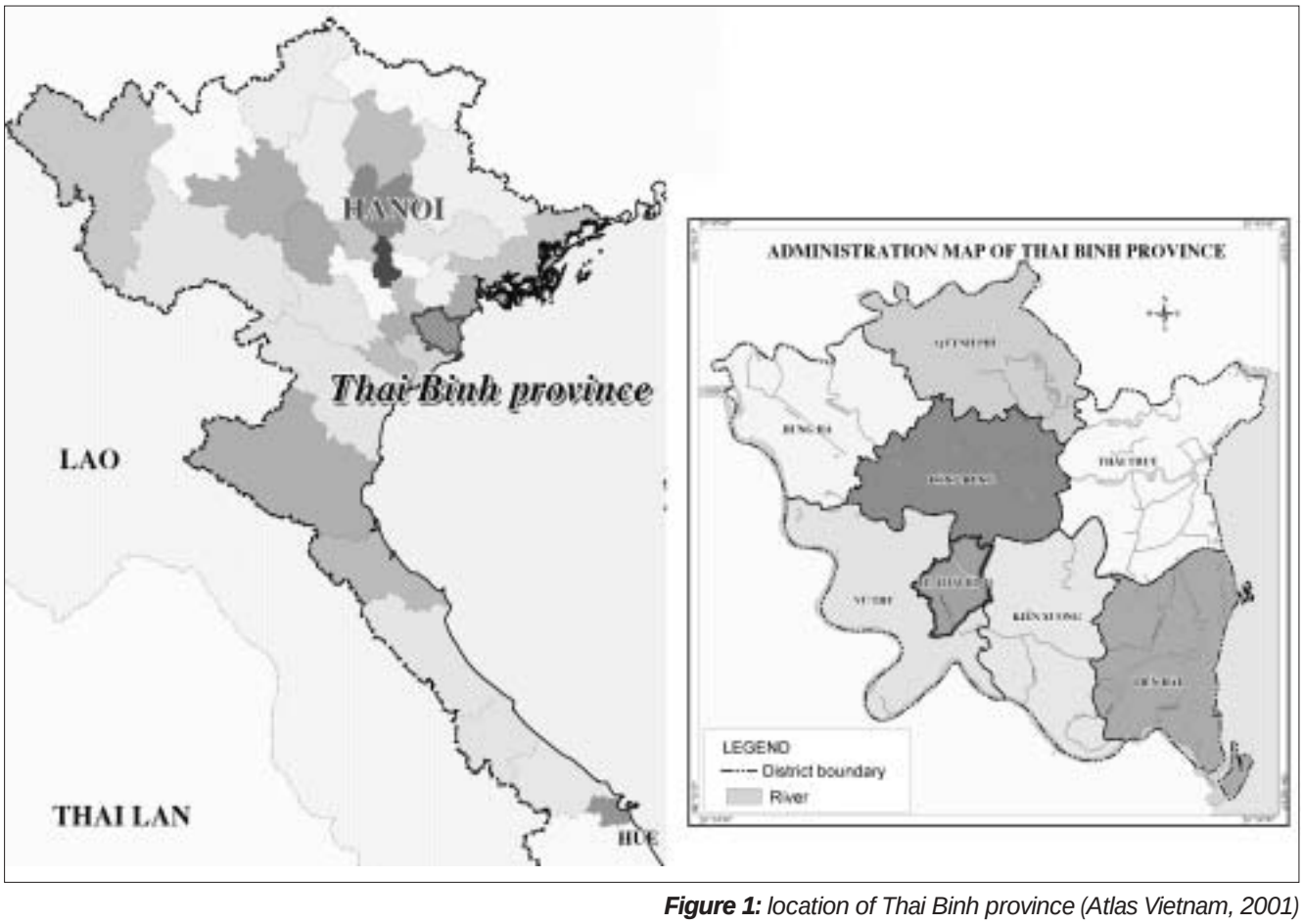

Figure 1: *location of Thai Binh province (Atlas Vietnam, 2001)*

The socio-political environment and development policies

The various agrarian reforms

It is thanks to Ho Chi Minh, founding father of the Communist Party of Vietnam, that Vietnam liberated itself from French colonial rule. The country became officially free once again upon the Vietnamese declaration of independence in 1954. But many decades of conflict were neces-sary before Vietnam freed itself from the American presence. The war against the Americans officially ended in 1976. At that time, the communist political regime, already in power in Northern Vietnam, extended its control to the rest of the country.

After independence and the unification of the country, the Communist Party put a collectivization policy into place throughout Vietnam. In rural areas, land collectivization was enforced in two successive waves, in 1978-1979 and in 1983-1985.

From collectivized agriculture to Directive n°100 – With the installation of the communist government in Vietnam, the leaders choose to establish a collectivized agricultural system. But already in the '70s, this system is considered as bureaucratic and inefficient. It is paralysed by the State sector monopoly and planned allocations of subsidies (2). With the reunification of the country in 1975 and the economy in the South being more developed, some co-operatives practise a system of informal contracts by which farmers can rent a given acreage of paddy fields in exchange for a set contribution. Directive n°100 in 1981 makes this system legal while leaving the co-operative in charge of decisions concerning crop planting. Most agricultural work becomes the responsibility of families who have to hand over part of their crops but can keep the rest.

The renewal marks the beginning of a policy change – In spite of the new boost given to agricultural production, the co-operatives suffer and their economic deficit deepens. The 6th Congress of the Communist Party of Vietnam in 1986 then adopts the policy known as "Renewal" (Doi Moi), that marks Vietnam's commitment to a process of liberalization. The acreage farmed by each co-operative member depends on its productive capacity and on the availability of co-operative land. Leases are for 20 years (rather than 1 to 3 years as before) during which the co-operative paddy fields are the farmers' responsibility. Each co-operative member looks after a plot of paddy fields and is wholly responsible for the 8 stages of rice growing (formerly 5 stages). The rate of land rental is set at 10% for each crop and remains unchanged for 5 years. But in general, agricultural taxation is reduced. State farms enjoy financial autonomy. Should they go bankrupt, they are disbanded and their land divided up among farmers. Free trade is liberalized (3).

As soon as it is declared law in 1987, this land regulation turns out to be difficult to enforce in the context of a market economy and a society in a state of rapid change, following the opening up of the Socialist Republic of Vietnam to non-socialist countries. On several occasions, the National Assembly passes amendment laws (1990, 1993 and 1999) accompanied by decisions and decrees for their enforcement. In 1999, the Prime Minister Pham Van Khai signs a decree by which the State recognizes (agricultural and urban) land use rights in accordance with the right of exchange, concession, rental, sub-rental, land use inheritance rights and the right to use land as security and as investment capital. However the enforcement of these laws remains difficult in practice and discourages farmers (3).

Bureaucratic malfunctions and price, salary and currency reforms led to the abolition of planned subsidies and of the dual pricing system (the market price and the state price). Resolution n°10 (Khoan 10) of 1988 recognizes the family farm as a production unit: it allocates agricultural land to family farms and abolishes the system of low-price compulsory sales and the policy of self-sufficiency for every district. This Resolution also had the effect of stopping State price control. In keeping with the principle that to achieve socialism, sufficiently rapid economic growth is at first necessary in order to be able to share it out equitably, the role of the market and the motivation of farmers are also taken into account. Production experiences a consider-able boom in this period. Vietnam climbs to 3rd place among world rice exporters. The rate of growth of livestock production outstrips that of population growth during the period 1981-1988.

Currently, Vietnamese agriculture is highly liberalized. Today, the role of the State is limited to a monopoly of agricultural produce exports. The State has ceased all activity on the domestic meat produce market. No public service carries out animal slaughter; fiscal and sanitary inspections are not very common. Intermediation mechanisms (producer groups, unions,

fairs, wholesale markets, etc.) ensuring the proper practice of trading activity do not exist either.

After twenty years of reforms, the Vietnamese economy has become liberalized and agricultural production has been developed. Currently, a clear differentiation is appearing between farms, and non-agricultural revenue is playing a large part in this. In the Red River Delta, 40% of farms have been in difficulties since the curtailment of the co-operative system. Although the reforms and socio-economic changes have positive consequences with regard to food security and development of agricultural production, the inequalities between farms are growing and the poorest ones are in an increasingly worrying situation.

This economic liberalization has led to Vietnam opening up to foreign markets. Vietnam is currently a candidate to join the World Trade Organization.

Table 1: *Evolution of the consumption of meat during the last decade in Vietnam (kg/inhab/year)*

Year	***1991***	***1992***	***1993***	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***	***2000***
Total	*14,5*	*15,5*	*16,6*	*17,7*	*18,3*	*19,3*	*20,2*	*21,1*	*22,3*	*23,3*
Pork meat	*10,7*	*11,6*	*12,6*	*13,5*	*14,0*	*14,8*	*15,5*	*16,3*	*17,2*	*18,0*

Thai Binh's development priorities

Since 2004, Thai Binh has declared its priorities to be the intensification of arable and livestock farming. The directives concerning livestock development in the province over the period 2004-2010 aim to change the structure of agriculture, to industrialize agricultural production and to respond to market demands concerning livestock production. The People's Committee has concrete objectives: between now and 2010, it wishes to see, in Thai Binh province, the value of livestock production within agriculture totalling at least 40%. It also wishes to see the proportion of fattened cross-bred pigs with exotic breeds rise to 40% by 2010.

