

little 'own' revenue sources and overly transfer-dependent. Local authorities have little autonomy and flexibility in deciding the level and composition of their current expenditures. They have virtually no independent revenue-raising power, and both revenue assignment and expenditures are decided at the central level. As a result, local governments have difficulties in exerting much influence on the pattern of socioeconomic development in their region.

Second, the lack of stability in tax assignments and tax sharing arrangements creates both uncertainties and disincentives for provincial governments which are attempting to pursue long-term development plans. The transfer system also discourages local responsibility, so recipients are tempted to run bigger deficits to increase transfers.

Third, to the extent they involve negotiation, the transfer system is criticized for lack of transparency and accountability. As a result, expenditure allocation is likely to respond to bureaucratic and political judgments at the central level and also to be influenced by the relationship between political leaders at the central and provincial levels. The future development of transfers should incorporate simple formula-based criteria both to discourage negotiation and to consider different characteristics among regions.

#### **4.4 FOR SUSTAINABLE REGIONAL DEVELOPMENT PROJECTS/PROGRAMS**

The management of integrated regional development programs in the central region of Vietnam calls for the central role of the local authorities to coordinate activities at various levels, to promote economic and social services to support diversification and integration of regional economies, and take initiative to monitor, regulate and guide development activities from the standpoint of local people. Thus, the central issues for integrated regional development programs/projects are: (1) How to organize a consistent multi-level system for planning administration, incorporating coordination among the central ministries/agencies, among the local departments/agencies and between the central and local governments in planning and implementing regional development programs/projects; (2) How to overcome a limitation of the existing development administration system; and (3) How to strengthen local financial base.

Taking into account the constraints as identified above, followings are some general ideas on how to improve institutional and financial framework for regional development programs/projects.

- Increasing the autonomy of local governments in terms of management and financial capability of development programs/projects by decentralizing authorities to lower levels of governments in appropriate area and by providing incentives to mobilize revenues of their own.
- Ensuring correspondence between local expenditure responsibilities and financial resources (including transfers from the central government) so that functions assigned to local governments can be carried out effectively.
- Giving expenditure discretion to local governments in appropriate areas to increase the efficiency of public spending and to improve the accountability of local officials to their constituents in the provision of local services.
- Establishing a system of intergovernmental transfers that is transparent, based on objective and predictable criteria, and not subject to negotiation and ad hoc bargaining.
- Providing some equalizing transfers to offset differences in fiscal capacity among some localities and to ensure that poor localities can offer sufficient amounts of key public services.
- Incorporating mechanisms to support public infrastructure development and its appropriate financing.
- Establishing an multi-level management system for planning, implementing and

coordinating regional development programs/projects.

Institutional and Capacity Building is essential to effectively and efficiently implement strategic projects and programmes throughout their whole cycles from pre-implementation, implementation, and post-implementation phase. In order to ensure quick decision making, stable project finance, technical quality assurance, appropriate management ability, and sustainable technical and financial capacities for operation and maintenance, there is a need for the establishment of new implementation organizations.

For example, the Central Region Development Committee (CRDC) will be established to collectively and centrally control and manage the implementation of such projects and programmes that will require inter-provincial coordination and particularly those financed by international lending agencies. CRDC will have a Project/Programme Management Unit (PMU) that may be organized by responsible representatives from provincial governments, qualified staff from private sector, and professional management consultants. The PMU may play a central role for implementing the regional programmes to assess, revise and prepare regional development programmes/projects, to take budgetary measures and identify fund sources, to strengthen institutional/financial capabilities, and to monitor and evaluate the progress/results.

At the Central Government level, a Central Steering Committee (CSC) should be established that assumes the functions of important policy making and perhaps appointment of the Chairman of the Board of CRDC. CRDC should be an autonomous body authorized and empowered with the capacity of taking implementation initiatives to a large extent, except for dealing with matters that may require the approval of CSC. Thus, a multi-level management system may consist of a Central Steering Committee (CSC), a Central Region Development Committee (CRDC), provincial People's Committees, district and commune People's Committees.

In addition to the establishment of CRDC, PMU and CSC, Central Region Development Programmes require new institutions that can effectively and efficiently implement and manage specific projects of the programmes, such as Dung Quat Industrial Estate Development Project and Highway No. 9 Improvement Project. Dung Quat Industrial Development Corporation (DQIDC) should be established as a public/private joint venture company, the equity of which will be shared by the Government, Quang Ngai Province, and private investors. Indochina East-West Trade Corridor Development Organization (ITCDO) should be organized as an international organization involving Laos and Thailand, and assume prime responsibility for effective and efficient operation and management of the new East-West Trade Corridor along the Highway No.9.

With respect to financing proposed programmes/projects, allocation of more development budgets, credit facilities for loan acquisition, and bi-lateral/multi-lateral financial assistance will require favorable Government support. Also, project financing systems will be rationalized so that CRDC can reasonably disburse necessary funds specifically earmarked for the projects that rest with the responsibility of CRDC. This will require to establish reasonable financing mechanisms taking into account the share of responsibility between the central and provincial governments. Arrangements will also be required to induce private-sector participation in infrastructure development thus saving the public-sector spending insofar as practical. Issuance of bonds such as "Central Region Infrastructure Funds" in U.S. or other foreign markets will be a possible means of raising capital funds although the use of the funds will be limited to "revenue-producing projects". CRDC can manage the funds if guaranteed by the Government.

## **CHAPTER 5 AGRICULTURE**

### **5.1 GENERAL INTRODUCTION**

The Ministry of Agriculture and Rural Development (MARD) calculates that about 70% of the rural population, that is equivalent to about 41.7 million people, rely exclusively on agricultural income. Only some 30% of the rural population depend on both, agricultural income and other forms of income generated by rural employment. The future performance of this sector will be the essential influence on general living standards and alleviating poverty, rising real wages and increasing agriculture induced savings, increasing employment, counterbalancing rural-urban migration, and ensuring the country's continued and future food security.

### **5.2 LAND TENURE RIGHTS**

The land law promulgated on 27 September 1993 regulates the principal land tenure rights in the agricultural sector. There is no agricultural land ownership in the strict sense, but a land use right. Such right is granted for 20 years per household for the cultivation of annual crops and 50 years per household for that of perennial crops and forestry use. The right may be extended for continued agricultural use for the same duration.

In principal, taxes are levied using a formula which combines land class with output. Exemptions from and deductions of tax are, in principle, possible. Tax exemptions are allowed before any yield is obtained on land planted with perennial crops, before any yield is obtained on land, which has been converted to other crops than planted before and on irrigation land. Tax deductions are allowed in case of (1) natural calamity and (2) war. The tax deduction is also allowed in the case of (1) bare hill and (2) wasteland. Tax rate varies from 10% to 40% depending on the scale of the damage.

### **5.3 PRICING AND MARKETING MECHANISMS**

In general, input and output price controls have been eliminated in 1989 (with the exception of few products). Agricultural producers can set their own prices and sell to and trade with anybody they choose (Figure 5.1 refers). This free price formation mechanism is essential to the market economy.

Prices of major agricultural commodities are listed in Table 5.1.

### **5.4 PAST GROWTH PERFORMANCES, STRUCTURE AND REGIONAL DISTRIBUTION OF THE AGRICULTURAL SECTOR**

#### **5.4.1 Past Absolute and Weighted Growth Performance**

Viet Nam's gross agricultural output (GAP, including forestry and fishery) grew by about 3.6% over the period 1986 to 1990. However, GAP has shown a strong growth performance averaging 4.27% over the period 1990 to 1994. SDR V showed the worst growth performance in this period, in which Q.N. Da Nang and Quang Ngai provinces are included. SDR IV, to which two other target provinces belongs, achieved medium growth.

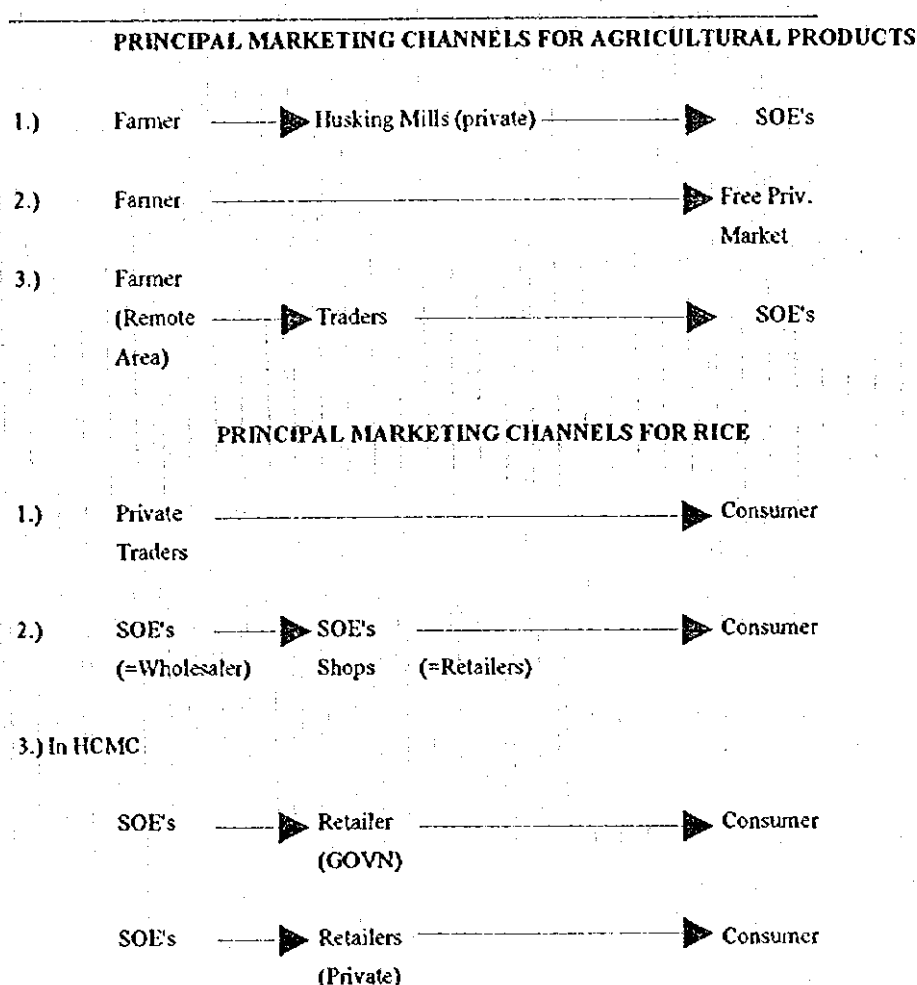
### 5.4.2 Relative Economic Status of the Study Area

The weighted growth rate reflects the differentials in absolute size of the Province's GAP. A ranking of GAP by size for the 1990 and 1994 positions out of 53 districts shows 19th for Q N Da Nang, 35th for Quang Ngai, 45th for Quang Tri and 50th for T.T.Hue in 1990, while in 1994 20th for Q N Da Nang, 38th for Quang Ngai, 48th for T.T.Hue and 52th for Quang Tri. The farm sector in the study area suffers from smaller holding size and fewer granted natural resources except for surplus farm labor force, leading to a failure in food self-sufficiency entailed in vicious circle of chronic poverty.

### 5.4.3 Structural Composition of GAP at National Level

The structural composition of Viet Nam's GAP over the period 1991 to 1995 was mainly carried by agriculture, which accounted on average for about 83.0%, followed by fishery with 9.2% and forestry with some 7.8%. Within agriculture itself food crops are the single most important item. They accounted for 40.4% of total GAP on average and out of this, paddy is with 36.2% the most important individual item.

Figure 5.1 Principal Marketing Channels for Agricultural Products



Source : Pricing Committee, Prime Minister's Office.

Animal husbandry is the second most important single item in the country's GAP. It accounted for 16.4% of GAP on average over the period, followed by industrial crops, the average share of which was some 13.3% of GAP.

#### 5.4.4 Major Crop Production 1985 to 1995

Output of major crops has, with the exception of cassava, increased over the ten year period 1985 to 1995 (Table 5.3 refers). The strongest increase in absolute terms was recorded for coffee, total acreage of which increased from 14,000 ha in 1985 to some 120,000 ha in 1995. Productivity on paddy fields could be increased by 0.85 tons/ha, from 2.78% tons/ha in 1985 to 3.63 tons/ha in 1995. Likewise, average productivity for maize, sweet potato, tea, rubber, coffee and coconut was also increased with the strongest productivity gains achieved in coffee. As shown in Table 5.2, the study area has a higher share in acreage under industrial crops, implying possible future contribution in expanding exportable crop production. In this context, Vietnam position as a primary commodity exporter in future should be predicted by orienting the farm sector to do right choice of commodities with a secured, stable outlet in international markets.

A conventional analysis indicates that coffee, tea, cocoa, silk, natural rubber, cashewnut and cinnamon are promising items, whereas pepper and cassava have larger risk for future expansion. As for sugarcane, it is economically feasible as an import substitute. Quality of export products becomes a key factor to determine export earnings and to guarantee stable outlets, but there remains much room to improve quality of the current Vietnamese export products. In the case of reclaiming mountainous or hilly areas for developing tree crops as export commodities, there would more hazards and constraints that limit pursuance of quality or yield.

Planners as well as growers should take this into account so that they can pursue a sustainable compromised way of exploitation in terms of environmental conservation. Details are discussed in the pre-feasibility study, but a brief outlook for major commodities planned in the study area are summarized in Table 5.5.