According to the provincial political powers, the two means of livestock production to be encouraged are "farms" and family farms, in order to reach 1.4 million pigs in 2010, with 1,600 livestock farms and 16,400 family farms. The transition from traditional livestock farming to industrial, or at the very least semi-industrial livestock production, would bring about an increase in the volume of production while improving quality and better responding to consumer demand.

The objectives of the People's Committee for the period 2004-2010 are therefore: to promote "industrial" livestock production (poultry and pigs), to industrialize the processing of livestock produce and to find marketing outlets.

In order to achieve these goals, technical progress in the production of breeding stock and in the processing industry needs to be made. To facilitate this, the government is trying to encourage livestock farmers, particularly with the help of financial subsidies, to adopt higher-return exotic breeds. The People's Committees place emphasis on training courses and extension activities to support farmers in the changes to their livestock farming systems. Finally, the Communal People's Committees are responsible for the construction of infrastructure in special areas, created to encourage the building of (semi-) industrial farms and family farms.

A densely populated environment intensively exploited by man

A large and dense population…

In 2002, there were 1,827,000 inhabitants in Thai Binh province, 94.2 % of them in a rural environment. The average population density is of 1,183 inhabitants per km^2. The average num-ber of people per family is 3.75 and the population growth rate is 1.02%.

Vietnam is the most densely populated among Southeast Asia's major agro-economic countries. Average land area per capita is about 0.41 hectares, one of the lowest in the world. With a population density of 240 inhabitants km^2 with only 9 million hectares allocated for agriculture (i.e. one quarter of the total land area), the country has to support 9 inhabitants per ha of agricultural land (Table 2 and Table 3).

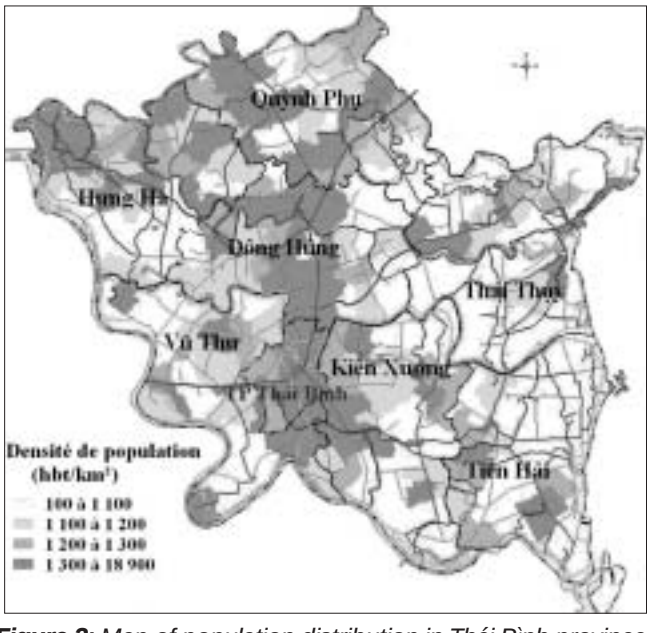

Figure 2: *Map of population distribution in Thái Bình province*

…but with low income

Agriculture remains fundamental to the Vietnamese economy, employing a labour force of 26 million (70% of active population) and contributing 24.3% of GDP in 2000 (Table 1). The country's approximately 10m ha of cultivated land is low compared with other countries of Southeast Asia (e.g. Thailand with 20m ha, Indonesia with 22m ha, Myanmar with 10m ha, and the Philippines with 9m ha). Vietnam's total food production in 2001 was about 34.5 million metric tons, of which 49% was from the Mekong Delta, 20% from the Red River Delta.

According to the Ministry of Agriculture and Rural Development, each farming household in Vietnam farms on average 7.5 sao (1 sao = 360 m^2) of paddy fields, giving two crops a year.

However, the plains of Northern Vietnam where Thai Binh province is located are overpopu-lated. There are about 800 to 900 inhabitants/km^2 of paddy fields. Each family farms 1.5 to 2 sao, which is equivalent to less than half the national average (3).

Table 2: *Selected socio-economic indicators related to the Vietnamese agricultural sector*

Item	***Year***	***Value***
Land area per capita (ha)	*2000*	*0.41*
GDP growth (%)	*2000*	*6.75*
Agricultural growth (%) (Includes agriculture, forestry and fisheries)	*2000*	*1.6*
Contribution to GDP of agriculture (%) (Includes agriculture, forestry and fisheries)	*2000*	*24.3*
Contribution to GDP of households (%)	*2000*	*32.1*
Fertilizer imports (millions of metric tons)	*2001*	*3.24*
Vegetable exports (millions of USD)	*2001*	*305*

Source: Statistical year book of Vietnam 2001, 2002

Table 3: *Population, agricultural land area and inhabitant density of Vietnam*

Year	Population (million inhabitants)			Land (m ha)		Density (capita per ha)	
	Total	Agriculture	%	Agriculture	Arable	Agriculture	Arable
1990	66.0	47.1	71.4	6.7	5.3	9.8	12.5
1991	67.2	47.8	71.1	6.8	6.4	9.9	10.5
1992	68.4	48.6	71.1	7.0	5.5	9.8	12.4
1993	69.6	49.3	70.8	7.1	5.5	9.8	12.6
1994	70.8	49.9	70.5	7.1	5.5	10.0	12.9
1995	72.0	50.5	70.1	7.1	5.5	10.1	13.1
1996	73.2	51.0	69.7	7.7	5.6	9.5	13.1
1997	74.3	51.5	69.3	7.8	5.7	9.5	13.0
1998	75.5	51.9	68.7	8.1	5.7	9.3	13.2
1999	76.6	52.2	68.1	8.7	5.8	8.8	13.2
2000	77.3	52.6	68.0	9.3	5.8	8.3	13.3
2001	78.7	53.0	67.3	9.4	6.5	8.4	12.1
2002	79.7	53.6	67.3	9.4	6.6	8.5	12.1

A natural environment full of contrasts

a) The climate

The Red River Delta has a humid, subtropical climate, strongly affected by the East Asian monsoons. In Thai Binh province, average annual rainfall is nearly 1,400mm and the average temperature is 24°C. Average humidity is from 85 to 90%. There are three distinct seasons, distin-guished by temperature, humidity and sunshine:

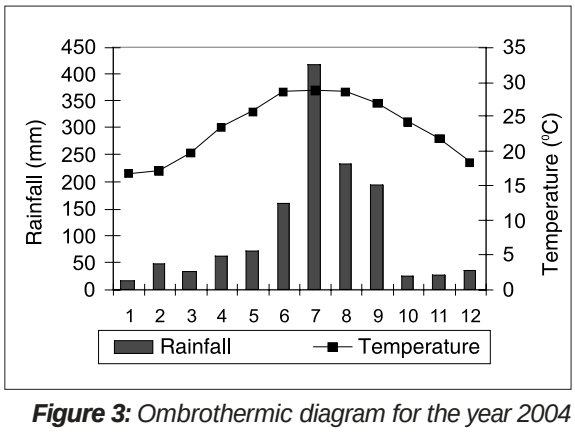

Figure 3: *Ombrothermic diagram for the year 2004 (Thai Binh Climate Station)*

Spring, from January to May, is very humid owing to almost permanent fog, with light precipitation and low temperatures. Summer, from June to September, is typified by high temperatures and heavy precipitation (Figure 3): 4/5 of annual precipitation takes place during this season (4). Winter, from October to December, is the dry season, with abundant sunshine and light precipitation; Sunshine is distributed as shown in Figure 4 with 1,600 to 1,800 hours of sunshine per year (1).

The principal limiting factor in this province of Northern Vietnam is the drop in temperature from December to February, with a minimum temperature reaching 4°C some years, which limits fish farming and prevents the growth of some species, such as rice.

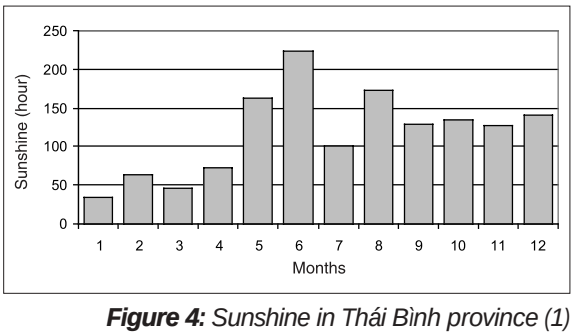

Figure 4: *Sunshine in Thái Bình province (1)*

b) Soil types

The national map of soil types only shows one type of soil for Thai Binh province. This is a soil derived from alluvia of the Red River, which flooded this region regularly until it was com-pletely confined, between the 13th and the 18th century. With its salty-clayey texture, this soil suitable for growing rice is reputed for its fertility (Table 3).

Table 4: *Chemical characteristics of the alluvial soils located within Red River dikes; soil not renewed by the River's annual flooding*

Village *(District)*	***Depth*** *(cm)*	***OM*** *%*	***pH*** *H2O*	***Total elements*** *(%)*			***Available elements*** *(mg/1000g soil)*		***Exchange cations*** *(meq/100g soil)*	
				N	***P_2O_5***	***K_2O***	***P_2O_5***	***K_2O***	***Ca^{++}***	***Mg^{++}***
Vu Dong *(Kien Xuong)*	*0-15*	*3.38*	*4.90*	*0.17*	*0.07*	*2.12*	*2.48*	*10.00*	*5.37*	*1.37*
	15-25	*2.75*	*4.80*	*0.16*	*0.05*	*2.20*	*2.77*	*10.00*	*6.50*	*4.62*
Hoang Dieu *(Dong Hung)*	*0-15*	*2.13*	*4.60*	*0.18*	*0.06*	*1.67*	*5.12*	*11.00*	*6.10*	*3.50*
	15-25	*1.15*	*5.10*	*0.09*	*0.03*	*2.23*	*2.47*	*7.00*	*6.00*	*6.70*
Quynh My *(Quynh Phu)*	*0-15*	*2.08*	*5.95*	*0.19*	*0.07*	*1.55*	*19.22*	*7.00*	*7.50*	*2.87*
	15-28	*1.45*	*7.36*	*0.12*	*0.07*	*1.24*	*20.64*	*4.00*	*7.50*	*2.37*

In low-lying areas, the pH is often low, requiring farmers to lime their fields regularly (4).

There is also a second soil type (yellow alluvial soil), which is found on the alluvial terraces on either side of the Red River or its tributary the Trà Ly river. These terraces are flooded annually during the high water season, in July and August (Table 4).

Table 5: *Chemical characteristics of the alluvial soils located outside Red River dikes; soil renewed by the River's annual flooding*

Village *(District)*	***Depth*** *(cm)*	***OM*** *%*	***pH*** *H2O*	***Total elements*** *(%)*			***Available elements*** *(mg/1000g soil)*		***Exchange cations*** *(meq/100g soil)*	
				N	***P_2O_5***	***K_2O***	***P_2O_5***	***K_2O***	***Ca^{++}***	***Mg^{++}***
Vu Doai *(Vu Thu)*	*0-15*	*2.47*	*6.35*	*0.23*	*0.09*	*1.77*	*11.44*	*6.00*	*9.30*	*2.50*
	15-25	*1.37*	*6.65*	*0.13*	*0.05*	*1.43*	*15.44*	*6.00*	*10.00*	*2.00*
Hiep Hoa *(Vu Thu)*	*0-15*	*2.52*	*6.00*	*0.24*	*0.05*	*1.87*	*13.02*	*6.00*	*8.70*	*3.50*
	15-25	*1.37*	*6.20*	*0.11*	*0.02*	*1.77*	*19.08*	*5.00*	*8.60*	*3.30*
Quynh Ngoc *(Quynh Phu)*	*0-15*	*2.08*	*6.40*	*0.19*	*0.07*	*1.55*	*19.22*	*7.00*	*7.12*	*2.12*
	15-28	*1.45*	*6.48*	*0.12*	*0.07*	*1.24*	*20.64*	*4.00*	*6.75*	*1.62*

These alluvial soils with low pH, about 6 (4), are the sign of a lack of alkaline reserves and of an environment low in carbonates that responds poorly to fertilization. They cover a small area, and are suitable for growing maize and groundnuts. In summer, the level in watercourses is high and the water carries a lot of alluvia down with it. The opposite occurs in winter, when salt water reaches from 15 to 20km inland.

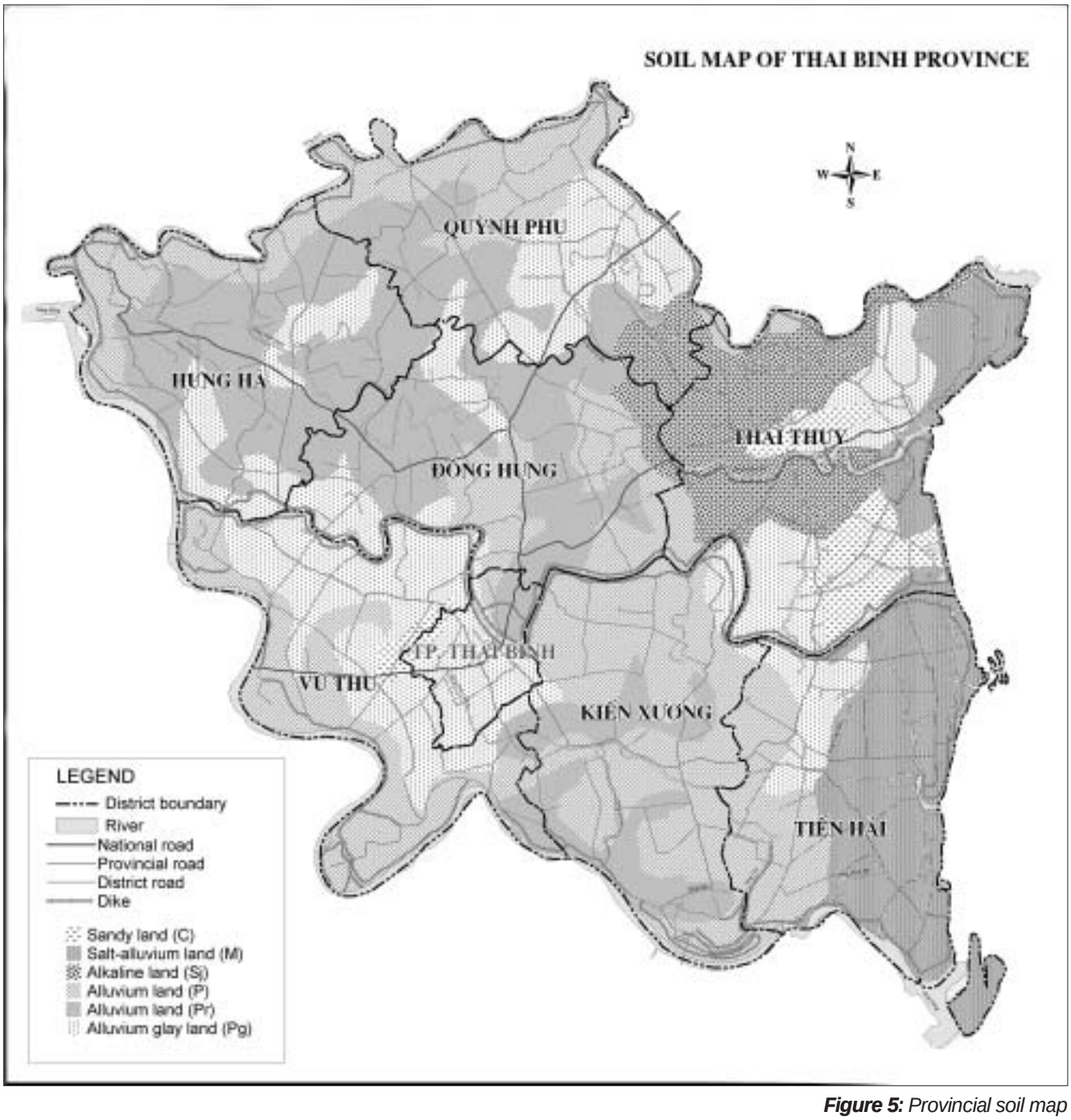

Figure 5: *Provincial soil map*

A compartmentalized occupation of land

The agrarian landscape of the province is typified by a marked separation between inhabited and cultivated areas. There are three main agro-ecological units:

i) Paddy fields i.e. diked-off land – on these wide plains, laid out with irrigated perimeters, the only discernable "contours" are the dikes running along the main watercourses. This is an environment difficult to comprehend, as a difference in relative altitude between two plots of land of only a few tens of cm, often difficult to see with the naked eye, can cause significant differences in access to water and established crop types. Wherever one is, agricultural land is therefore classified according to its topographic level into

low-lying [1], mid-level [2] and high-level [3] land (4). The lowest-lying land is sometimes converted into ponds; they are also used for com-bined wet rice growing and fish farming in the rainy season.

ii) Alluvial land, flooded annually in July and August, has no access to irrigation. Dry crops are the first choice for this land, mostly maize, groundnuts and mulberry bushes (5).

iii) Inhabited areas are clearly defined and located on the highest ground; dwellings are in clusters. Demographic pressure is such that within these areas, all available land surrounding houses is put to use. Living enclosures are thus places of multiple activities. Agricultural production activities (fruit, vegetables, fish, pigs, etc.) as well as processing activities (crop drying, threshing, distilling rice alcohol, making soya tofu, etc.) can be found there, intermingled with domestic activities. The garden constitutes an important element of the family patrimony, in particular for historical reasons: during the collectivist regime, it was the only piece of land where families could grow what they wanted, and from which they could make a direct profit. It therefore appears in the Vietnamese land registry (Table 5).