### 5.5 EXPORTABLE COMMODITIES CROPS AND THEIR MARKET PROJECTION

Apart from rice export, Vietnamese agriculture earns foreign currency by exporting agro-related commodities, major components of which are shown below:

Table 5.1 Recent Market Price Trends of Farm Products

UNIT VND/KG																		
DATE	RICE ordinary			PORK			BEEF			FISH grade 4			SUGAR refined			SOYABEAN		
PLACE	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM
FEB 25 1995	3,700	3,700	2,600	19,000	20,000	26,000	31,000	35,000	31,000	7,500	8,500	11,000	7,300	7,000	7,000	4,600	4,500	4,500
APR 14 1995	3,700	3,700	2,550	24,500	25,000	28,000	30,000	30,000	30,000	7,300	8,000	9,000	7,300	7,000	7,000	4,600	4,500	4,500
JUN 30 1995	3,100	3,000	2,950	28,000	25,000	27,000	31,000	35,000	40,000	10,000	9,000	12,000	7,000	7,000	6,700	6,000	5,000	5,000
JUL 27 1995	3,200	3,000	2,950	28,000	25,000	26,000	33,000	35,000	40,000	8,000	9,000	10,000	7,000	7,300	6,700	6,000	6,500	6,500

GASOLINE 50 kg		VND/l		DIESEL 50 kg		VND/l		D.A.E.		PARATHION 50 kg		CEMENT Hoang Th		STEEL bar round dia 6 mm	
PLACE	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM	HANOI	DANANG	HOCHIM
FEB 25 1995	3,200	3,100	3,100	2,500	2,600	2,600	-	-	3,350	-	-	14,500	700	740	930
APR 14 1995	3,200	3,200	3,100	2,500	2,700	2,600	-	-	3,350	-	-	14,500	900	750	1,050
JUN 30 1995	3,200	3,200	3,100	2,500	2,700	2,600	-	-	3,350	-	-	17,000	900	1,000	1,600
JUL 27 1995	3,300	3,150	3,200	2,500	2,700	2,600	-	-	-	-	-	950	970	1,600	4,400

RECENT EXPORT PRICE OF FARM PRODUCTS FROM HOCHIMIN TO FOB				RECENT INFLATE RATE %				RECENT FOREIGN EXCHANGE RATE			
COMMODITY	DATE	1993	1994	1995	1996	DATE	US\$	US\$	YEN	YEN	
TOTAL		4.1	7.0	11.7			LOW	HIGH	LOW	HIGH	
CEREAL		6.9	11.0	17.2		FEB 25 95	11,040	11,060	113.20	115.37	
FOOD STAFF		8.5	11.1	21.6		APR 14 95	11,644	11,656	129.13	134.59	
OTHER GOODS		6.7	1.6	5.5		JUN 27 95	11,029	11,051	124.10	126.37	
SERVICE		9.8	6.7	6.6		JUL 1 95	11,042	11,045	129.11	132.24	

Source: Vietnam Economic Review

**Table 5.2 Comparison of Agricultural Indicators among Areas**

Item / Region	State	North	Central	Study Area	South
Population Share (%)	100.0	37.0	25.4	6.5	37.6
State population 1994, 71,465 thousand					
GAP/GDP (%)	36.9	38.9	31.7	31.9	33.5
State GAP 12,658 million VND					
GAP Annual Rate (+ %)	0.54	0.60	0.28	0.00	0.86
GAP Share (%)	100.0	30.7	22.0	3.8	47.3
Per Capita GAP 1,000 VND <sup>a</sup>	177	147	158	103	223
Farmland Area (%)	100	29.0	37.1	4.3	46.7
Total Farmland Area 6,992 thousand ha					
Per Capita Farmland (m <sup>2</sup> )	979	767	933	643	1,218
Annual Sown Area (%)	100	32.0	24.0	5.2	44.0
Total Sown Area 7,278 thousand ha					
Farmland per Farm Labor (m <sup>2</sup> )	367	352	337	229	585
Total Farm Labor 19,051 thousand					
Labor Distribution (%)	100	30.2	40.4	6.9	19.3
Farmland / Total Land (%)	21.1	17.6	11.1	11.4	51.8
Paddy Land / Total Farmland (%)	58.8	58.6	48.8	54.2	63.7
Industrial Crop / Total Crop (%)	16.2	17.4	23.7	24.1	18.0
Share of Food Crop Output (%)	100	30.1	19.6	4.6	50.3
State Food Production 23,879 thousand ton (Paddy Equivalent)					
Per Capita Food Production (kg)	334	272	257	236	448
Food Crop Yield (t/ha)	3.15	2.95	3.03	2.98	3.27
Average Growth Rate / Year (%)	2.25	0.45	0.87	0.92	2.85

Note : North covers region I, II, III, Central does Region IV, V, VI, South does VII and VIII

Source : Agricultural Statistics of Vietnam, State Economy Statistics 1995 Edition

**Table 5.3 Major Crop Production 1985 to 1995**

		(Unit : tons/percent)				
		1985	1990	1994	1995 *)	Growth Rate
Unit		1985 to 1995				
Paddy	1,000 tons	15,875	19,225	23,528	24,000	4.50%
Maize	1,000 tons	587	671	1,000	1,200	7.50%
Sweet						
Potatoes	1,000 tons	1,777	1,929	2,126	2,351	2.90%
Cassava	1,000 tons	2,940	2,276	2,430	2,496	-1.60%
Tea (dry)	1,000 tons	28	32	38	40	3.80%
Rubber	1,000 tons	48	58	118	135	11.00%
Coffee	1,000 tons	12	64	175	220	34.00%
Coconut	1,000 tons	611	894	1,190	1,100	6.10%

Note : \*) Preliminary.

Source : JICA study team based on MPI data.

1) **Coffee:** Arabica varieties with an optimum range of air temperature between 5 - 22 C are highly competitive, but their prices are higher by 20 - 25% than those for robusta or liberica. Future international demand for soluble coffee (from robusta) will expand in the developing world and surplus supply of arabica will possibly occur, though the price skyrocketed in 1994. In the study area, both types should be planted in suitable land conditions to mitigate price risk.

2) **Tea:** Future demand expansion is expected in east Europe, Arab and African countries where not only black tea, but other types are also consumed. Some of the old suppliers suffer from higher labor cost, aggravating their competitiveness, and this would improve Vietnam's position as a supplier of various types of tea. As processing equipment also affect quality of tea for exports, renovation of processing facility will become a key to success in exportation.

**Table 5.4 Major Crop Output and Productivity 1985 to 1995**

Major Crop	Unit	1985	1990	1994	1995 *)	A.I.
Paddy	1,000 ha	5,704	6,027	6,598	6,600	896
	tons/ha	2.78	3.19	3.56	3.63	0.85
Maize	1,000 ha	397	432	532	550.0	153
	tons/ha	1.47	1.55	1.86	1.95	0.48
Sweet	1,000 ha	320	321	344	386	66
	tons/ha	5.55	6.00	6.18	6.20	0.65
Potatoe	1,000 ha	335	257	279	281	-51
	tons/ha	8.77	8.86	8.69	8.70	-0.07
Tea (dry)	1,000 ha	42	44	52	55	13
	tons/ha	0.68	0.73	0.73	0.73	0.05
Rubber	1,000 ha	64	81	150	160	96
	tons/ha	0.75	0.71	0.78	0.84	0.09
Coffee	1,000 ha	14	62	100	120	106
	tons/ha	0.88	1.04	1.76	1.83	0.96
Coconut	1,000 ha	81	121	146	145	64
	tons/ha	7.57	7.39	8.17	7.59	0.02

Note: \*) Preliminary.

Source: JICA study team based on MPI data.

3) **Rubber:** Revival of natural rubber has elevated its share in the total rubber supply to some 40%, giving Vietnam a chance to expand rubber exports, because traditional suppliers more or less switched their rubber plantings into oil-palm or other ones due to tight labor supply. But the rubber price largely depends on the form of processing that decides grades for marketing. This urges Vietnam to introduce new latex processing mills into smoked sheets with higher quality.

4) **Silk:** World market price of raw silk has remained in a deep slack but future supply is projected as dwindling. So, if the quality of silk from emerging supplier, Brazil, would not be fully satisfied, Vietnamese silk will have chance to get share with Thailand in international market, but first of all restoration of mulberry acreage and technical renovation in worm rearing and for silk reeling will act as a precondition of its successful entry into the world market.

## 5.6 FOOD SECURITY AND THE SOCIAL DIMENSION

Despite of a relatively strong growth performance of GAP over the period 1990 to 1995 sight should not be lost of the absolute strategic role which agriculture will continue to play well into the next century. There is common agreement and enough evidence that farm incomes have improved since the introduction of Resolution 10 in 1988. Rice production has increased considerably from some 217 kg per capita to about 349 kg per capita in 1994.

## **5.7 NATIONAL DEVELOPMENT OBJECTIVES**

Rural development, agricultural development and performance are closely interrelated and reflected in Viet Nam's development master plan 1996 to 2000 and the Government's ten-point plan to develop rural Viet Nam as announced in May 1996. Individual numerical targets have been identified as in Table 6.6, and major targets are recapitulated as follows :

- An average annual growth rate of GAP of 4.5%
- An average annual per capita consumption of 380 kg food; 22 kg to 25 kg of various kinds of meats; 10 kg to 12 kg of sugar consumption; 60 kg to 70 kg of vegetable consumption and about 50 kg to 60 kg consumption of various types of fruits
- Reclamation of an average annual of 500,000 ha over the coming five years.

## **5.8 POTENTIALS AND CONSTRAINTS AT NATIONAL LEVEL**

There is no common denominator, which would allow to express the potential of Viet Nam's agricultural sector by using one or a set of convenient indicators.

### **5.8.1 Potential for Growth Performance**

Is not clear and difficult to determine with a long term perspective, mainly due to the lack of a consistent and a reliable set of empirical and econometric data. The growth analysis has shown that national GAP growth is carried to over 50% by the growth performance of SDR III and SDR VIII. Notwithstanding the above observations, GAP, in particular paddy and other food crop output must grow at a reasonable pace above projected population growth, in order to ensure Viet Nam's food security, per capita food intake and nutritional targets.

### **5.8.2 Potential for Expansion**

There is no doubt that Viet Nam has potential for expanding acreage to be cultivated for annual and perennial crops, livestock development and forestry, because of the country's relatively large so called "waste land" resources. However, as regards food crop production, in particular paddy, the absolute upper limits of such expansion are not clear.

### **5.8.3 Potentials for Intensification**

There is a strong potential to intensify Viet Nam's agricultural production, in particular in paddy production. Single crop areas could, where technically feasible, be converted to double cropping. Potentials to increase output could also be realized by drainage improvement, flood protection, irrigation, the provision of rural roads and village electrification as well the systematic introduction of high-yield and fertilizer responsive varieties. Another potential source of output increase would be improving the country's inadequate drying, storage and so on.

### **5.8.4 Potentials for Crop-diversification and Exports**

Viet Nam has some potential for crop diversification into tuber crops and cotton. There is also some potential for export crops such as coffee, to some extent tea, rubber and pepper as well as pigs. However, there is no commonly acknowledged position as regards the country's long-term comparative advantages in industrial crops and livestock.



#### **5.8.5 Other Potentials**

With increasing per capita income the potential will emerge to establish a viable domestic food and agro-processing industry and in fact the Government plans to increase processing capacity for rubber, coffee and tea.

Table 5.5 Recent Trends of Agricultural Commodities

YEAR	COMMODITY	PRODUCTION	EXPORTS	WORLD MARKET	PRICE	YEAR	COMMODITY	PRODUCTION	EXPORTS	WORLD MARKET	PRICE	YEAR	COMMODITY	PRODUCTION	EXPORTS	WORLD MARKET	PRICE	YEAR	COMMODITY	PRODUCTION	EXPORTS	WORLD MARKET	PRICE
	/AREA	QTY	QTY	PLACE	UNIT		/AREA	QTY	QTY	PLACE	UNIT		/AREA	QTY	QTY	PLACE	UNIT		/AREA	QTY	QTY	PLACE	UNIT
		1,000 mt	1,000 mt					1,000 mt	1,000 mt					1,000 mt	1,000 mt					1,000 mt	1,000 mt		
1980	COFFEE	11,241	543	5,897		1980	COFFEE	11,241	543	5,897		1980	COFFEE	11,241	543	5,897		1980	COFFEE	11,241	543	5,897	
1981	WORLD	11,217	543	5,897	US \$/lb	1981	WORLD	11,217	543	5,897	US \$/lb	1981	WORLD	11,217	543	5,897	US \$/lb	1981	WORLD	11,217	543	5,897	US \$/lb
1982		10,802	555	6,002	1,000	1982		10,802	555	6,002	1,000	1982		10,802	555	6,002	1,000	1982		10,802	555	6,002	1,000
1983		10,412	548	5,899	1,000	1983		10,412	548	5,899	1,000	1983		10,412	548	5,899	1,000	1983		10,412	548	5,899	1,000
1984		10,533	515	5,550	2,000	1984		10,533	515	5,550	2,000	1984		10,533	515	5,550	2,000	1984		10,533	515	5,550	2,000
1985	VIETNAM	62	999	99	100	1985	VIETNAM	62	999	99	100	1985	VIETNAM	62	999	99	100	1985	VIETNAM	62	999	99	100
1986		79	764	60	100	1986		79	764	60	100	1986		79	764	60	100	1986		79	764	60	100
1987		82	1,333	123	100	1987		82	1,333	123	100	1987		82	1,333	123	100	1987		82	1,333	123	100
1988		100	1,438	136	100	1988		100	1,438	136	100	1988		100	1,438	136	100	1988		100	1,438	136	100
1989		130	1,383	180	100	1989		130	1,383	180	100	1989		130	1,383	180	100	1989		130	1,383	180	100
1990	TEA	2,462	1,037	2,271		1990	TEA	2,462	1,037	2,271		1990	TEA	2,462	1,037	2,271		1990	TEA	2,462	1,037	2,271	
1991	WORLD	2,340	1,062	2,348	1,000	1991	WORLD	2,340	1,062	2,348	1,000	1991	WORLD	2,340	1,062	2,348	1,000	1991	WORLD	2,340	1,062	2,348	1,000
1992		2,448	988	2,438	1,000	1992		2,448	988	2,438	1,000	1992		2,448	988	2,438	1,000	1992		2,448	988	2,438	1,000
1993		2,282	1,199	2,245	1,000	1993		2,282	1,199	2,245	1,000	1993		2,282	1,199	2,245	1,000	1993		2,282	1,199	2,245	1,000
1994	VIETNAM	2,316	1,340	2,425	1,000	1994	VIETNAM	2,316	1,340	2,425	1,000	1994	VIETNAM	2,316	1,340	2,425	1,000	1994	VIETNAM	2,316	1,340	2,425	1,000
1995		44	728	32	100	1995		44	728	32	100	1995		44	728	32	100	1995		44	728	32	100
1996		44	747	34	100	1996		44	747	34	100	1996		44	747	34	100	1996		44	747	34	100
1997		50	764	36	100	1997		50	764	36	100	1997		50	764	36	100	1997		50	764	36	100
1998		60	516	39	100	1998		60	516	39	100	1998		60	516	39	100	1998		60	516	39	100
1999		64	581	36	100	1999		64	581	36	100	1999		64	581	36	100	1999		64	581	36	100
2000	RAW HIDE	TON				2000	RAW HIDE	TON				2000	RAW HIDE	TON				2000	RAW HIDE	TON			
2001	WORLD	81,987				2001	WORLD	81,987				2001	WORLD	81,987				2001	WORLD	81,987			
2002		91,282				2002		91,282				2002		91,282				2002		91,282			
2003		102,270				2003		102,270				2003		102,270				2003		102,270			
2004		144,475				2004		144,475				2004		144,475				2004		144,475			
2005	VIETNAM	144,306				2005	VIETNAM	144,306				2005	VIETNAM	144,306				2005	VIETNAM	144,306			
2006		0,599				2006		0,599				2006		0,599				2006		0,599			
2007		0,360				2007		0,360				2007		0,360				2007		0,360			
2008		0,360				2008		0,360				2008		0,360				2008		0,360			
2009		0,559				2009		0,559				2009		0,559				2009		0,559			
2010		0,368				2010		0,368				2010		0,368				2010		0,368			
2011	PEPPER					2011	PEPPER					2011	PEPPER					2011	PEPPER				
2012	WORLD	205				2012	WORLD	205				2012	WORLD	205				2012	WORLD	205			
2013		149				2013		149				2013		149				2013		149			
2014		214				2014		214				2014		214				2014		214			
2015		170				2015		170				2015		170				2015		170			
2016		140				2016		140				2016		140				2016		140			
2017	VIETNAM	13				2017	VIETNAM	13				2017	VIETNAM	13				2017	VIETNAM	13			
2018		12				2018		12				2018		12				2018		12			
2019		11				2019		11				2019		11				2019		11			
2020		9				2020		9				2020		9				2020		9			
2021		18				2021		18				2021		18				2021		18			
2022		19				2022		19				2022		19				2022		19			
2023		19				2023		19				2023		19				2023		19			
2024		19				2024		19				2024		19				2024		19			