Property title deeds have only recently been granted in Vietnam; it only happened in 1993 with the new land law, after a first stage that was carried out during the reform of 1986. These rights have a time limit on them: 20 years for land yielding annual crops and 50 years for land yielding perennial crops. Land was shared out according to pedological criteria, in particular soil quality, and topographical criteria, i.e. height of the land; but there is no link between the location of dwellings and family land.

The countryside is therefore typified by a spatial separation between dwellings, livestock farms and ponds on the one hand, and cultivated fields on the other. This is both a bonus and a constraint for the transfer of livestock effluents. Over the last few years, however, a transgression of this order has been witnessed; some livestock and/or fish farmers, constrained by the lack of available space on inhabited land and wishing to expand, set themselves up outside villages near paddy fields.

Table 6: *Soil use in Thai Binh, example of Vu Thu district*

Types of soil use	***Vu Thu***		***Thai Binh province***	
	Ha	***%***	***Ha***	***%***
Total area	*19,843*		*154,601*	
Agricultural area	*12,045*	*61*	*96,469*	*62*
- Annual plants	*10,697*	*54*	*91,424*	*59*
Rice growing	*9,318*	*47*	*87,491*	*57*
- Perennial plants	*692*	*3*	*1,513*	*1*
- Gardens	*656*	*3*	*3,386*	*2*
Fish farming area	*1,173*	*6*	*7,309*	*5*
Forests exploited	*0*	*0*	*3,394*	*2*
Public works	*3,150*	*16*	*26,569*	*17*
Dwellings	*1,655*	*8*	*12,443*	*8*
Area not used	*1,820*	*9*	*8,494*	*5*

Source: Thai Binh Statistics Office, 2003

[1] *dat thap*
[2] *dat trung binh*
[3] *dat cao*

Figure 6: *Map of land-use in the province*

The importance of the hydraulic system

Hydraulic constructions play an important part in the Delta's agriculture. For centuries, the inhabitants of the Delta have struggled against floods, in particular against those caused by the Red River, whose flow increases drastically during the rainy season. This struggle was given concrete expression by the construction of numerous primary and secondary dikes along the banks of the main rivers and their tributaries, in particular during the collectivist regime (from 1954 to 1986). At the same time, the need for water for crops initiated the establishment of a vast irrigation network, omnipresent in the rural landscape and primordial in the choice of crops to be planted. This is the case with growing rice, for which maintaining a permanent flow of water constitutes the prime means of controlling weeds. Almost all agricultural land can thus be irrigated and the paddy fields are crisscrossed with canals (often made of cement) and earth drains, potentially interchangeable thanks to motorized pumps or bailing.

Thai Binh province is one of the most recent deltas in the Red River drainage basin. It was formed by sea receding progressively to the east and by significant hydraulic constructions built in the past. The province can be thought of as an island that has been cut off, surrounded by the Red River, the Thai Binh River and the sea, with a very dense hydrographical network. Down-stream in the Delta, this province is located in the very low-lying area, where the topography varies on average from 1 to 2 metres. The water level follows the hydrological pattern of the Red River, the Thai Binh River and its branches downstream, as well as the tides. Flooding occurs in the summer season, from June to October, caused by excess rain and river water; the low-water level season lasts from November to May. The tide fluctuates between 1.9 to 2.4 metres on average, with a maximum of 3.8 metres.

The containment of the rivers has divided Thai Binh into two independent primary hydraulic ponders in terms of irrigation and drainage, separated by the Kien Giang River, namely: North and South Thai Binh (Table 6).

The Northern ponder of Thai Binh includes the following districts: Hung Ha, Dong Hung, Quynh Phu and Thai Thuy. The South ponder includes the districts Vu Thu, Kien Xuong, Tien Hai and the town of Thai Binh. These two ponders are mostly irrigated and drained by gravitational irrigation and/or by pumping, depending on water levels in the rivers and the tide. Gravitational irrigation using locks is only practised at times of low tide, at the beginning of the summer season, but rarely in the spring. Drainage by pumping is mostly carried out by the big central pumping stations, managed by the hydraulic companies. The very powerful pumps with an outflow from 1,000 m^3/h to 4,000 m^3/h irrigate and drain areas from 50 ha to a few hundred ha.

Surface waters of Thai Binh are irrigated either by local pumping stations managed by the communes, or by gravitation and/or by bailing. Local pumping stations are either stationary or mobile (boat, bicycle) and use electric or petrol-driven pumps, with a small outflow (320 m^3/h to 1,200 m^3/h).

Table 7: *Characteristics of the two primary hydraulic ponders of Thai Binh*

ponder	*Area cultivated*	*Projected area*		
		Irrigated	*Area irrigated/A. cultivated*	*Drained*
North Thai Binh	*58,907 ha*	*56,109 ha*	*95.25 %*	*73,923 ha*
South Thai Binh	*44,053 ha*	*40,970 ha*	*93.00 %*	*47,225 ha*
Provincial total	*102,960 ha*	*97,016 ha*	*94.22 %*	*121,148 ha*

Source: MARD, 1993

Table 8: *Capacity of public pumping stations in Thai Binh province*

Number of pumping stations	*Area irrigated (ha)*		*Area drained (ha)*		*Number of pumps*	*Capacity*	
	theory	*reality*	*theory*	*reality*		*m^3/h*	*kw*
377	*50,000*	*31,000*	*25,000*	*20,000*	*1,044*	*1,448,060*	*37,875*

Source: MARD, 1993 (VIE/89/034)

Table 9: *Distribution of irrigated area by type of irrigation in Tien Hai district*

Irrigation by public stations			*Irrigation by local stations*			*Gravitational irrigation or bailing*	
Number of stations	*Area irrigated*	*%*	*Number of stations*	*Area irrigated*	*%*	*Area irrigated*	*%*
37	*6,863 ha*	*69*	*53*	*1,543 ha*	*15.5*	*1,543 ha*	*15.5*

Source: Hydraulic Company of Tien Hai district, Thai Binh, 2003

Thai Binh's hydraulic management is very hierarchical and top-down: the Thai Binh Provincial Department of Agriculture and Rural Development (DARD) deals with hydraulic development and management policy in the province; the Provincial Hydraulic Department (PHD) is under the management of the Province's DARD and takes care administratively of all the irrigation works and of drainage at the provincial level; the Provincial Dikes Department (PDD) is under the management of the DARD and takes care of all maintenance work on the dikes and of flood and typhoon response at the provincial level; the 2 Hydraulic Companies of the 2 North and South ponders are under the management of the PHD and each is responsible for providing water to the District Hydraulic Companies in each ponder; the District Hydraulic Company is under the management of the PHD and is responsible for irrigating and draining the communes in its district; the District Office of Agriculture and Rural Development is managed by the District People's Committee, co-ordinates with the PDD, and looks after the dikes; the Agricultural Co-operative takes care of irrigation and drainage on its territory. Due to decollectivization and local history, there are several kinds of agricultural co-operatives in Thai Binh at different levels, namely: i) The communal agricultural co-operative that takes care of irrigation for the whole commune; ii) The inter-village agricultural co-operative that takes care of the irrigation of a few villages in a commune; et iii) The village agricultural co-operative that takes care of the irrigation of a single village. Finally, farmers who water their land must pay a charge for irrigation water and drainage. This tax is collected by the agricultural co-operatives and goes to the hydraulic company. This charge is calculated according to the kind of irrigation/drainage, the crop planted and the growing season.

Intensive vegetable production, dominated by rice cultivation

Since the land redistribution of 1993, the State allocates 1 sao (360 m2) per inhabitant to be fed. Most families opt for food security and grow rice on between 3 and 10 sao, whatever their agricultural and non-agricultural activities. The great majority of paddy fields therefore receive two crops of rice a year: spring rice from February to May-June, then summer rice from July to October-November. Control of water supply made possible by hydraulic developments, the introduction of varieties with a shorter life cycle and a reduction in the time land lies fallow between crops have enabled the progressive integration of a third annual crop. Maize, potatoes and sweet potatoes are most commonly planted (Figure 7).

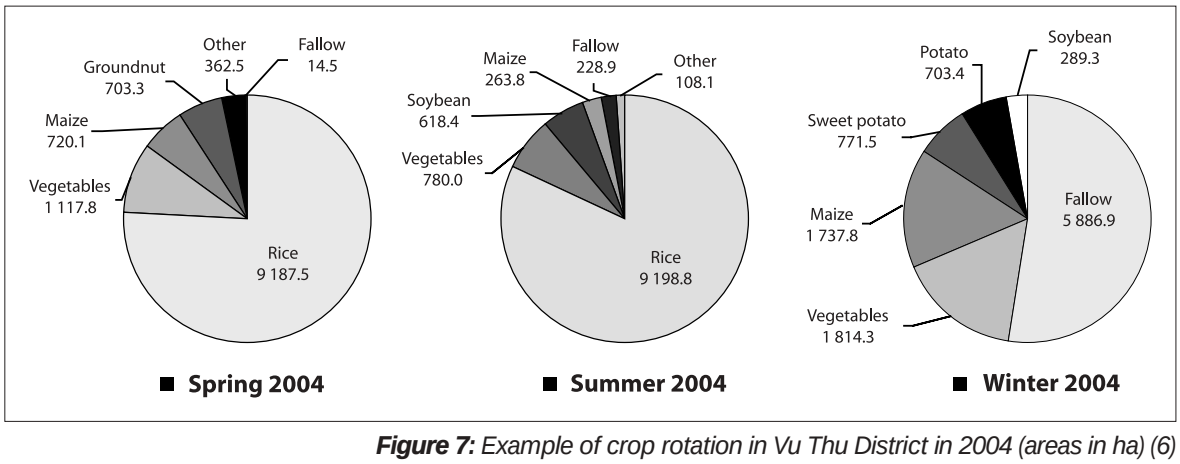

Figure 7: *Example of crop rotation in Vu Thu District in 2004 (areas in ha) (6)*

The dry winter crops are: sweet potato grown to feed pigs and potatoes reserved for human consumption. Soya, processed into tofu, and maize, mostly grown as animal feed, as well as vegetables, can be grown all year long. The vegetables, cooking potatoes and groundnuts, are grown for local markets and for export, jute and yellow nutsedge *(Cyperus esculentus)*, grown to make mats, are sold into commodity chains.

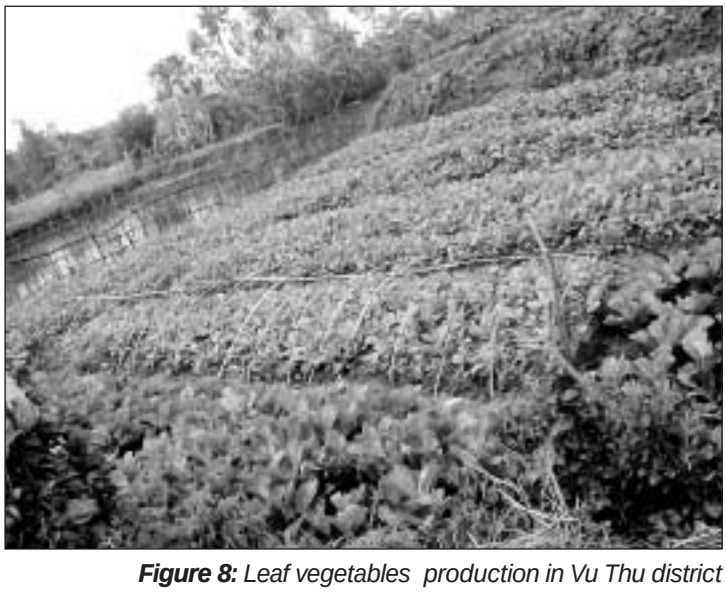

Figure 8: *Leaf vegetables production in Vu Thu district*

Perennial crops such as mulberries or bonsais are less common (1). When living space permits, a vegetable patch or an orchard can be planted there. The produce usually goes towards feeding the family, but can also be sold at local markets.

Some of this produce is processed on the farm. The rice is used to make rice wine and noodles. After distillation, the mash residue is a by-product that goes into the feed rations for pigs. Soya is turned into tofu. The watery residues generated by the processing of soya and rice are also consumed by pigs.

Chemical inputs are widely used by farmers in the Delta, and high yields are obtained: about 7 and 5.5 metric tonnes/ha for spring rice and maize, respectively (6). The communal co-operatives market fertilizers and herbicides and organize extension meetings every season, often in partnership with their suppliers (private and semi-private industrial companies).

Box 1: Crop cycles

The crop cycles observed on fields are shown in the table. They depend on the altitude of the land in relation to the hydraulic infrastructure. In contrast to rice, which is flooded, several other crops are described as "dry crops".
Low-lying land can only receive two rice cycles in the spring and in the summer. In winter, the saturation of the land that follows the rainy season and the rice harvest is such that it makes it impossible to grow anything. The land is left to lie fallow and can be grazed by cattle. High- and mid-level land can receive three crop cycles.
The following crop rotations have been observed:

- *Three dry crop cycles: Vegetables-Vegetables-Vegetables, Maize-Soya-Maize, Soya-Vegetables-Maize,*
- *Two rice cycles and one dry crop cycle: Rice-Rice-Potatoes, Rice-Rice-Sweet potatoes, Rice-Rice-Vegetables, Rice-Rice-Maize, Rice-Rice-Soya,*
- *Two dry crop cycles: Maize-Maize, nutsedge-nutsedge, Groundnuts-Maize,*
- *Two rice cycles: the rice cycles vary with the varieties used; when the field receives three cycles, the summer rice is often a short-cycle rice.*

Table 10: *Crop rotations observed among the farmers surveyed*

Month		Feb	Ma	Apr	Ma	Jun	Jul	Au	Sep	Oct	No	Dec	Jan
Diked-off land, irrigated	Mid- or high-level land	R	R	R	R	R	R	R	R	R	R		
		R	R	R	R	R	R	R	R	R	W	W	W
		DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC
	Low-lying land	R	R	R	R	R	R	R	R	R			

Caption: R: rice, DC: dry crops W: winter dry crops

Table 11: *Evolution of crops production (Mt) for 2002*

Production 2002 (Mt)	Vietnam	France	European Union	World
Sugar canne	16 823 500		114 000	1 288 403 240
Cereals	25 035 054	69 123 110	214 158 088	1 837 484 690
Soya beans	201 400	207 000	791 505	179 917 302
Maize	2 314 700	16 013 000	40 624 313	602 589 189
Cassava	4 157 700	-	-	184 852 540
Sweet potatoes	1 725 100	-	65 635	136 130 396
Paddy rice	34 063 500	105 000	2 603 700	576 280 153

Source : FAO, 2003

Livestock production, a booming pork commodity chain

Livestock farming accounts for 30 % of agricultural production in Thai Binh province. Given a significant increase in the consumption of animal products linked to the industrial development of the country, the development of livestock productions, especially pig production, is today receiving very special attention and significant support from the government.

According to the assessment of the situation in the province[4], livestock farming is developing faster than arable farming. This evolution is progressively changing the structure of agricultural production. Indeed, the value of livestock production represented about 18% of the total value of agricultural production in 1995 but easily reached 26% by 2003. Some farmers have begun to produce livestock with a high added value: pigs for lean meat, high quality poultry. Province-wide, there are more than 6,700 medium- and large-scale livestock farms. This specialized kind of farm, semi-industrial or industrial, usually generates a higher than average profit for livestock farmers.

However, the rate of current livestock farming development in the province has not realized its potential in the opinion of the provincial People's Committee. The changes in structure and farming practices are indeed slow. Traditional livestock farming is still predominant. For the most part, the farms remain small and scattered, often located in villages, where people live. Farmers wishing to increase their pig production are thwarted by a lack of funds to invest, an absence of land on which to extend their buildings and limited technical know-how to manage an industrial-scale production, beginning with control of reproduction, feeding, sanitary safety, and culminating in slaughter.

[4] *Minutes of meeting N012-NQ-TU, Thai Binh Provincial People's Committee, August 2004*

Table 12: *Evolution of pork meat production (Mt) from 1990 to 2002 in Vietnam compared to Asia, Europe and USA*

Production 2002 (Mt)	***Year***			
	1990	***1995***	***2000***	***2002***
World	*69 862 273*	*78 635 452*	*89 533 448*	*94 185 700*
Asia		*39 826 719*	*48 385 305*	*52 430 782*
Europe		*24 698 308*	*25 334 959*	*24 986 877*
France	*1 726 800*	*2 144 000*	*2 312 000*	*2 350 000*
Vietnam	*728 560*	*1 007 000*	*1 409 015*	*1 653 595*
United States of America	*6 964 000*	*8 097 000*	*8 597 000*	*8 937 000*

Source : FAO, 2003

Overview of the pig production sub-sector

A significant potential for development of pork commodity chains exists on the country's domestic market, given the growth of towns, the more so since pork remains the meat most favoured by the Vietnamese. In addition to fresh meat, there is also a market for some processed products, mostly made by traditional methods. These are mainly local salted meat products.

In addition to this are export possibilities. At the national level, exports linked to livestock farming for the moment only concern pork: 34,000 metric tons were exported in 2001, of which 15,000 metric tons to Russia, 12,000 to Hong Kong, 5,000 to China / Laos and 2,000 to Malaysia.