**Table 5.6 Development Targets of Agricultural Subsectors**

<b>FOOD PRODUCTION</b>	<b>TARGETS</b>	1.) Increase the area cultivated with paddy to a total of 1,000,000 ha 2.) Increase the area cultivated with maize to 400,000 to 500,000 ha
	<b>REQUIREMENTS</b>	a.) Increase cropping intensity of food crops b.) Introduce hybrid paddy and maize varieties c.) Improve management of irrigated areas d.) Promote investment into the construction of stock, food product processing and milling facilities
<b>COFFEE</b>	<b>TARGETS</b>	1.) Increase area cultivated with coffee to 190,000 ha to 200,000 ha (Equivalent to an increase of 50,000 ha to 60,000 ha) 2.) Increase coffee processing capacity to 200,000 tons/year
<b>RUBBER</b>	<b>TARGETS</b>	1.) Achieve 330,000 TO 350,000 ha of cultivated area and some 220,000 tons of production
	<b>REQUIREMENTS</b>	a.) Keep the existing cultivated area b.) Add some 80,000 to 100,000 ha of cultivated area c.) Increase processing capacity by 50,000 to 60,000 tons d.) Promote the development of the rubber processing industry
<b>TEA</b>	<b>TARGETS</b>	1.) Achieve a total of 100,000 ha of cultivated area and 70,000 tons of dry tea bud
	<b>REQUIREMENTS</b>	a.) Increase cropping intensity b.) Increase cultivated area by 30,000 ha c.) Modernize tea processing facilities
<b>MULBERRY</b>	<b>TARGETS</b>	1.) Achieve a total cultivated area of 60,000 to 70,000 ha and a production output of 5,000 tons
	<b>REQUIREMENTS</b>	a.) Cultivate an additional 25,000 to 30,000 ha b.) Increase silk-worm breeding capacity to 3,000 to 3,500 tons a year and 10 million meter of silk
<b>COTTON</b>	<b>TARGETS</b>	1.) Achieve a total cultivated area of 150,000 ha of cotton and 5,000 tons of cotton seed
	<b>REQUIREMENTS</b>	a.) Invest into two new processing plants (30,000 tons cotton seed/year each)
<b>VEGETABLES &amp; FRUIT</b>	<b>TARGETS</b>	1.) Achieve a total production of 7 million tons fresh fruit 2.) Achieve a total production of 3-4 million tons of fresh fruits
<b>SUGARCANE</b>	<b>TARGETS</b>	1.) Achieve a total production of 800,000 to 1,000,000 million tons
	<b>REQUIREMENTS</b>	a.) Expand the area under cultivation b.) Expand the capacity of existing sugar plants c.) Increase the capacity of sugarcane processing to over 40,000 tons sugarcane/day
<b>LIVESTOCK</b>	<b>TARGETS</b>	1.) Increase output to 1.8 to 2.0 million tons live weight of meats 2.) Increase fresh milk production to 60,000 tons
	<b>REQUIREMENTS</b>	a.) Implement disease control programs b.) Upgrade centers of animal breeds
<b>OIL-BEARING CROPS</b>	<b>TARGETS</b>	1.) Increase the area cultivated with groundnuts to 350,000 ha to 400,000 ha and a total production of 500,000 tons 2.) Increase the area cultivated with cashewnuts to 100,000 ha

Source : Ministry of Agriculture and Rural Development.

## 5.9 NATURAL CONDITION OF THE STUDY AREA

### 5.9.1 Geographical Condition

The topography of the target area in relation to crop suitability and productivity is less favorable than in other parts of the country. Flat plains develop only along the coastal areas and in large river basins, where paddy fields are concentrated. These flat plains are easily flooded with a perennial, high ground water table and such a condition has led to the formation of paddy tracts. Table 5.7 summarizes agricultural land availability in 1993. In summary it may be said that a basic constraint of the study area is its scarcity of flat land.

### 5.9.2 Climatic Conditions

The general climatic conditions in the northern two provinces located above the Haivan Pass differ from those prevailing in the southern two provinces. In winter, northern provinces have a lower mean temperature, while in spring and in early summer prevailing Laotian wind deprives the soil surface from humidity in this region, often causing seasonal drought to the standing crop.

**Table 5.7 Land Availability for Agriculture 1993**

	(Unit : ha / %)					
	Quang Tri	T.T.Hue	Q.N.D.N.	Q.Ngai	Four Provinces	Viet Nam Total
Total Land Area	458.9	500.9	1,199	517.7	2,676	33,099
out of which						
Agricultural Land	59.5	47.1	113.3	86.0	306	7,348.0
( in percent)	13.0%	9.4%	9.5%	16.6%	11.4%	22.2%

Source : Land Use Survey, 1993.

Common climatic features in all four provinces are summarized in Table 5.8. In the western mountainous zone of Quang Tri and T.T.Hue frost damages to coffee, rubber trees and inter-cropped maize are reported by the staff of a forestry management project.

**Table 5.8 Agro-Meteorological Data of the Target Area**

Province	(Unit : as indicated)				
	Annual Rainfall	Relative Humidity	Mean Temperat.	Minimum Rainfall	
Quang Tri	2,106-3,572 mm	55%-90%	24.4	Feb.24	Jan. : 8.5
Thua Thien Hue	2,077-3,193 mm	81%-85%	24.7-25.5	Feb.March 5	Jan. : 18.9
Q.N. Da Nang	2,064 mm	68%-90%	21.8-29.9	Jan.19	Jan. : 18.8
Quang Ngai	1,889-1,955 mm	74%-91%	21.2-29.7	Jan.-Aug.12	Jan.Nov. : 21.2

Notes : 1) Temperature in centigrade. 2) Rainfall in hilly-mountainous regions reaches 3,23 mm.

Source : Provincial Statistics, 1994.

### 5.9.3 Pedological Conditions

Major features of soils in the study area are as follows: Few organic soils are distributed in the old lacustrine formation along the sea coast. Also, least fertile silica sand deposits along the sea coast form a problematic soil that is easily transported by wind, thus invading into fertile paddy fields. In some hilly areas, soils are stony, containing boulders or fragmented stones that hamper cultivation. The sandy soils in the plains of Thua Thien Hue and Quang Tri are subject to exposure from westerly winds during the main cropping season leading to drought for upland crops. Red yellow soils prevailing in hilly/mountainous areas have medium fertility but give low yield without proper application. Potential soil fertility is shown in Table 5.9.

Soil characteristics are particularly important for tree crops, for their growth during the gestation period depend heavily on soil fertility and water holding capacity. High quality coffee and tea prefers black soils derived from basaltic parent materials, that are limitedly distributed in Quang Tri and Thua Thien Hue provinces. Calcareous and red yellow soils are inferior to these black soils as far as tree crops like coffee, tea and mulberry are concerned. Cashewnut trees have broader ability of adapting itself to soils and other environmental conditions.

Table 5.10 gives soil information in Q.N.Da Nang, and Table 5.11 summarizes the soil distribution for the four Provinces together. The data were calculated from the satellite images. Data in the two tables are not strictly comparable, since the soil classification is not the same.

The agricultural land use pattern is depicted in Table 5.12. Agricultural land use is highest in Quang Ngai and Quang Tri with 16.6% and 13.0% of the total land area respectively. In both, T. T. Hue and Q.N.Da Nang agricultural land use accounted for about 9.5% of the total land area. Provinces have launched, therefore, new economic zone development projects with a view to facilitate immigration of farm population from densely populated to thinly populated hilly areas. However, settlers have not yet succeeded in settling in such zones in a stable way. GRDP of agriculture in Vietnam and the study area are summarized in the Table 5.13. Farm household earned only 49 - 69% of national average.

## 5.10 PRESENT ECONOMIC CONDITION

The agricultural sector has been the mainstay of the Central Region, supporting daily life of inhabitants with the provision of food and commodity. GAP in all Provinces except Thua Thien Hue played a relatively dominant role in the structure of GRDP. Per capita income measured in monetary terms was below national average in all four Provinces under consideration (Table 5.15 refers). Per capita income was particularly low in Thua Thien Hue accounting in 1994 for some 38% of national average only.

### 5.10.1 Major Crops

Paddy has been by far the most important crop as the source of staple food. Other starchy crops such as maize, sweet potato and cassava serve as subsidiary crops supplementing rice crop in all four Provinces. The four Provinces have had to purchase rice from other areas due to chronic failure in food self sufficiency. Therefore, the relative importance of rice production has been low although it has the highest share and the greatest importance within the region. This is partly attributable to lower yield and smaller acreage of paddy fields.

The yield level of paddy is evidently lower than that at national level, due mainly to adverse climatic conditions like floods and cold spell (especially winter paddy has a very low yield level), lower use of sophisticated inputs that farmers can hardly afford to purchase and the fact that all flat land has already been utilized as paddy field (Table 5.16 refers). The extension wing of the provincial agriculture department switched their general policy for paddy from triple to double cropping. On the other hand, there are still some single paddy areas because of limited water availability, which should be converted into double cropped fields.

**Table 5.9 Potential Soil Fertility and Product Groups**

Main Soil Group	Potential Fertility	Suitable and Potential Crop
1.) Sand dune and sandy soils at the coast line	Low, because low water & nutrient holding capacity	Casualina Tree Cashewnut
2.) Saline Soils	Low. If salinity exceeds 1,500 mmho even tree doesn't grow	Palm Tree Casualina Tree
3.) Sulfate Soils	Low. Acid-toxic by sulphuric-acid formation	Cattle Feed grasses reeds & redges
4.) Alluvial Soils	Medium to High (Usually paddy soils)	Paddy Sweet potatoe Cassava Sugarcane
5.) Swampy and Peat Soils	Medium to low. Low Fertility, poor drainage	Lotus Rainfed paddy Cattlefeed grass
6.) Degraded Grey Soils	High to Medium. Higher part of alluvial soils in hilly area	Cassava Maize Beans
7.) Lateric and Greyish-brownish Soils in Semi-arid Areas	Medium	Paddy Cashewnut Pineapple Fruit trees
8.) Black Soils	High to Medium. Alkaline basaltic rock origin	Cotton Pineapple Fruit trees
9.) Yellowish-red Soils (Mostly lateritic)		
A) No Stones	High to Medium	Coffee Tea Mulberry Tree
B) Stony	Medium to Low	Pepper Rubber Cinnamon
10.) Yellowish-red Humus Soils in Mountainous Areas	High to Medium	Coffee Macademia Nut
11.) Humus Soils in the High Mountains (Histosol Group)	Medium (In natural forest)	Mulberry Tree Forest Trees Rubber
12.) Deluvial Soils	Medium (Some sandy, Susceptible to soil erosion)	Cassava Taro Fruit Trees Mulberry Trees Forest Trees
13.) Skeletal Soils	Low. Much stoney. Sometimes with rock pan/rock bed	Grass Pine Tree

Source : JICA study team.

**Table 5.10 Soil Distribution/Agronomic Land Use Pattern Q.N.D.N. Province**

	Saline Soils	Aluminium Soils	Silt Soils	Black Soils	Red & Yel. Soils	Lateritic Soils	Forest Red & Y. Soils	Seasand	Silica Sand	Terraced Plots	Waste Land
ha	14,383	2,113	66,781	464	833,886	5,436	126,733	15,061	28,050	10,970	272,449
% of total	1.2	0.2	5.6	0.0	69.6	0.5	10.6	9.2	2.3	10.5*)	22.7

Note : \*) Of total farmland.

Source : Q.N.D.N. Provincial Committee.

**Table 5.11 Soil Distribution in the Study Area**

Type of Soils	Coastal Sand	Saline Soils	Sulfate Soils	Alluvial Soils	Peat Soils	Degraded Grey Soils	Black Soils	Yellow-Red Soils	Mount. Humus Soil	Mountain Soil	Deluvial Rock Soil	Skeletal Rock Soil
ha	91.3	39.6	12.8	273.1	19.7	31.1	6.2	1699.9	321.5	33.9	22.4	117.7
% of total	3.5	1.5	0.5	10.2	0.7	1.2	0.2	63.7	12.0	1.3	0.8	4.4

Note : \*) Of total farmland.

Source : Calculation based on the satellite image.

### 5.10.2 Other Crops

The study area's agricultural sector has many constraints, leading to less diversity in crop species with excessive bias towards paddy, with few cash crops (Table 5.17 refers). Among these, sugarcane seems important in the southern districts, because the climate suits and there is a national sugar mill in Quang Ngai. Besides, there are other minor subsistent crops that are mostly home consumed, such as rush for room mat production. Minor cash crops include peanut, taro sesame and seasonal vegetables, mostly rotated with rainfed paddy, whose acreage never exceeds 5% in total. Subsidiary crops have occupied a major part of non-paddy crop land to supplement staple paddy but nowadays their trend began declining.

Cash crops occupy a relatively lower position as income source in the study area, for the reason that farmers cannot afford to allocate their narrow farm land to these auxiliary crops. Cash crops by and by become one of important and promising alternative replaceable to grains, as a component of crop diversification responsive to changing domestic and international demand. Previewed urbanization will create new demand for fresh or perishable products including vegetables and fruits (Table 5.18 refers), while export promotion will induce another trend of expanding certain lucrative items like coffee, as well as of declining others like pepper. World market price of cashew nut or pepper is presently gloomy, but it has still some room to revive. Both domestic and export demand for silk will continue only if the quality suits and the production cost comes to a reasonable level. The current crop calendar is given in Figure 5.2.

### 5.10.3 Livestock

Livestock is kept by farmers mainly for the purpose of draught and transport, and some of them raise pigs and fowls for marketing. Livestock is deemed as a form of farm assets since meat production has not yet become an active industry, due partly to lack of self supplied feeds or high cost of purchased ones, partly due to lack of modern marketing channels handling fresh foods and also to feeble purchasing power of local consumers. Supply and consumption of milk remains inactive due to consumer habits among the local population, but future industrialization will not fail to induce milk consumption (Table 5.19 refers). As far as number of heads is concerned, the four Provinces have a fairly larger share in livestock holding than the

national average, but they have less slaughtering or meat production, implying that they have higher rate of draught animals in their herds (Table 5.19 refers).

**Table 5.12 Existing Land Use Pattern 1995**

Land Use	Quang Tri		Thua Thien Hue		Q.N. Da Nang		Quang Ngai		Target
	ha	%	ha	%	ha	%	ha	%	ha
A) Total Land Area	458.9	100.0	500.9	100.0	1,198.5	100.0	517.7	100.0	2,676.0
1.) Agricultural Land	59.5	13.0	47.0	9.4	113.3	9.5	86.0	16.6	305.8
(1) Annual Crop Land									
a. Paddy Field	30.7	6.7	32.3	6.4	56.9	4.7	40.9	7.9	160.8
3 crops year	0	0.0	0.3	0.1	15.6	1.3	9.4	1.8	25.3
2 crops year	15.6	3.4	19.8	4.0	28.3	2.4	21.7	4.2	85.4
single crop year	7.5	1.6	8.7	1.7	8.4	0.7	9.1	1.8	33.7
upland rice	5.5	1.2	1.6	0.3	0	0.0	0	0.0	7.1
paddy nursery plot	2.1	0.5	2.0	0.4	4.6	0.4	0.7	0.1	9.4
b. Annual Industrial Crop	14.8	3.2	10.5	2.1	38.2	3.2	23.3	4.5	86.8
c. Vegetable Plots	0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.3
d. Rush Planted Field	0	0.0	0	0.0	0.2	0.0	0	0.0	0.2
e. Other Annual Crops	4.8	1.0	0.3	0.1	1.0	0.1	14.7	2.8	20.8
(2) Perennial Crop Land	7.1	1.5	2.0	0.4	15.1	1.3	6.0	1.2	30.2
a. Peren. Industrial Crop	6.1	1.3	1.2	0.2	2.1	0.2	2.9	0.6	12.3
b. Fruit Orchard	0.6	0.1	0.4	0.1	2.8	0.2	0.3	0.1	4.1
c. Other Perennial Crops	0.4	0.1	0.4	0.1	10.1	0.8	2.8	0.5	13.7
d. Land for Nursery Trees	0	0.0	0	0.0	0	0.0	0	0.0	0.0
(3) Pasture / Grass Land	1.8	0.4	0.7	0.1	1.0	0.1	0.1	0.0	3.6
(4) Agricultural Water Surface	0.3	0.1	1.3	0.3	0.8	0.1	0.9	0.2	3.3
(5) Special Use Forest *)	1.1	0.2	33.9	6.8	62.5	5.2	5.2	1.0	102.7
2.) Unused Waste Land	285.0	62.1	258.4	51.6	556.5	46.4	269.5	52.1	1,369.4
(1) Waste Land in Plains	21.6	4.7	9.6	1.9	22.0	1.8	15.1	2.9	68.3
(2) Ditto in hills/mountains	252.5	55.0	198.6	39.6	499.0	41.6	228.9	44.2	1,179.0
(3) Unused Water Surface	3.1	0.7	22.8	4.6	2.6	0.2	1.7	0.3	30.2
(4) Land in River Bed / Basin	7.4	1.6	6.3	1.3	21.4	1.8	8.9	1.7	44.0
(5) Denuded Mountain Rocks	0.3	0.1	0.8	0.2	2.0	0.2	12.0	2.3	15.1
(6) Other Unused Wasteland	0.1	0.0	2.0	0.4	9.5	0.8	2.9	0.6	14.5
3) Reclaimable Land **)	6.4	1.4	6.1	1.2	30.7	2.6	7.2	1.4	50.4
(1) Land in Flat Plains	2.2	0.5	3.1	0.6	2.9	0.2	3.0	0.6	11.2
(2) Land in Hill/Undulation	4.2	0.9	3.0	0.6	27.8	2.3	4.2	0.8	39.2

Notes: \*) Classification by forestry department. \*\*) Only estimated.

**Table 5.13 Comparison of Farm Household Income**

Viet Nam	Target Area	Q.T.	T.T.Hue	Q.N.D.N.	Q.N.
A.12,658	536	121	278	72	65
B.1,322.1	914	646	1,088	820	945

Notes: 1) Average 1990 to 1994 at 1989 constant prices. 2) A= National in billion VND.

B= per farm household in thousand VND.



**Table 5.14 GAP and GRDP Structure 1990 to 1994**

(as indicated, but expressed in 1989 fixed price)

	[Unit]	1990	1991	1992	1993	1994	Mean
Quang Tri	Bio. VDN	76	79	69	49	52	65
Thua Thien Hue	Bio. VDN	60	66	83	79	73	72
Q.N. Da Nang	Bio. VDN	279	281	276	267	285	224
Quang Ngai	Bio. VDN	120	127	121	110	126	121
National Level	Bio. VDN	11,642	11,900	12,756	13,241	13,753	12,658
Quang Tri	% GRDP	47.8	47.6	40.6	28.7	29.2	38.5
Thua Thien Hue	% GRDP	17.7	18.6	21.2	17.3	14.9	17.8
Q.N. Da Nang	% GRDP	35.9	35.5	34.7	32.1	31.3	33.8
Quang Ngai	% GRDP	47.1	46.2	43.2	38.3	39.3	42.6
National Level	% GDP	39.4	38.0	37.5	36.0	34.4	36.9

Source : JICA study team.

**Table 5.15 Per Capita Income in the Study Area 1990 to 1994**

(as indicated, VND in constant 1989 price)

	[Unit]	1990	1991	1992	1993	1994
Quang Tri	[000 people]	478.8	492.0	507.4	520.9	535.0
Thua Thien Hue	[000 people]	903.0	920.9	950.4	973.2	995.4
Q.N. Da Nang	[000 people]	1,793.4	1,835.7	1,873.5	1,911.7	1,952.7
Quang Ngai	[000 people]	1,072.1	1,094.4	1,122.5	1,149.5	1,178.8
National Level	[000 people]	66,233.3	67,774.9	69,405.2	70,982.5	71,464.8
Quang Tri	[000 VND]	158.7	160.6	136.0	94.1	97.2
Thua Thien Hue	[000 VND]	66.5	71.7	87.3	81.2	73.3
Q.N. Da Nang	[000 VND]	155.6	153.1	147.3	139.7	146.0
Quang Ngai	[000 VND]	111.9	116.1	107.8	95.7	106.9
National Level	[000 VND]	175.8	175.6	183.8	186.5	192.4

Source : JICA study team.

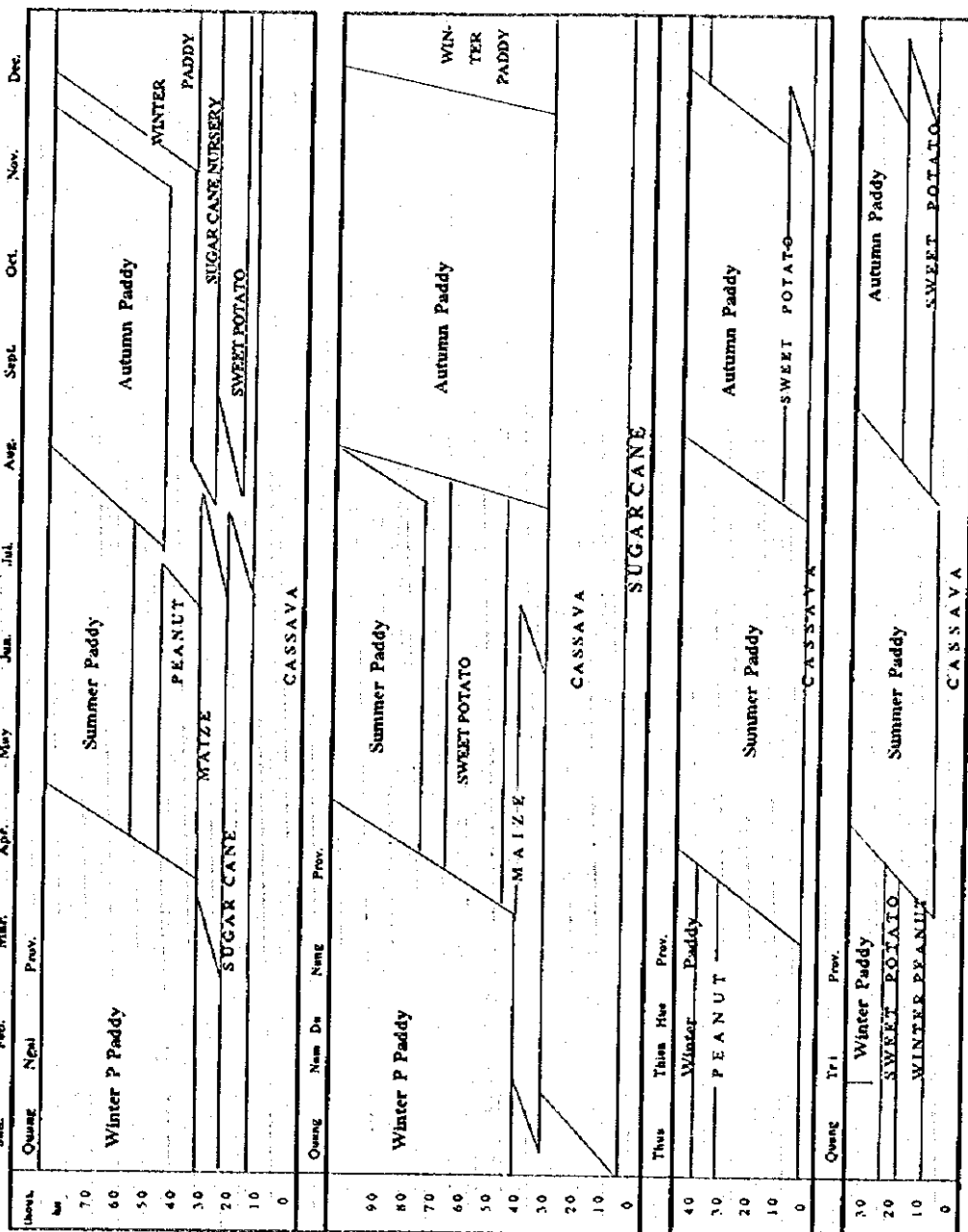
**Table 5.16 Paddy Production**

(Unit : 1,000ha / tons paddy/ha)

Parameter	Viet Nam	Q.Tri	T.T.Hue	Q.N.D.N.	Q.Ngai
Total Sown Area	6,393	41.8	49.2	121.4	90.3
of which spring paddy	38.1%	48.3%	54.1%	39.0%	38.6%
autumn paddy	22.4%	35.6%	43.9%	18.1%	35.7%
winter paddy	39.5%	16.1%	2.0%	42.9%	25.7%
Annual Yield	3.3	2.2	2.7	3.0	2.6
of which spring paddy	115%	119%	96%	93%	75%
autumn paddy	102%	108%	109%	126%	136%
winter paddy	85%	30%	30%	96%	101%

Source : Agricultural Statistics, MARD, 1995

Figure 5.2 Current Crop Calendar



**Table 5.17 Major Upland Crops**

(Unit : 1,000ha / tons/ha)

Parameter		Viet Nam	Q. Tri	T.T.Hue	Q.N.D.N.	Q Ngai
Cropped Area	Maize	477	1.5	0.6	5.0	3.3
	Sweet Potatoe	363	6.4	8.8	18.0	9.4
	Cassava	271	4.9	6.5	17.7	11.8
	Peanuts	216	2.2	2.4	8.8	3.2
	Sugar Cane	145	0.0	0.4	4.0	8.4
Crop Yield	Maize	17.0	7.9	10.2	14.8	14.0
	Sweet Potatoe	60.3	44.8	49.7	45.0	45.5
	Cassava	86.2	79.6	62.4	91.8	73.1
	Peanuts	10.6	7.2	9.9	8.0	10.0
	Sugar Cane	410.0	191.0	319.9	261.6	462.0

Source : Agricultural Statistics, MARD, 1995

**Table 5.18 Perishable Cash Crop Production**

(Unit : ha, mean 1989-94 / tons)

Parameter	Viet Nam	Q.T.	T.T.H	Q.N.D.N.	Q.N.
<b>Cropped Area</b>					
Vegetables	270,683	1,673	3,236	4,669	4,136
Major Fruits	166,856	1,474	583	2,993	1,476
<b>Production</b>					
Vegetables	3,243	8.5	33.4	56.0	39.6
Major Fruits	1,936	22.7	10.2	55.9	46.1

Source : Agricultural Statistics 1995 and Provincial Data.

**Table 5.19 Livestock Herds**

(Unit : 1,000 head, million fowls, kg/head)

Parameter	Viet Nam	Q.T.	T.T.H	Q.N.D.N.	Q.N.
Buffalo	2,906	28.8	34.7	49.2	45.1
Cattle	3,252	58.0	190.2	187.9	159.8
Pig	13,758	149.2	179.9	497.1	326.3
Poultry	122.0	1.1	1.4	2.8	1.9
Pig (Live Weight)	81.2	7.4	9.3	26.3	16.2

Source : Agricultural Statistics 1995 and Provincial Data.