In 2002, Thai Binh province alone exported 4,000 metric tons of pork meat to Hong Kong. The government wishes to increase these exports and to conquer new markets. However, the poor quality of Vietnamese pork, too fatty, and its high production costs penalize it on world markets. Consequently, this desire to export and to develop the sub-sector results in an imperative to improve the quality of the product (standards of hygiene, proportion of lean meat, etc.).

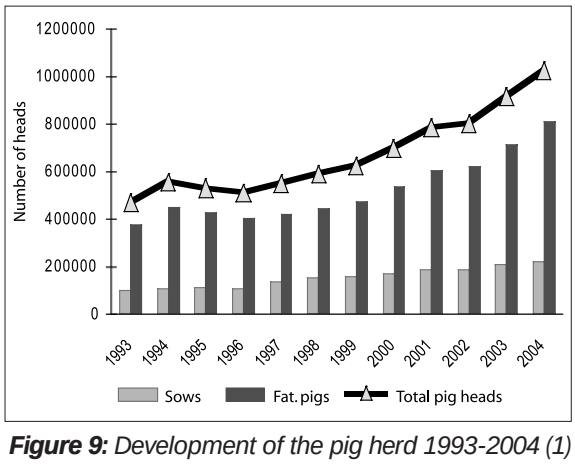

Figure 9: *Development of the pig herd 1993-2004 (1)*

The government has therefore implemented measures to support and encourage the development of intensive pork production. Subsidies are allocated to livestock farmers buying batches of more than 6 exotic sows. Easier access to credit is arranged for intensive pig farming investment projects. Training courses are given in several communes in order to improve livestock farming performances and to encourage production of leaner animals (feeding practices, genetic choices).

The provincial decree Nº12-NQ-TU concerning the development of livestock farming for the period 2004-2010 has thus set an objective of increasing livestock production by 13% annually, in order to reach 1.4 million animals in 2010. The pork sub-sector is the largest in the meat sector, far ahead of poultry or cattle and water buffalo, since it alone represents roughly 75 % of total production. The proximity of centres for meat consumption (Hanoi) and for processing and export (Haiphong) has encouraged the boom in pork production in the province. By 2004, with more than one million animals counted [5] (Figure 10), the pig herd has grown on average by roughly 10 % annually since 1993 (Figure 9), rising steadily from 400,000 animals to about 1.1 million in ten years (1). This development has come with deep structural changes and this trend should continue over the coming years, because the provincial authorities consider the increase in pork production as a priority. A few variations aside, the pig herd is distributed evenly throughout the province's districts.

[5] *Corresponds to the numbers of pigs on farms at the time of the survey and not to the number of pigs produced annually*

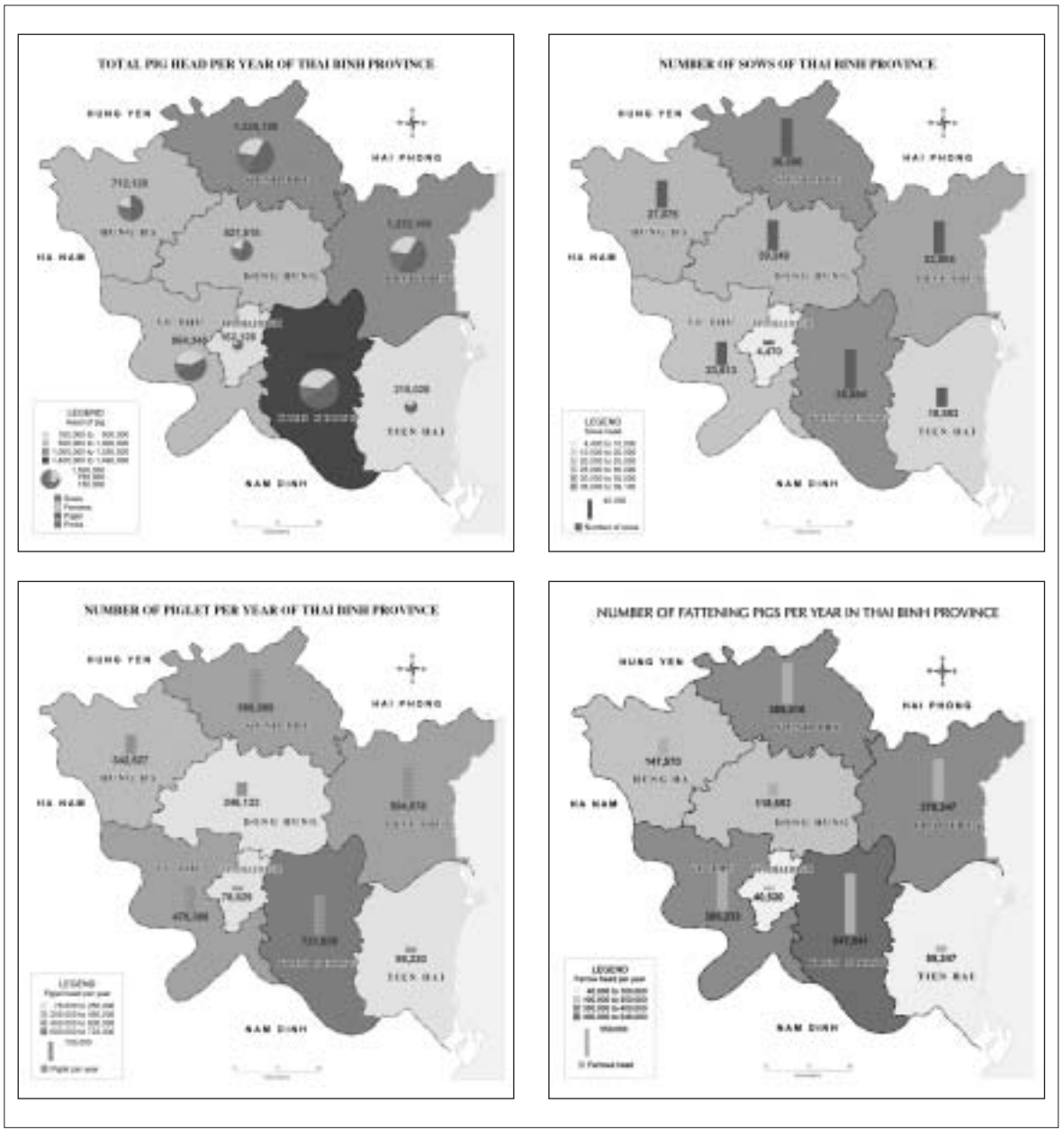

Figure 10: *Distribution maps of total pig production, pig herds, pig herds>10 sows*

Pig producers and their various breeding systems

Pig production is a traditional activity in the rural environment; pork is the second staple foodstuff after rice and its sale represents a significant source of income for a large majority of rural households (7). It therefore concerns nearly all farming households who in this way put to use the by-products of their plant produce (2). There are several categories of producers, as shown in Table 12.

Table 12: *Kinds of pig farms, terminology and change over time*

Kind	***Local name***	***Criteria***	***1993***	***2004***
Traditional farms	*Nông Hộ*	*Less than 5 sows (or 19 pigs)*	*420,000*	*412,000*
Family farms	*Gia Trại*	*From 5 to 19 sows (or 19 to 99 pigs)*	*89*	*2,452*
Farms	*Trang Trại*	*More than 20 sows (or 100 pigs)*	*88*	*1,335*

The great majority of rural households practise traditional livestock farming (Nông Hô). These small-scale farmers have their farms buildings near their homes. Generalizing, it can be stated that all houses in the communes of Thai Binh keep at least a few pigs. Their production is mostly destined for home consumption or for sale through very short commodity chains (friends, neighbours, local market). Pork production is not a significant source of income for these households. Indeed, it is not practised with this in mind, since these families have other, more significant sources of income: agriculture, other livestock farming, trade, other work, etc. These farmers usually do not seek to expand their operations, either because pig farming is not a priority or because they do not have the necessary funds available.

"Farms" (trang trai) are differentiated by the use of a permanent exterior workforce and their more advanced technical nature, both with regard to feeding and to genetics. Many belong to the Thai Binh Livestock Farming Company, the former provincial cooperative privatized in 2004, and are usually farrow-to-finish pig farms with exotic sows of the breeds Large White and Landrace. As opposed to traditional and familial pig farms, they are often located outside areas of settlement, owing to the large area taken up by their buildings, impossible to integrate into villages. The big farms are intensive, integrated operations with several kinds of farming practised on a large scale, according to the VAC system. These farms are for the most part the result of a business enterprise and not the enlargement of pre-existing pig farms. This is why they are situated outside villages, distant from where people live. The owners of these farms are often entrepreneurs who have invested heavily in them. Most seek to improve performance and to enlarge their farms.

Medium-sized farms in the process of intensifying production or family farms include a whole range of intermediary situations. In most cases, they have developed from small operations located in villages. Pig husbandry for the most part takes place on land also used for dwellings.