Generally, slaughtering of domestic animals needs permission from the aspect of public hygiene, and pig meat has the largest share in retail markets, followed by poultry, reflecting the

existing consumption pattern. Livestock will be more utilized for meat, milk and leather purpose rather than draught and transport. Milk production has recently been taken up by Q.N.Da Nang Province with German cooperation, and other provinces will shortly follow livestock improvement in this direction.

## 5.11 AGRO-ECONOMIC CONDITION

The agro-economic profile of the four Provinces is summarized in Table 5.20.

### 5.11.1 Farm Income

Judging from GAP and farm population, annual farm income per farm household comes to about 1.5 million VDN (in constant 1989 prices), where 65% of the total population earn farm income, accounting for 33% of the total. In other words, around 50% of total income should be derived from agriculture. However, data from the farm census reveal that there is a wide range in the farm income distribution, showing growing disparity. Especially, small holding and lower productivity has limited their farm income. As for farm income, they are evidently lower than the national average, in addition they do not have other effective sources of earning extra-income to supplement it. In Central Vietnam primary industries are hardly relied on as household income source as seen in Table 5.21.

### 5.11.2 Agricultural Input

Farmer's input consumption has not been precisely grasped since the Doi Moi renovation, because marketing channels have too drastically been diversified since then. In Viet Nam, input use depends on value of the crops and response. Production costs per household and crop budget are provided in Table 5.22.

**Table 5.20 Agro-economic Profile of the 4 Provinces**

Parameter	(Unit : 1,000 household/person; ha)					
	Viet Nam	Study Area	Q.T.	T.T.H	Q.N.D.N.	Q.N.
Farm Household	9,576	599.5	68.8	87.8	255.6	187.3
Farm Population	45,468	2,795.8	331.6	456.8	1,140.2	867.2
% of Total Popul.	65.5	62.8	65.4	48.1	60.9	77.1
Farm Labour	21,473	1307.5	131.3	199.3	591.0	385.9
Farm Land	7,348	245.3	40.8	40.1	92.7	71.6
of which						
Paddy Field	4,252	162.5	24.1	32.6	64.5	41.4
Other Annual Crops	1,271	52.8	2.9	4.8	21.0	24.1
Perennial Crops	1,247	168.1	2.1	1.7	7.0	6.0
Sown area with Crops	7,827	369.2	54.0	64.0	164.6	113.7

Source : Statistical Yearbook 1994.

**Table 5.21 Income Sources Composition**

(Unit : percent)

Item	Agriculture Forestry	Non-farm Self-Empl.	Wages	Pension	Other Income	Total Income
Viet Nam	36.3	36.8	21.8	3.3	1.8	5,488
Study Area	21.2	45.8	28.0	3.3	1.7	4,446

Source : Statistical Yearbook 1994.

**Table 5.22 Production Cost per Household and its Structure**

(Unit : 1,000 VDN/%)

Item	Total Cost	Seed	Chemical Fertilizer	Organic Fertilizer	Insecti- cides	Transpor- tation	Rental Charge	Hired Labour	Service Charge
Viet Nam	934	30.6	44.4	1.3	8.3	0.9	3.2	6.4	5.0
Study Area	743	26.6	45.6	0.7	8.3	0.5	6.6	6.6	5.3

Source : Viet Nam Living Standard Survey, 1993.

As exemplified in Table 5.23, a household with an average holding can hardly earn one million VDN, or 80 thousand VDN per month, implying that non-farm income, accounting for more than three fourths of the total household income as given in Table 5.23 offers the last resort that actually sustains the household. This has resulted from the fact that the farm holding is too small to absorb the total labor force, namely only one adult per average 0.3 ha farm household is enough to cater for both crop and livestock, and the rest family members should earn in non-farm sectors, leaving little room for farm mechanization as illustrated in Table 5.24.

**Table 5.23 Estimated Farmer's Gross Return from Crops**

(Unit : ton/ha; ha, 1,000VDN)

Crops	Yield (t/ha)	Farm-gate Unit Price	Value per ha	Cost per ha	Of which Labour	Net Return per hh	Net Return per ha
2 Crop paddy	4.2	1480 *)	6,252	3,267	900	986	2,985
Sugarcane	70.0	200	14,000	10,465	4,410	1,167	3,535
Cassava	45.0	90	4,050	1,950	850	693	2,100
Cocoon	0.6	29	17,423	14,544	7,980	950	2,879

Source : JICA study mission.

Note: \*) Including value of straw.

### 5.11.3 Local Price of Agricultural Outputs

Farm products are sold in local markets at a cheaper price than in urbanized areas. For example, polished rice costs (in VND / kg) 3,500 - 7,500, sweet potato 1,500 - 1,800, cassava 1,200 - 1,500, maize 2,400 - 3,800, vegetables 2,500 - 9,000 and fruits 3,000 - 12,000 though the price levels broadly fluctuate between on and off season.

**Table 5.24 Agricultural Labor Requirements and Number of Agricultural Machinery Currently Available in the Study Area**

Item	(Unit)	Q.Tri	T.T.Hue	Q.N.D.N.	Q.Ngai
Labor Requirement	(000 pers.)	80.9	68.0	170.4	117.3
Large Tractor	Units	217	201	135	260
Small Tractor	"	318	445	585	266
Electric Motor	"	423	509	228	177
Water Pump	"	9,819	2,212	928	351
Rice Mill	"	1,392	2,026	1,476	956
Thresher	"	0	7	762	430
Feed Cutter	"	116	363	39	64
Seed Sower	"	70	159	82	62

Source : Agricultural Statistics, 1994.

### 5.11.4 Price Level of Agricultural Inputs

No official data are available for local input price levels after liberalization, except for the data gathered in the study team's interview. In any event, there has been little demand for agricultural inputs on account of feeble farmers' purchasing power. Besides, retail prices of bulky inputs tend to be dearer due to transport surcharges. Table 5.25 provides data on local price levels.

### 5.11.5 Marketing System

Like other former planned economy countries, marketing channels of agricultural produce still remain in a transient stage for further development into a free market economy, but now farmers can sell their products much more freely at their own disposal to lucrative markets. The estimated marketing quantities of paddy are calculated in Table 5.26. The normal marketing channels for paddy are : from individual farmer to farm collectors, to middlemen/traders, to the urban market and retailers. Or, from individual farmers to cooperatives, to the District food company, to the Provincial food company and from here to the Regional food company.

The typical marketing channel for industrial crops is from individual growers to producer organizations, to contractors/processors and exporters or the existing vegetable/fruit market. The number of fruit and vegetable markets in the study area are summarized in Table 5.27.

### 5.11.6 Food Consumption

The population in the area mostly consume more food than what they produce, and even in ordinary years local production can hardly meet total demand for staple food from the local population. The nutritional status has not been officially measured in the study area, but there is no doubt that it is lower than national average observing from local production and income points of view.

A preliminary estimation was made, assuming a constant 2% population growth rate and present acreage of paddy field, to know how fast growth in paddy yield is required to attain a complete self-sufficiency level of 300 kg paddy equivalent/person/year by only paddy. The result of this calculation are summarized in Table 5.28. As can be seen, desperate efforts for keeping a high rate of yield growth without a single year of failure would be required to become self-sufficient in staple food. According to the study team's social survey it was revealed that local people have to buy two thirds of daily food, implying that the whole area suffers from a food deficit and poor meal gradients. Data of slaughtering shows that protein intake lies more on fish. Table 5.29 shows the food consumption structure in the study area.

## **5.12 IDENTIFIED CONSTRAINTS**

### **5.12.1 Agricultural Constraints**

The farm population suffers from a host of constraints, major ones are : petty size of farmland per agricultural household, unfavorable environmental (land, soil, climatic) conditions, underdeveloped farm infrastructure (irrigation and so on), frequent and heavy damage from natural calamities, low level of food self-sufficiency and poor farm assets, limited non-farm income source, and limited availability of farm inputs and backward marketing system. Typical constraints in the study area are summarized in Table 5.31. The identified problems in each zone in the agricultural sector and their attributes are as outlined below :

#### **1) Natural Conditions**

Climatic constraints include winter cold spell in the Northern two Provinces, summer drought in the same Provinces caused by Westerly dry-wind, sand invasion from coastal sand deposit, flood attack during typhoon season (in Zone A1 and B1) and cold spell in winter acts as prohibitive factor in the Northern Provinces, where both area and yield of winter paddy are affected by coldness. Those derived from soil conditions mainly consists of silica sand in zone C with poor water/nutrient holding character, partly acidic and stony soils distributed in new economic zones in B1.

#### **2) Socio-Economic Conditions**

Those on population and limited land availability include: small holding per farm household, poverty among rural communities as a result of vicious cycle especially in natural calamity prone areas. Remoteness and poor access to markets as well as poor road conditions affect development in zones A2, B2 and B3. Small holding of farm household is another commonly found constraint that hinders development. Longer gestation period for tree crops raises the difficulty in sustaining rural life to settlers in new economic zones.

#### **3) Structural Conditions**

Low educational standard among farming population, lack of marketing facility, lack of outlet for farm products to the population equipped with real purchasing power, biased concentration on paddy production that limits smooth crop diversification and so on also serve as negative factors in the process of modernization.

### **5.12.2 Limitations in Development**

There are number of limitations to solve or ease the above cited constraints. They are:

- Scarce room for expanding paddy fields by reclamation, because almost all flat land has been exploited except for saline area, land prone to floods and so on

- Remoteness of hilly-mountainous areas, where reclaimable land exists, without proper access road, access to market, nor irrigation water
- Scarcity of investment resources both in public authorities and private farmers and necessity to wait during embryonic periods for tree crop growing and so on.

Reclaimable sites are too often stony but also on steep slopes subject to erosion.

**Table 5.25 List of Selected Input Prices**

Kind of Input	Name	Unit	Farm Gate Price	Remarks
Fungicides	Benlate	kg	69,500	Retail Shop
		480cc(bottle)	69,000	Retail Shop
	Thiodan	100cc(bottle)	56,100	Retail Shop
	Kitazin-10H	kg	7,200	Retail Shop
Insecticides	Diazinon-10G	kg	11,500	Retail Shop
	Basudin-10H	kg	10,700	Retail Shop
	Karate	250cc	39,000	Retail Shop
	Azodrin	100cc	5,600	Retail Shop
	Sevin-85%wp	kg	83,000	Retail Shop
	Rudomil	kg	176,000	Retail Shop
	Herbicide 2.4-D	480cc	25,300 (bottled)	Retail Shop
	Sofit-300EC	100cc	18,900	Retail Shop
	Monitor ha	(hired spraying ha)	63,000	Retail Shop
Fertilizer *)	Cattle Manure	kg	50	Cooperative
	Apatite Rock	kg	156	Cooperative
	Compound	kg (15:15:6)	12,500	50 kg bale Retailer
	Urea-42%	kg	2,680	From Sugar Mill
	Superphosphate	kg	800	From Sugar Mill
	Potash Sulphate	kg	1,520	From Sugar Mill
	Superphosphate	kg	2,800	Retail Shop
	Potash Muriste	kg	1,600	Retail Shop
Seeds	Paddy-HYV	kg	6,500	Retail Shop
	Hybrid Maize	kg	24,500	Retail Shop
	Ground Nut	kg	3,800	Retail Shop
	Cotton Seed	kg	7,000	Retail Shop
	Potatoe Seed	kg	2,900	Retail Shop
	Tomato	kg	175,000	Retail Shop
	Cucumber	kg	125,000	Retail Shop
	Cabbage	kg	14,000	Retail Shop
	Lettuce	kg	15,500	Retail Shop
Seedlings	Sugarcane	kg(10pcs)	250	From Sugar Mill
	Coffee Tree	kg(5plants)	4,800	Cooperative
	Rubber Tree	kg(8plants)	9,500	Cooperative
Irrigation Water		ha/season	500,000	Cooperative
Hired Labour		adul/day	10,000	Mutual Help

Notes : \*) Under contracted cropping with processing mills, the unit price becomes much lower than the retail price.

Source : JICA study team survey 1996.



**Table 5.26 Estimated Marketing Quantities of Paddy and Industrial Crops**

Disposal Form	To State	Barter	Seed Selling	Feed	Labor	Loss Payment	Self consumed
<b>Paddy</b>							
in %	12.00	7.00	7.00	2.00	0.30	0.05	71.50
in kg	235	137	130	40	6	2	1,400
in 1,000 VDN	517.0	301.0	286.0	88.0	13.0	4.4	3080.0
<b>Industrial Crops</b>						Other use	
in %		50.00	4.50	0.01	0.04	45.00	0

Notes : 1) Paddy = Viet Nam Household Survey, 1993.

Source : Rural Household Census 1994.

**Table 5.27 Number of Existing Vegetable and Fruit Markets**

Location	(Unit : Number)			
	Q.T. City	Hue City	D.N. City	Q.N. City
<b>Number of Markets</b>	1	2	2	1
<b>Retail Markets</b>	86	90	80	37

Source : JICA study team.

**Table 5.28 Per Capita Food Availability and Nutrition**

Year	Viet Nam	Q.T.	T.T.Hue	Q.N.D.N.	Q.N.
1990	324.4	173.2	208.2	247.6	269.9
1991	324.9	265.8	198.6	251.0	298.7
1992	348.9	265.1	195.1	237.7	223.3
1993	359.0	179.4	149.7	226.7	201.4
1994	361.3	196.8	135.6	237.6	257.2
2000	379.0	152.9	80.3	205.6	175.8
2010	422.3	84.3	8.7	170.0	99.4

Note : Current and forecast per capita food availability in paddy equivalent.

Paddy equivalent = 1/5 cassava root weight, or 1/3 of tubers of sweet potatoe and potatoe is equivalent to 1 paddy.

Source : JICA study team.

**Table 5.29 Prospects for Food Self-Sufficiency**

(Unit : 1,000 person; t/ha)					
Item	Year	Q.T	T.T.Hue	Q.N.D.N	Q.N.
Estimated	2000	177.2	329.7	646.8	390.5
Population	2010	224.7	418.1	820.3	495.2
Required per ha	2000	3.6(2.2)	5.1(2.7)	5.0(3.0)	4.7(2.6)
Annual yield level	2010	4.7	6.4	6.4	6.0
Necessary An. Yield	2000	6.3%	8.3%	6.6%	7.7%
Growth Rate	2010	4.3%(-12%)	4.9%(5.4%)	4.3%(-10%)	11.1%(-0%)

Notes : () shows current yield level rate.

Source : JICA study team estimations.

**Table 5.30 Per Capita Annual Food Intake in the Study Area**

Item	Rice	Other G.	Meat	Fat	Fish	Eggs	Tofu	Peanuts	Fruits	Sugar	Tea	Others
(in kg)												
Sel-suppl.	49.0	43.0	5.0	3.5	6.0	4.0	5.8	4.0	6.0	4.3	1.2	5.8
Purchased	102.0	141.0	17.0	0.0	17.0	18.0	0.0	2.0	14.0	0.0	1.2	13.9
TOTAL	151.0	194.0	21.0	3.5	23.0	22.0	5.8	6.0	20.0	4.3	2.4	19.7
(in 1,000 VND)												
	Grain	Meat	Eggs	Fat	Fish	Prawn	Fruits	Vegetabl.	Condim.	Other Food		Total
Viet Nam	316	89	6	19	101	28	25	47	3	9	42	713
Study Area	302	119	9	12	77	21	22	48	30	13	64	747

Notes : Annual agricultural production ranges 707 for the area and 633 for national level. Per capita income comes to 853 and 1,105 thousand, respectively.

Source : Viet Nam Household Survey, 1993.

**Table 5.31 Typical Constraints in the Study Area**

(Unit : ha/% to 300 kg paddy)							
Item		Viet Nam	Study Area	Q.Tri	T.T.Hue	Q.N.D.N	Q.Ngai
Farmland	per household	0.49	0.33	0.37	0.29	0.33	0.33
Irrigated		0.69	0.50	0.75	0.22	0.47	0.62
Food Self-	sufficiency	115.0	76.0	72.0	59.1	80.0	83.3
Cattle Holding		2.2	1.4	1.6	2.6	0.9	1.1

Source : Calculated from Provincial Agricultural Data 1992 to 1995.

## 5.13 DEVELOPMENT STRATEGY

### 5.13.1 Agricultural Zoning

Agricultural zoning of the study area should be based on future prospects or possibilities for development as well as on current agricultural land use and climatic/topographic conditions. A remarkable agro-climatic limiting factor, that is cold spell in winter, affects the growth of typical tropical crops like paddy and sugarcane, that should be selected as one of the key factors for the zoning. Then, topographical factors, distinguishing flat plains, where paddy field develops from sloped lands, where upland, rainfed field predominates, should also be chosen as a factor for zoning. Finally, local economic factors, current traffic convenience and so on have to be taken into account for future development in industrial/cash crops. Taking all these factors into account, six zones can be established for demarcation within the area. The characteristics of these zones are given in detail in Table 5.32. Major features may be summarized as outlined below.

**Zone A.** This zone covers paddy areas within flat coastal plains, where irrigated paddy land has been developed for centuries. Currently it is mainly cropped with double or triple paddy, accompanying some rotation with sugarcane, rush and so on. Zone A is divided into A1 in the Northern two Provinces and A2 in the Southern two, the latter having more advantages in terms of climatic environment (less cold spell, less drought and so on).

**Zone B.** It demarcates upland areas adjacent to zone A with a higher altitude, where mostly hilly, undulated topography predominates. This zone is divided into three, that is B1, B2 and B3. B1 covers the Northern two Provinces and B2 the Southern two, based on the same categorization as applied to zone A. Rather flat inland basin developed in Q.N. Da Nang Province can be separated from B2 as B3, where fairly large tracts of paddy fields develop. It has a gentle slope not steeper than 10 degree where tree crops can be planted without providing terraces.

**Zone C.** In steep mountainous area where the slope gradient exceeds 10 degree, and thus countermeasures for preventing erosion are essential, or along the coastal sand areas where measures have been taken or are to be taken to stabilize the existing arable land against sand intrusion. Zoning is illustrated in Figure 5.3, and their suitable crops are depicted in Table 5.33.

### 5.13.2 Development Policy

An agricultural development strategy always starts from the above-cited constraints, trying to find the solution for each problem or constraint so that future agriculture can rightly cope with expected demands for domestic/local consumption and for export. Besides, it must be enough sustainable for a long time, consistent with present government efforts/policies, because they have already considered various view points for the smooth acceptance of local population according to the locality and capacity of beneficiaries.

The core of a policy consists of diversification in crop and livestock production, maximization of use in limited available resources including WID and VAC, in which agro-related industries are also included as target areas of development. Here, coexistence with other industries, service sector attaches importance since agricultural role should encompass so many activities, inclusive of supply of labor force, of land, of resources such as water to these peripheral sectors, so that mutual prosperity can be pursued in a sustainable way.

#### 1) Agricultural Intensification

In the process of shifting to a free market economy, precious capital investment must be focused on enough capital responsive areas, whether it is of public or private resource. Intensification of agriculture has two dimensions, one accompanied by a higher level of input use or investment, and the other in the form of renovation of way of farming, or reform of

organization and systems. It means to create more intensive farming than the existing one and so often requires additional resources including new techniques, new farm land by reclamation, new system or structure for farming or marketing and other sectors, such as supporting facilities, related industries or new demands/outlets and so on.

### **(1) Strategic Setup of Development by Zones for Higher Productivity**

Since there remain much limited areas for further reclamation of new farmland, farmers have to resort only to vertical expansion, that means crop diversification and yield improvement by introducing new varieties, new techniques and intensive resource input. In order to maximize productivity, suitable and sustainable techniques should be chosen to apply according to the environmental conditions prevailing in the zone. It follows that a zone has particular means and type of intensification in line with local conditions.

### **(2) Comparative Importance/Priority by Zones**

For the time being, the farming population settled in the new economic zones or hilly areas faces many difficulties in their routine life as compared with those in flat land areas. They have to wait for a long embryonic period until perennial tree crops bear fruit or come into ripening stage. It follows that measures for stabilizing life of such settlers be taken urgently, proper to rendering aid to traditional households in coastal plains, except for settlers in coastal sand areas.

## **2) Crop Diversification**

Crop diversification has many implications. The currently employed set of crops are not always relevant to maximize productivity in an area, it can intensify crop coverage and to consume more idle labor force throughout a year, it can meet a changing demand for domestic and international markets, it can avoid or prevent damages from floods, drought, pest attacks, sudden price fall by glut market supply of a crop, and also loss from overproduction. It is easier to put into practice when basic need for staple food is met by self-supply, because self-sufficient farmers can only pursue production of lucrative cash crops. In any region of the world, crop and livestock diversification has become a common task to meet ever-diversifying demand for farm produce. Usually, it tends to proceed on producing more value-added products for higher labor productivity. Therefore, crop diversification is often accompanied with the creation of processing units or marketing facilities within the diversified areas.

### **(1) Strategic Setup of Diversification Development for Crops and Livestock**

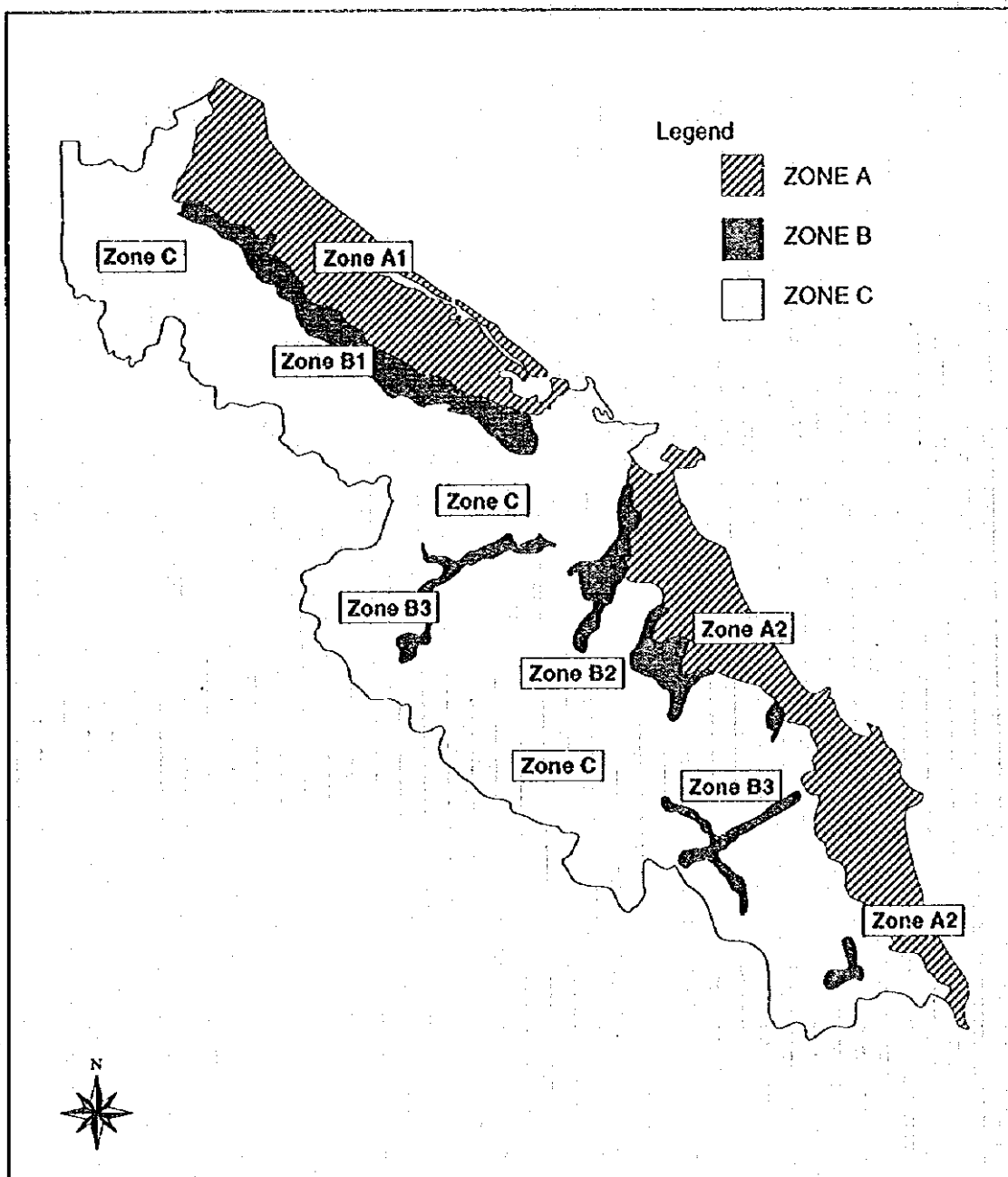
Similar consideration can be applied to formulate crop diversification according to prevailing natural and socio-economic conditions in each agricultural zone. The largest issue in promoting crop diversification lies in the fact that the area, particularly that in the Northern Provinces has suffered from a staple food deficit, and this factor often curbs farmers' effort to diversify their cropping especially in paddy fields. Also, drainage problems tend to check development in crop diversification in the summer-autumn season in flat or irrigated paddy areas. Therefore, diversification could most easily be started in the hilly upland area, where subsidiary crop predominates. Flat paddy areas would become the last to diversify after completing powerful drainage systems. The relative suitability of strategic crops is shown in Table 5.34.

### **(2) Crops that can be Selected as Diversification Campaign**

Since farmer's choice decides diversification, new crops must have higher profitability, larger crop stability and suitability to natural conditions. In flat land, sugarcane and some oil bearing seed crops constitute those for diversification in the Southern part, while vegetables and spices can serve as component of diversification in the Northern part. In hilly land, tubers and subsidiary grains can be converted into tree crops, but once the choice has been made, it is not

so easy to switch perennial crops into others. Tree crops planned in Viet Nam are also cultivated in other tropical countries, and these countries come to suffer from harder competition in keeping a share in the international market. There is no crop, whose price and international outlet are guaranteed or safeguarded. Therefore, it is wise to select those crops with dual functions, for example one for export and another for import substitution.

**Figure 5.3 Agricultural Zoning in the Study Area**



Source: JICA Study Team

**Table 5.32 Detailed Characters of Agricultural Zones**

zone	Location in 4 Provinces	Main Products Now & in Future	Future Farming Prospect	+ Advantages - Disadvantages	Measures and Programs
A 1	Flat Coastal Plain in Q.Tri & T.T.Hue, River Basins of Thach Han, O Rau, Bo & Huong River	Summer-Paddy, Autumn-Paddy, cassava, peanut sweet potato - paddy + maize, paddy + vegetables, improved winter paddy of cold resistant characters	serving as the main staple supplier, plus perishable produce to urban area, fortified with resistant varieties against cold spells in winter	+ access to urban market - chilly climate & dry spell + cool climate for particular crops - floods - small holdings	maximizing land use efficiency, medium & small scale irrigation and flood control systems are indispensable
A 2	Flat Coastal Plain in QN.DN. & Q.Ngai River Basins of Yen, Thu Bon, Tra Bon and Tra Khuc	Summer-Paddy, Autumn-Paddy, Winter Paddy, cassava, sugarcane sweet potato, peanut, cashewnut - paddy + maize, paddy + sugarcane / vegetables	serving as the main staple supplier, plus perishable produce to urban area, broiler & milk supply more sugarcane supply	+ mild climate + access to market/ mills - infertile soils - small holding	optimizing cropping, medium and small scale irrigation and drainage systems are essential to stabilize /improve productivity
B 1	Hilly Area of West Gioling, Cam Lo, Trieu Phong, South Phong Dien, Huong Tra, North Huong Thuy	cassava, peanut, rain-fed paddy, sweet potato, taro, pepper - sugarcane, tea, potato, mulberry, coffee, fruit trees	specialized in industrial material supply with subsistence foodcrop cashcrops must be resistant to dry or cold climate	+ reclaimable land availability + cool climate - erosion - poor access to market	in addition to small scale irrigation, technical & financial aid for industrial crop expansion is acutely required. Plant protection
B 2	Hilly Area of Hoa Vang, Dai Loc Que Son, Hiep Duc, Tien Phuoc, Binh Son, Th Nghia, Nghia Hanh, Buc Pho	cassava, peanut, tobacco, sweet potato, rain-fed paddy -, sugarcane, tea, pineapple potato, rubber, mulberry, cacao fruit trees, chili and condiments	specialized in industrial material supply with subsistence foodcrop cashcrops must be adaptable to humid and warm climate	+ ample land space for reclamation, - stony soils or infertile soils - poor access to market	in addition to small scale irrigation, technical & financial aid for industrial crop expansion is acutely required. Plant protection be organized
B 3	Alluvial River Basin of Cai & Bun Rivers in Q.N.Da Nang surrounded by mountain areas	Summer-Paddy, Autumn-Paddy, Rain-fed Paddy, cassavas, sweet potato taro, - sugarcane tea, coffee, cacao, mulberry	serving as the main staple supplier, plus perishable produce to urban area, broiler & milk supply sugarcane	+ less steep slope on fields + mild climate - remoteness to market & mills	highland industrial crop promotion with technical and financial leverage is essential
C	Forestry Area in the western side of the zone B1 & B2, in ethnic minority areas	slash and burn system, tubers & rain-fed paddy - Agro-forestry for sustainable cropping with rubber & fodder trees	afforestation plus tree-crop plantation, small scale subsistence farming in a permanently settled system	- steep slope - stony soils - inherited slashing - insulated way of life from economy sphere	high-land industrial crop promotion with technical and financial aid is required with social development aid

Source: IICA Study Team

### 3) Conservation of Agricultural Environment

#### (1) Formulation of Sustainable Development Consistent with Environmental Conservation

There are two aspects of conserving agricultural environment, namely how to cope with negative, threatening impacts, i.e., land use conversion from farming to other activities such as urban housing, creation of industrial areas and so on, and risk of flood/drought attack due to over exploitation of forest resources. Legal protection for productive farmland located nearby urban centers already exists to control random land exploitation for other purposes than agriculture. Farmland protection from natural calamities/disasters includes various means starting from river-basin management with afforestation practices in the upper catchment area in rivers/streams, to polder dyke construction surrounding farm tracts to be protected and so on.