While reliable statistical data for farms remain rare, a survey of a sample of pig farmers made it possible the describe the main kinds of systems for managing existing herds in the province (8).

In this sample, 70 % of farmers possessed at least one sow. The rearing of exotic breeds of sows is limited to large-scale units equipped with installations suitable for intensive farming, such as individual stalls, maternity sections and open metal flooring. Most farmers prefer to keep local Mon Cai sows that are less demanding technically and financially. Exotic breeds of sows are found only on farms with over 5 animals (Table 12). Farrowers are often fatteners. Only two farmers are exclusively farrowers. 30 % of pig farmers questioned were exclusively fatteners (n=12). Pigs fattened for meat are type F1 (Mon Cai x exotic breed) or F2 (F1 x exotic breed). Pure breed Mon Cai pigs are only bred together to produce fresh sows.

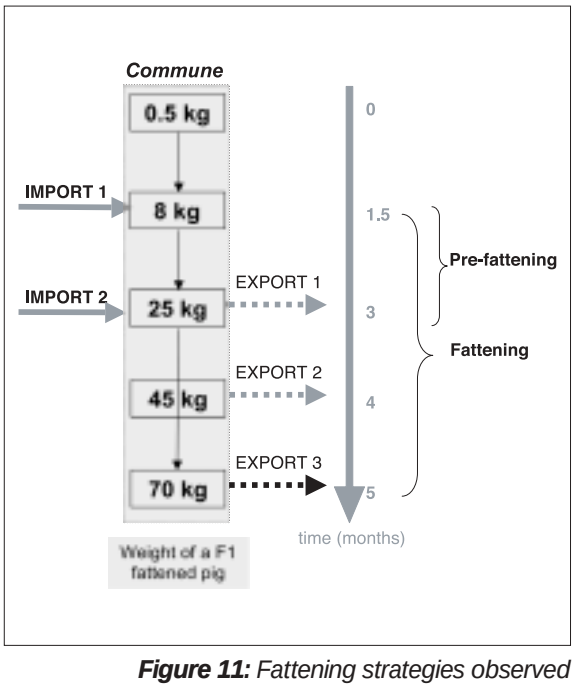

Figure 11: *Fattening strategies observed on the farms*

Table 11: *Distribution of sows in the farms surveyed*

			Sow breeds		Number of pig farms		
Number of sows (NS)	**Number of farms**	**Average NS/farm**	**L**	**E or C**	**100%L**	**L & E**	**100%E**
0	13	0					
0<NS<5	18	1,8	100%	0%	18	0	0
5<=NS<10	6	5,5	85%	15%	4	2	0
10<=NS<15	3	11	6%	94%	0	1	2
15<=NS<20	1	17	18%	82%	0	1	0
NS=20	1	20	0%	100%	0	0	1
NS=60	1	60	0%	100%	0	0	1
*L: Local breed sows E: Exotic breed sows C: Exotic*local crossed sows*							

Fattening time and the final weight of pigs fattened for meat are variable. In Vietnam, a difference is made between “thit” pigs and “got” pigs. In theory, “thit” pigs are pigs being fattened and finished for meat, and “got” pigs are weaned piglets. In reality, all pigs destined for slaughter at a high weight (between 50 and 90 kg according to provinces breeds) are considered to be “thit” pigs. “Got” pigs are some piglets that will be slaughtered aged 3 months at the latest (20-30 kg) or sold to become “thit” (Figure 11). Some farmers are specialized in rearing “got” pigs (n=4) that they sell for slaughter or on to “thit” pig farmers (n=3). However, the weight of animals at sale remains greatly conditioned by the market price and the number of available places in sheds. In this way, each farmer chooses what he considers is the right moment to sell. Both how much any one farm produces and the number of animals kept at any one time are therefore difficult to calculate exactly.

The feed given to animals varies from traditional feed produced on the farm to balanced feed and concentrates offered by the big manufacturers, i.e. Vina Feed, Cargill, Japfa ComFeed, Guyomarc'h, CP, Proconco. Feed rations are made up of rice and maize husks, and industrial feed. They are topped up with floating vegetation such as water hyacinths and spinach, banana tree stalks, potato and sweet potato leaves and kitchen waste. Feed is given in the form of a cooked soup. These mixed diets make it impossible to predict the digestibility and the quantities of rejected excreta, except for animals of exotic races that are only fed with industrial feed (n=6).

Market orientations of pig production

Pork is above all considered as a product for sale. Home consumption and sale from the farm not being very developed, 80 to 90% of fattened pigs are sold. Indeed, country-dwellers do not consume much pork compared with urban Vietnamese. Surveys in rural areas have shown that between 40 and 64% of people questioned ate pork meat less than three times a month. On the other hand, in Haiphong, consumption is apparently daily for 40% of families and every other day for 46% (9).

There are three commodity chains for marketing pork (10): Short circuits supplying the local market, within the district, and involving only one kind of stakeholders lower down the chain, local slaughterers/retailers; a short commodity chain supplying Thai Binh from the districts in-volving two actors, local slaughterers and urban retailers; and a long commodity chain supplying Hanoi and the port of Haiphong, the closest export centre, involving several actors lower down the chain: collectors, slaughterers, urban wholesalers, retailers and exporters. This commodity chain is the best organized one, with contracts that bind farmers to collection companies.

Although a few big commercial farms currently rear more than 200 pigs a year, nearly all production is fragmented and carried out by myriad small-scale family farms. 10% of farmers are farrowers. 80% are fattening-to-finishing pig farmers of which 60% are carrying out a low-earning supplementary activity with less than 6 pigs a year. Then come those who produce more than 6 pigs a year with high feed costs (less than 10%) and those who manage to reduce these costs and maintain a profitable activity (15 to 25%). In addition, some farmers pre-fatten pigs (“Lon got”) which provides a good source of income (10). Producers are not very specialized. Even on family farms and farms, it is rare to find a pork producing operation on its own. The system of land distribution, applied more strictly in Thai

Binh province than in the provinces in the south of the country, allocates an area of land to each family for crops determined by the number of members in a household. The livestock farmer is therefore always a crop farmer. Inhabitants also often possess a fish-farming pond. Just like pig farming, fish farming is practised in a more or less intensive fashion depending on the goals of the farmer. The leader of a commune questioned explained: *"we all have pigs, chickens, paddy fields and fruit trees and many also have fish-farming ponds. You could say therefore that we are all partly livestock farmers, arable farmers and fish farmers, all at the same time."*

The livestock farmer can thus choose to develop his pig husbandry while also developing or maintaining other activities, such as ducks, fish, gardens, tea, etc., but often the pig farming operation is enlarged to the detriment of other farming activities, orchard or pond. This kind of pig farmer is very opportunist. The number of pigs reared can be multiplied in a very short space of time if the prices of meat are favourable. Similarly, the pig farming operation can decline very rapidly and be replaced by other more profitable activities such as chicken or duck farming. These farmers usually seek to expand their pig farming activities when the context is favourable. But they are often limited by available space. For example, prices go up before Têt (lunar New Year, between the end of January and the beginning of February). The winter months are a prosperous period and farmers fill their buildings to maximum capacity. Conversely, the market slumps in the summer months. Some sheds are on occasion emptied and used for other farming activities (storage of rice, chicken coop).

Box 2: The concept of a "farm" in Vietnam

A "farm" or "big" farm is an industrial farming operation typified by the desire of the owner to specialize in one kind of production. System specialization often involves the enlargement and intensification of the farm. The "farm" is thus differentiated from other farms by: its size or the size of its herd, the large-scale investments of the owner, and the technical know-how of the farm manager.

Official definitions of the various farm structures producing pigs:

- *A farm is an operation involving more than 20 sows or more than 100 pigs.*
- *Family farms house between 5 and 19 sows, or between 19 and 99 pigs.*
- *Small producers possess less than 5 sows or less than 19 pigs.*

In a second kind of family farm, pig farmers seek to construct another building because the one near their dwelling is no longer big enough. So they put up a building on an available plot of land. The farmers then have a choice between constructing only a pig production unit or setting up an integrated system.

Other animal husbandry

i) Poultry - Poultry production represents a significant proportion of livestock farming in the province, which produced a little over 7 million birds in 2002, an increase of 200% since 1993 (1). Most farms are broiler chicken farms with about 196,732 laying hens and broiler chickens and 83,163 broiler ducks and laying ducks.

As with pig production, there are several kinds of farms operating in different commodity chains. All farms have farmyard poultry, made up of at least a few mother hens and a cock (mixed production of eggs, chicks and/or chickens). Produce is intended for family consumption and the local market. Some farms have chosen to develop their poultry produce on more specialized farms. Laying and broiler ducks (local breeds and Muscovy ducks) are kept in buildings or outside near a lake, a pond or a canal. When there is no pond, the farmer takes his ducks onto his paddy fields. They feed on the aquatic fauna and flora of ponds and rivers. Broiler chickens are reared in buildings. The most intensive units export broiler chickens to the neighbouring province of Nam Dinh and to Hanoi. The size of batches in the farms surveyed varies from 100 to 600 birds (6 farms). Farming cycles are from 45 to 60 days for broiler chickens, 60 to 75 days for local ducks and 80 to 90 days for Muscovy ducks. The advantage of Muscovy ducks is that they can be reared all year round, unlike local ducks that cannot withstand the low winter temperatures. The number of cycles completed in a year depends on the market, investment capabilities and the farmer's decisions.