**Table 5.33 Suitability of Crops by Agricultural Zone**

Agricultural Zone	A 1	A 2	A 3	B 1	B 2	C
Stable Crop	Chill resistant	Hybrid paddy				
			Hybrid maize			
Cash Crop	Vegetables	Sugarcane	Tree crops			Timber trees
Livestock	Pig/Poultry	Pig/Poultry	Milk cow		Meat cattle	

Source: JICA study team.

**Table 5.34 Relative Suitability of Strategic Crops**

Conditions Crop Species	suitability grade	low - high temperature	annual rainfall	slope steepness	soil adaptability	price viability
Coffee	A	Q.T. T.T.Hue	Q.N. QN.DN.		Q.T. Q.D. T.T.Hue	X
	B	Q.N. QN.DN.	Q.T. T.T.Hue	4 provinces	Q.N.	
Tea	A	4 provinces	Q.N. QN.DN.	4 provinces	Q.D.	
	B		Q.T. T.T.Hue		Q.N.	X
Rubber	A	Q.N.	4 provinces	QN.DN.	4 provinces	X
	B	Q.T. T.T.Hue		Q.N.		
Cashew nut	A	4 provinces	Q.N. QN.DN.	4 provinces	Q.N. QN.DN.	
	B	Q.T. T.T.Hue	Q.T. T.T.Hue		Q.T. T.T.Hue	X
Sericulture	A	4 provinces	Q.T. T.T.Hue	QN.DN.	Q.T. T.T.Hue	X
	B		Q.N. QN.DN.	Q.N.	Q.T. T.T.Hue	
Sugar cane	A	Q.T.	Q.N. QN.DN.	4 provinces	Q.N. QN.DN.	X
	B	QN.DN. T.T.Hue	QN.DN. T.T.Hue		QN.DN. T.T.Hue	
Pepper	A	Q.N. QN.DN.	Q.N. QN.DN.	4 provinces	4 provinces	
	B	Q.T. T.T.Hue	QN.DN. T.T.Hue			X

Note: Grade A indicates higher suitability than grade B.

Q.T.; Quang TQN.DN.; Quang Nam Da Nang  
Q.N.; Quang NT.T.Hue; Thua Thien Hue

## (2) Vulnerable Areas to Escalating Pollution

Just as industrialization, introducing more sophisticated techniques into agriculture inevitably leads to pollution, in such form as higher levels of residual chemicals in soils, chemical contamination and eutrophication in lagoons. Also, agro-industry has a potential to escalate water and air pollution. Measures for controlling pollution incur additional cost that become a heavy burden on each pollution generating sector.

## **5.14 DEVELOPMENT PLAN**

### **5.14.1 Provincial Long Term Programmes**

Each Province has established a long term development program as shown in Table 6.35, in which various targets to be reached by 2000 or 2010 are set and some techno-economic provisions are envisaged for the approval by the central government. Current trends have been reflected in compiling these master plans so as to make them more realistic and sustainable. Yet, the Doi-Moi policy has made every farmer the actual decision-maker to put the production targets into practice, the role of the provincial agricultural department has become rather catalytic than active, providing farmers with infrastructure and supporting services.

### **5.14.2 Priority Areas/Sub-sectors for Future Plan**

The study area has much handicap in crop/livestock productivity attributable to climatic topographic and other constraints, but these will be tackled in the following way:

**Zone A.** In major flood-plains there is almost no room for expanding arable land by new reclamation, and future increase in crop production could be expected only in improving crop yields and proper crop diversification. To meet this demand, it will be effective to select suitable and promising cash crops and launch production promotion projects, that cover proper site or areas with market/processing access. A crop/animal research institute will serve as the technical source for modernizing and promoting cash crop production, providing extension staff with basic know-how to be diffused among cash crop producers.

What must be urgently introduced in this zone includes irrigation improvement through middle-small scale dam construction (especially in A1) to realize double paddy cropping coping with the task of approaching food self-sufficiency.

**Zone B.** In hilly areas, there still remains some room for expanding arable land through the activities within new economic zones and so on. Here, reclamation activities should be fully consistent with environmental conservation, hence the most adequate means of development be taken to establish sustainable way of farming. Here, agro-forestry and sylvo-pastoral farming can be applied to the reclamation to enhance the fertility of arable land as well as to minimize erosion or to prevent land degradation. Agricultural activities in this zone are restricted, because it is imperative to protect the environment prior to economic activities.

**Zone C.** Environmental conservation has the top priority in this zone before planning any type of exploitation. Forest coverage must be increased as fast as possible, while bare land should be planted with either indigenous forest tree species or artificial ones. At the same time, the slash and burn system must be replaced by settled farm or forestry management one otherwise the natural environment would never be restored. The planned agricultural land use in the four Provinces up to the year 2005 as well as 2010 is depicted in Table 5.36. and Table 5.37, while the current status in 1993 is given in the previous Table 5.12.

### **5.14.3 Future Prospects and Desirable Agricultural Performance**

Food sufficiency within the study area will not be met in coming decades. It will be wiser to promote, instead of exclusively pursuing food self-sufficiency, crop diversification into various cash crops for export and domestic markets (preferably processed commodities rather than perishable ones, because of the remoteness to bigger urban areas and of adding higher values). If existing trend further continues in future, the self sufficiency rate and nutritional status would be forecast as detailed in Table 5.38 and 5.39.



## 5.15 DEVELOPMENT COSTS

Development costs for reclamation, land consolidation, irrigation and drainage and so on depends highly upon present conditions of planned sites and the scale of exploitation. Only very rough estimation from collected information that we can refer to is given in Table 5.41.

**Table 5.35 Planned Agricultural Activities in the Target Area**

Program	Detail Item	Q.Tri	T.T.Hue	QN.DN.	Q.Ngai
Farmland area Expansion	Annual crop	1,810 ha	3,130 ha	2,900 ha	3,000 ha
	Perennial C.	4,250 ha	3,000 ha	4,350 ha	4,200 ha
	Agro-forestry	1,200 ha	700 ha	23,200 ha	900 ha
Crop Intensification and/or Rationalization	single - double	7,460 ha	8,650 ha	5,080 ha	9,060 ha
	triple to double high yielding var.	few triple crop dry resistant	few-triple crop cold-resistant	10,680 ha IR varieties	20,450 ha hybrid maize
Crop Diversification	paddy-sugarcane	3,150 ha	2,300 ha	7,080 ha	8,000 ha
	cash crops fodder / industrial	sugarcane sericulture	sugarcane vegetables	sugarcane vegetables	maize/cinnamon bean rotation
New Economic Zone Expansion	rubber planting	17,500 ha	2,000 ha	not decided	not decided
	mulberry garden	4,230 ha	1,500 ha	3,000 ha	1,000 ha
	coffee / tea	1,000 ha	cassava etc.	1,000 ha each	2,500 ha
Crop Yield Improvement	cash crop target	peanut +0.3t/ha	sugarcane 8%/y	cane 30t/ha maize	cane+20% maize
	paddy yield target	paddy +1.0%/yea	paddy +1.5%/year	4%/y, paddy 0.7%	10%, paddy+2.5%
Industrial Crop Processing Factory	Commodity	Silk Reeling	Latex Processing	Tea Processing	Canning etc.
	Planned Place	Vinh Linh	Huong Tra	Dac Phu	Dung Quat
	Capacity ton/year	360 ton/year	15ton / day	80ton/day	300 ha
	Commodity	sugar centrifuging	sugar refining	Sugar Centrifugat	New sugar mill
	Planned Place	Phuong Hoa	Phong Dien	Thang Binh	Duc Pho
	Capacity ton/year	1,000 ton/day	3,000 ton/day	500ton/day	2,000 ton/day

Source : Verbal hearing by the JICA study team

## 5.16 DEVELOPMENT ALTERNATIVES

The four Provinces have established ambitious development programs including tree crops. However, targets should be focused on really suitable tree species, because the products will be subject to international competition, or if not exported, they will have to serve for import substitution. In this context, it will be better to review whether currently planed or started crops/plants are really suitable to natural and socio-economic conditions.

Table 5.42 gives an example of alternatives indicating future tree crops that can be introduced in new reclaimable areas or in existing paddy fields in the case of sugarcane. Even though there exists about one million hectare of reclaimable land in hilly and mountainous areas, actually exploitable area as arable land is estimated at only around 5%, because soils are stony or acidic, or have shallow tillable layers, or crops are subject to damage by wild animals. It is anticipated that overall agricultural development will create some 105,750 additional jobs within the agricultural sector (Table 5.43 refers). Total agricultural labour force requirements for the four Provinces are estimated in Table 5.44.

In the table, reclaimed land use indicates already planted area, but mostly still in the gestation period without harvest, or planned area where settlers in new economic zones plant crops up to 2000. New reclamation gives a possible alternative in which tree crop area is to be expanded by settlers who will also take care of production forest expansion with agro-forestry activities. In agro-forestry, mainly leguminous fodder trees can be applied as livestock feeding base. About fifty thousand hectare of land for agro-forestry can be envisaged in afforestation projects.

**Table 5.36 Planned Agricultural Land Use in 2005**

Parameter	Unit	Q.Tri	T.T.Hue	Q.N.D.N.	Q.Ngai	Study Area
1.) Spring Paddy Area	ha	20,700	27,200	50,200	35,200	133,300
2.) Autumn Paddy Area	ha	18,400	19,900	23,000	21,300	82,600
3.) Winter Paddy Area	ha	6,400	1,500	52,600	38,600	99,100
4.) Total Paddy Area	ha	45,500	48,600	125,800	95,100	315,000
5.) Maize Area	ha	2,300	800	7,500	4,200	14,800
6.) Sweet Potato Area	ha	4,000	6,100	17,400	7,900	35,400
7.) Cassava Area	ha	4,000	5,100	13,500	9,300	31,900
8.) Other Stable Food Area	ha	10,300	12,000	38,400	21,400	82,100
9.) Cashewnut Area	ha	0	0	600	1,200	1,800
10.) Sugar Cane Area	ha	0	0	3,700	9,900	13,600
11.) Mulberry Area	ha	1,800	1,000	1,500	500	4,800
12.) Rubber Area	ha	3,000	900	0	0	3,900
13.) Cinnamon Area	ha	400 *	0	1,500	3,500	5,400
14.) Coffee/Tea Area	ha	500	600	1,500	1,500	4,100
15.) Total of 9)- 14)	ha	4,800	1,900	5,800	11,600	24,100

Source : Estimated by the Study Team based on the provincial plans

\* pepper

**Table 5.37 Planned Agricultural Land Use in 2010**

Parameter	Unit	Q.Tri	T.T.Hue	Q.N.D.N.	Q.Ngai	Study Area
1.) Spring Paddy Area	ha	21,300	28,100	53,700	35,600	138,700
2.) Autumn Paddy Area	ha	22,700	17,700	24,500	19,000	83,900
3.) Winter Paddy Area	ha	5,800	2,100	53,300	46,600	107,800
4.) Total Paddy Area	ha	49,800	47,900	131,500	101,200	330,400
5.) Maize Area	ha	3,200	1,000	10,700	6,000	20,900
6.) Sweet Potato Area	ha	4,200	3,300	16,800	6,100	30,400
7.) Cassava Area	ha	4,200	3,300	8,800	6,500	22,800
8.) Total of 5)-7)	ha	11,600	7,600	36,300	18,600	74,100
9.) Cashewnut Area	ha	0	0	1,000	2,000	3,000
10.) Sugar Cane Area	ha	0	3,000	6,000	11,600	20,600
11.) Mulberry Area	ha	3,000	1,500	3,000	1,000	8,500
12.) Rubber Area	ha	6,000	1,500	0	0	7,500
13.) Cinnamon Area	ha	700 *	0	2,500	7,000	10,200
14.) Coffee/Tea Area	ha	800	1,000	2,500	2,500	6,800
15.) Total of 9)-14)	ha	10,500	6,000	15,000	24,100	56,600

Source : Estimated by Study Team based on the hearing from each province

\* pepper

**Table 5.38 Per Capita Food Supply within the Provinces**

(Unit : rice equivalent kg/person/year)				
Province Year	1995	2000	2005	2010
Quang Tri	136/135	133/126	135/121	137/117
Thua Thien Hue	98/97	94/89	94/84	92/78
Q.N. Da Nang	224/222	218/205	214/192	213/182
Quang Ngai	145/144	146/138	149/134	155/133

Note : Calculation for a 1% and 2% population growth rate.

Source : JICA study team.

**Table 5.39 Agricultural GRDP per Farm Household**

Unit : million VND (Unit : 1,000 VND)				
Item	Year	1990/94	2000	2010
Viet Nam		16,569 (232)	28,839 (291)	32,927 ( 327)
Quang Tri		65(129)	49( 83)	49( 65)
T.T.Hue		72( 76)	114(110)	153(104)
Q.N. Da Nang		278(148)	274(127)	272( 99)
Quang Ngai		107(118)	117(108)	112( 90)

Note : Per capita GRDP in brackets. Constant 1989 price base.

Source : JICA study team.