The consequences of the avian influenza epidemic in 2004 and 2005 on the total numbers of birds have not been calculated, however poultry farming, even reduced, is still very prevalent.

ii) Ruminants – There is not much cattle and water buffalo farming, mainly because land available for foraging is scarce in the area, and because of the low demand for cattle and dairy produce. Most of these animals are used for work, the females calving once a year and the calves being sold very young.

iii) Fish farming – There are various kinds of fish farming, but the most widespread is extensive mixed farming of herbivorous carp. Produce is mainly consumed by the household, due to the small surface area available per family. Yields are low, about 2 metric t/ha. Many households have dug a pond in their garden with the joint aim of having an expanse of water and of extracting earth for making building bricks. These ponds are used for subsistence fish farming and for growing floating vegetation to add to pig feed. However, over the last few years, fish farming has emerged as less of a secondary activity, but as a profitable form of livestock farming in its own right.

Figure 12: *Pig-Fish Farming Association Thai Binh, 2005*

Farming activities are stocking with young fish and fattening. Four species of fish are reared in the same ponds: the common carp *(Cyprinus carpio)*, the herbivorous carp *(Ctenopharyngodon idella)*, the silver carp *(Hypophthalmichthys molitrix)* and the bigheaded carp *(Aristichthys nobilis)*. It is possible to start fishing about 2 months after releasing the young fish, even if the fish are naturally bigger if they are caught later. Many fish are caught when the pond is emptied in December, before Têt. Feed varies depending on how intensive the system is: animal (and human) excreta, grass and leaves (maize, floating vegetation, etc.) and with increasing frequency, industrial feed. Soups made with broken rice and rice husks are also prepared. On less intensive fish farms, the farmer washes dishes and buckets used to prepare pig feed in the pond.

Box 3: The VAC system

VAC is an acronym for "Vuon - Ao – Chuong" in Vietnamese, meaning "Garden - Pond – Livestock shed". This is a system that works by integrating different kinds of farming physically close to each other. It enables the recycling of nutrients and water between the various kinds of production. It also enables a diversification of produce that makes it possible to limit the risks of price fluctuations.

Livestock farming supplies the family with a source of protein, fertilizer and the basis of fish feed (thanks to the organic matter). The pond produces floating vegetation, the basis of animal feed, and also makes it possible to rear fish, diversifying the family's diet. Finally, the rice crop is the staple element of the human and animal diet. In the garden, fruit trees, vegetables or other crops help diversify and balance diet. The organic fertilizing matter produced is absorbed by these various crops.

Traditional to Vietnam, this system obtains an optimum yield from surface areas that are often limited. Initially, the pond was dug to supply building material for the house and to create the garden. The garden had a particular importance, as it was the only place where families were free to plant the trees or crops of their choice rather than those they were obliged to plant. The system has become widespread and today most farms, small and medium-sized, operate in this way. Waste from livestock (pigs, poultry, cattle and water buffalo) and from dwellings (human excrement) occupies a key role in the integration of the different kinds of farming within the traditional VAC system (2).

Changes in integrated production systems

While animal and vegetable produce have been presented separately for practical reasons, the reality is otherwise: the Delta's traditional production systems are integrated. Duck farming, needing an expanse of water, is usually combined with fish farming. The VAC system is very widespread in the province (Box 3). Livestock effluents are the source of nutrients for plants grown, gardens, fish and the aquatic microflora in ponds and therefore play an important role.

As for with pigs, more intensive units are established near or outside dwelling enclosures. Fish farming is on the increase; the local authorities and the technical agricultural services support the conversion of low-yield paddy fields into fish-farming ponds (Box 5), according to the logic of maximizing the added value per hectare and of agricultural diversification. The State encourages the development of fish farming, in particular in Thai Binh province. A project has been established for the period 1999-2010 that aims to increase the volume of exports of farmed fish produce at the national level. Vietnam hopes to reach 2 million metric tons of farmed fish produce exported by 2010, or 2.1 billion Euros. The different aims of the project are to improve the current state of more than 6,000 ponds and to convert low-yield paddy fields into freshwater ponds according to the rice - fish system. The State, through the communes and the districts, subsidizes work up to 7,000,000 VND (equivalent to 369 Euros) per hectare of paddy fields converted into ponds. Between 2001 and 2004, the area of paddy fields converted into ponds totalled 1,907 ha, of which 40% ponds and 60% rice-fish farming. In all the communes visited during surveys, Thai Binh province encourages the consolidation of livestock farms and fish-farming ponds in specialized areas far from dwellings.

Box 4: The policy of "specialized areas": a tool for the development of pig farming

The specialized areas are demarcated areas in each commune where entrepreneurs are encouraged to invest and farmers to consolidate their land, to convert it and to specialize. The final aim is to favour intensification, pig and fish farming. These areas, bringing several farms together, aim to improve livestock farming efficiency and to facilitate access to veterinary care and deliveries of animal feed. They are also designed to ease problems of transport, drainage, effluent management and marketing. Officially, these special areas must respect several criteria:

- *Their creation and development take into account the areas' potential and local conditions. However, the priority is to create them on land with a low rice yield, far from dwellings, or on land near the Red River (to ease the building of infrastructure). They must also be accessible and served by infrastructure;*
- *They must be models of technical development, with an efficient improvement in the management of industrial livestock farming (reproduction, feeding, processing). The quality of produce must be a priority. Veterinary services must be strengthened and health safety guaranteed;*
- *The development of livestock farming must be linked to that of crop farming, to industrial processing of produce and to animal feed. In this way, these areas must encourage industrial feed and agricultural produce processing companies to open factories in the area, and must set aside land for growing animal feed crops (maize, soya);*
- *Finally, they must be models of respect for the environment: accessible, far from dwellings, containing enough water sources for livestock farming and for treatment of effluents.*

Box 5: Land quality and the problem of low-lying land

Diked-off land officially falls into one of three categories: high-level, mid-level or low-lying, which correspond to three different topographical levels. In general, Vietnamese farmers are allocated a little of each of these kinds of land, which have varying values. These differences in altitude can cause differences in access to water and in kinds of crops grown.

Thus it is possible on high-level land, in addition to the two classic cycles of spring and summer rice, to grow a third cycle of dry crops in winter.

Mid-level land is that on which it is possible to choose the crops to be planted in spring and in summer, as it is not flooded during this period. On the other hand, in winter it cannot receive dry crops as it is subject to flooding.

Low-lying land is constantly subject to flooding and is suitable only for growing rice.

The Vietnamese government is currently urging farmers in Thai Binh province to convert their low-lying land with low rice yields into fish-farming ponds, in order to increase income per unit of area on this kind of land. The aim of this policy is to reduce poverty.

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References

1. Bureau des Statistiques de Thai Binh. Annales des statistiques de la Province de Thai Binh en 2003, 2003.
2. Dao The Tuan. Changements récents de l'agriculture et défis du développement rural au Vietnam. Actes du séminaire PAOPA. Hanoi, 2003:9-14.
3. Thanh Liem L. La nouvelle gestion des terres au Vietnam (1986-2000). Washington DC: The Kenney Auditorium, 2000.
4. Barbier J-M, TRUNG HUNG BACH, LE QUERE E., NGOC HAN TRAN. La riziculture irriguée dans le delta du Fleuve Rouge: analyse des transformations de quelques pratiques culturales. *Agriculture et développement* 1997; 6:81-91.
5. Le Bahers G. Diagnostic agraire dans le district de Hung Ha, Vietnam: ENITA de Bordeaux, 2004.
6. Bureau Agricole de Vu Thu. Recommandations en fertilisation organique pour les principales cultures annuelles, 2005:4.
7. Bergeret P, Pham Hoang Ha. Dynamiques comparées de trois filières dans le delta du fleuve Rouge: riz, porc, ail - Spécial Vietnam. *Agriculture et développement* 1997:67-73.
8. Emonet-Denand V. Typologie fonctionnelle des exploitations porcines de la Province de Thai Binh basée sur le risque environnemental généré par les effluents d'élevages porcins. Paris-Grignon: INAPG, 2005.
9. Le Goulven K, Boutonnet JP, Codron JM. Commercialisation d'un produit agricole dans un contexte économique de transition: la filière viande porcine de Nam Thanh à Hai Phong. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 1999; 52 (3-4):305-312.
10. Le Coq JF, Jésus F. Ecopol, an integrative and participatory approach for concerted design of public decision. séminaire PAOPA “des approches inovantes au service du développement agricole". Ha Noi, 2002.