**Table 5.40 Food Purchase Cost to Procure 300 kg/Year Rice Equivalent**

(Unit : 1,000 VDN)					
Item	Year	1995	2000	2005	2010
Quang Tri		604(74%)	637(77%)	655(74%)	49 (65%)
T.T.Hue		792(92%)	823(98%)	843(97%)	866(100%)
Q.N. Da Nang		261(21%)	318(26%)	361(32%)	395(36%)
Quang Ngai		589(77%)	611(77%)	626(74%)	630(71%)

Note : Constant 1989 price base.

Source : JICA study team.

**Table 5.41 Estimated Development Costs**

Unit: Million USD				
Items of work	Area	Facility Scale	Unit Cost	Project Cost
Reclamation	Hilly	1,500 ha	0.022	33.0#
Tree Planting	Hilly	500 ha	0.004	2.0#
Irrigation as a whole	Coast	3,000 ha	0.015	45.7#
d o.	Highland	1,000 ha	0.049	
Reservoir	Hilly	4,000 ha	100	
Canal / Channel	Hilly	4,000 ha	10	
Pump and Station	Coast	11,000 ha	26	100SP x 2*

Remarks: #; per project, \*; number of pumps

## 5.17 PROPOSED PROJECTS AND PROGRAMMES

### 5.17.1 Overall Agricultural Development Process

Priority areas should be clarified in order to formulate a comprehensive agricultural development strategy within the study area to tackle present constraints. Though various alternatives can be considered as to how efficiently farm productivity is increased in each zone, the following is recommended so that the agricultural sector in the area can undergo a change from a planned to a market oriented economy.

Top priority for investment should be given to zone B, where there is some room for further reclamation, and the settlers in new economic zones are poorer than those, who have their holding in zone A, acutely needing assistance.

The second priority should be attached to the granary in zone A, where future development allows "direct food supply" to meet increasing urban demand for staples and vegetables.

The third priority, but not less important than the former two, should be given to consolidation of marketing, processing/storage facilities that must be developed keeping pace with production of marketable farm products or raw materials for processing.

### 5.17.2 Proposed Projects

Table 5.45 shows the projects to be listed in a long list, and most of them are also included in the agricultural plan toward 2000 or 2010 prepared by each Provincial agricultural department. The listed projects in the table have firm background, such as successful results in on-going similar ones, some of which have been technically or financially analyzed by local experts and actually their plans were submitted to the central government for budgetary approval. A focal point might lie in what extent agricultural sector expands the opportunities of absorbing farming labor through the proposed projects and related periphery industrial activities.

#### 1) Water Resources and Agricultural Development Projects by Medium and Small Scale Reservoirs

**Objectives.** The project aims at rationally intensive cropping in flat paddy area through the implementation of a water development system as a key to modernized agriculture.

**Contents.** Project components consist of the optimum water use through an agreed rotation system among farmers, thus economizing irrigation water and maximizing crop output/income within a command area, thus trying to meet increasing food demand. A soft loan from abroad can be applied to the procurement of inputs to initiate the rotation on a big scale.

**Justification.** The coordinated farming will enable the participants to do uniform practice of watering and drainage, fumigation or weeding. These practices also allow them to economize use of fertilizers by minimizing loss from flowing away into overflowing water.

**Scale and Area.** The projects will cover 5,290 ha in Binh Son District in Quang Ngai Province, and 2,610 ha in Vinh Linh District in Quang Tri Province. The loan requirement to cover these will amount to 510 million VND.

**Social Implication.** In this connection, it is emphasized that the irrigation projects sponsored by the Province must cover secondary canals to mitigate the burden of beneficiaries, and the projects be well informed among them so that full participatory approach may be secured, because a coercive project without prior consultation with farmers often ends up in failure.

#### 2) Sugar Cane Projects

**Objectives.** These projects have the objectives of substituting sugar imports and improving farm income, but growing conditions seem more favorable in the Southern Provinces that is Quang Ngai and Q.N.Da Nang.

**Table 5.42 Example of Cash Crop Composition for Reclaimed Plantations in Hilly Areas**

(Unit : ha)								
Item	Province	/ Crop	Study Area	Q.Tri	T.T.Hue	QNDN	Q.Ngai	
Reclaimable Land Use	Coffee	/ Cocoa	14,100	4,300	2,000	2,800	5,000	
	Tea		5,000	1,800	400	2,000	800	
	Rubber		15,500	6,000	4,000	3,000	2,500	
	Cashew		4,000	0	500	1,500	2,000	
	Mulberry		8,500	3,000	1,500	3,000	1,000	
	Pepper		900	400	300	0	200	
	Total Treecrop		48,000	15,500	8,700	12,300	11,500	
	Pineapple etc.		4,100	600	400	2,000	1,100	
	Total Planting		46,100	11,400	5,000	19,400	10,300	
New Reclamation (2000-2010)	Coffee	/Cocoa	13,200	4,000	1,800	2,600	4,800	
	Tea		4,200	1,500	400	1,700	600	
	Rubber		15,500	6,000	4,000	3,000	2,500	
	Cashew		2,900	0	500	900	1,500	
	Mulberry		6,900	2,500	1,200	2,500	700	
	Pepper		200	200	0	0	0	
	Total Treecrop		42,900	14,200	7,900	10,700	10,100	
	Paddy Field		11,200	3,000	2,900	3,100	2,200	
	Total Flat Land		13,700	3,500	3,400	4,000	2,800	

Source : JICA study team.

**Table 5.43 Agriculture Sector Additional Labor Absorptive Opportunities**

Item	Scale	Indicator	Number of Labor or Person
<b>Reclamation</b>			
Zone A	11,200 ha	0.5 ha/hh	44,800
Zone B	42,900 ha	5.0 ha/hh	17,160
<b>Hiring by Processing Units</b>			
Sugarcane	4 Units	6,500 t/d	20,250
Sericulture	1 Unit	400 t/d	19,440
Dairy/Meat	1 Unit	500 t/d	750
Rubber	1 Unit	19.5 t/d	1,400
Coffee/Tea	2 Units	200 t/d	500
<b>Hiring by Marketing Channels</b>			
Vegetables	5 Markets	500 t/d/market	1,000
Fruits	2 Markets	300 t/d/market	450
Total Additional Requirement			105,750

Source : JICA study team estimations.

**Table 5.44 Agricultural Labor Requirements in the 4 Provinces**

		(Unit : 1,000 persons)			
Year		Q.T.	T.T.Hue	Q.N.D.N.	Q.N.
1995	TFL	131.3	199.3	591.0	385.9
1995	Required	80.9	68.0	170.4	117.3
2010	TFL	202.6	291.1	821.7	557.9
2010	Required	87.4	73.3	194.6	132.7

Note : TFL = Total Farm Labor

Source : JICA study team.

**Contents.** Each Province has a plan for sugarcane promotion to live up to the state decision. It comprises expansion/concentration of cane producing area, construction/ expansion of sugar processing facility, including improvement in transportation, and farm road improvement for quicker delivery of harvested cane to the mills.

**Justification.** They can absorb rural manpower either in crop fields or in sugar mills. However, investment fund to create a new mill of raw sugar containing molasse comes to 5 million US \$ for equipment with a capacity 1,000 ton/day. Cane production can be organized properly with newly introduced high yielding varieties and suitable input supply.

**Scale and Area.** T.T.Hue Province has a plan of developing 7,500 ha at the cost of 114.3 billion VND, in four years, absorbing more than 2,200 laborers in farm, transportation and a mill. Quang Ngai Province has launched a new mill with a capacity 1,000 ton/day now under construction, and runs it under provincial management. With this in addition to the existing state-run mill, the province will produce 1,050 thousand tons of sugar cane until 2000, at an annual growth rate 19.6%. In Quang Tri Province, a sugar cane area extending over 3,150 ha is planned near Lao Bao town. In Q.N.Da Nang Province, a sugar mill with a capacity 1,000 ton/day has been approved.

**Social Implication.** This Southern region was selected for the project because farmers have experience of growing cane, irrigation water is available, soils/climate are suitable and the mill site is near.

### 3) Research Station for Flat Land Crop Diversification

**Objective.** To meet farmers' needs to challenge high yielding paddy techniques, it is imperative to establish a regional research station.

**Contents.** A paddy experiment station is located at the roadside of National Highway No.1 in Duy An near Da Nang City. It belongs to the agricultural department of the Province, responsible for rice seed production for diffusion and paddy experiments.

**Justification.** The central coastal region has specific natural / environmental conditions to which paddy and diversified crops must be adapted through proper research activities.

**Scale and Area.** It has a 9 ha paddy breeding plot and another 1 ha vegetable seed nursery. Now, necessity arises in crop diversification, but this station is not equipped with a facility for conducting experiment on other crops. This project envisages an expansion in both plots and equipment so that it becomes capable of offering demonstration for farmers displaying how to diversify crops in paddy fields.

#### 4) Highland Industrial Crop Promotion and Afforestation Program

**Objectives.** Though an experiment station is available for flat land, there is none for hilly or mountainous land in spite of its growing importance in developing agriculture in the four Provinces. The proposed project offers farmers demonstrations on how to develop cash/perennial crops and to manage agro-forestry on slope land, providing a training course for indigenous inhabitants and new settlers in new economic zones so as to improve their techniques. It can also provide loans for farm inputs, funds for compensating catastrophic price drop and afforestation to bare land in and around new economic zones.

**Contents.** A demonstration farm with facility training equipment, dormitory and plots could be provided by foreign assistance, while annual management expenditure for facility management and free lodging for trainees should also be met by another external aid. The facility should provide plots for various cash crop trees and alley cropping trials for agro-forestry where trainees can learn how to transplant seedlings, prune twigs, how to practice husbandry and harvesting /utilization.

**Justification.** The hilly and mountainous area of the Provinces concerned has a larger potential for the agricultural, agro-forestry development than the flat area, where quite different species of crops should be employed, but most settlers are novice beginners, who are not familiar with agro-forestry or agro-sylvo-pastoral techniques.

**Scale and Location.** Any place in zone B would be recommended as the site, only if traffic convenience is secured from the developing settlement areas. Around 25 hectare of land reclamation/ acquisition would suffice the construction of the center with irrigation facility.

**Social Implication.** The center should accept ethnic minorities as trainees who are possibly illiterate. It would serve as means of creating closer communication through cordial and persevering instruction with amicable attitude to liberate them from solitude.

Table 5.45 Agricultural Projects in the Study Area

Type of Project	Q.Tri	T.T.Hue	QNDN	Q.Ngai
R-1 Rationali'P	Vinh Linh	Song Phuong		Binh Son
R-1 Sugar Cane	Huong Hoa	Phong Son	Tam Ky	Duc Pho, Son Tinh
R-1 Research Station			Vinh Dien	
R-2 Training Center			Thanh My	
R-2 DAiry Cow			Giang, Dai Loc	
R-2 Sericulture	Huong Hoa		Hiên, Giang	
R-2 Rubber Plants		Phong Dien		
R-2 Coffe Plant	Gio Linh, Cam Lo			
R-2 VAC Project		Aloi, Nam Bong		
R-3 Bean, Peanuts				Mo Duc, Tu Nghia
R-3 Cashewnut		Pha Tam, Giang		Binh Son
U-3 Vegetables	Trieu Phong		Hoa Vang	

Source : Compiled by JICA study team.

#### 5) Dairy Cows and Other Ruminants Promotion Project

**Objectives.** This project is said to be the only international agricultural project now going on in Q.N.Da Nang Province, by GTZ. Both in this Province and in Quang Ngai Province, new bovine variety, Sindh, originated from India has been proliferated, and in Q.N.Da Nang Province goat husbandry for milking has been introduced. Future demand for milk in these

Provinces will increase for consumption by infants/elderly people or by processing sector of confectionery, and the chance for developing the dairy sector has come.

**Contents.** Diffusion of dairy production by artificial insemination service and milk collection and pasteurization system are envisaged.

**Justification.** The cool climate in the study area is favorable to dairy cows while cassava, paddy straw and agro-forestry products including hay are available for feeding them. If hybrid cows between indigenous and European varieties are employed, dairy husbandry suits for T.T. Hue and Quang Tri Provinces where cooler climate prevails.

**Scale and Area.** The Northern areas would have better growth conditions for dairy cattle as mentioned above. Hilly areas can be mobilized for dairy activities. A herd of 2,000 adult cows per province is desirable occupying 4,000 ha in an agro-forestry area for efficient milk collection. Initially, one household should care for one milk cow only.

**Social Implication.** Current nutritional status of inhabitants seems to have too much bias to carbohydrate, in lack of animal protein. So, promoting dairy, poultry and VAC for sweet water fish and pig meat timely match the measures that should be taken to rectify the existing bias. Besides, dairy practices suit for women in settlers' households as an activity of W.I.D..

## **6) Sericulture Development Project**

**Objectives.** As a program for hilly area development, sericulture is revived for cash income earning making use of idle labor force.

**Contents.** Sericulture techniques are extended and mulberry gardens are established in the target areas, while silkworm seed distribution centers are provided and silk thread reeling mills are established.

**Justification.** Sericulture really fits the current situation in these provinces on account of the following reason: a) it is a highly labor intensive industry, so it has a large capacity of absorbing idle labor power; b) the climate of the Northern Provinces, especially, suits rearing of silk worm; c) mulberry trees can be planted over hilly, sloped land without sacrificing fertile, flat farmland; d) since local farmers in all the four provinces have been engaged in traditional sericulture, it is not necessary to train the sericulture farmers from point zero; e) this is not food production, and so free from the problem of residual defoliating agents; f) as for international competitiveness, Viet Nam has advantage in mobilizing cheap labor and only what remains to be done is to reach an acceptable quality level.

**Scale and Area.** Quang Tri Province has planned an elaborate project in Huong Hoa and Vinh Linh Districts, developing more than 4,200 ha of mulberry field, constructing four reeling mills for raw silk from cocoon the project cost of which amounts to 80.9 billion VND. The project provides field and factory work for 3,900 persons in these Districts and brings farmers 110 percent as much earning as that obtained from the conventional system under paddy and subsidiary crop.

**Social Implication.** Eventually, sericulture increases both export earnings and farm income. It can also meet a strong domestic demand for silk-wear. Reasonable wage should be provided for the workers for field work and for thread reeling mills. This industry contributes to women's socialization, thus promoting W.I.D. in hilly areas.

## **7) Rubber Tree Planting**

**Objectives.** This program has already been diffused over the hilly areas in the project area, especially engaged by the settlers in new economic zones. In neighboring countries, such as Malaysia has by far larger capacity in its production with 1.2 tons of dried latex yield per hectare evidently higher than Vietnamese average, 0.7 ton/ha. However, it can well grow on red-yellow soils prevailing over the hillside in the project area, where 1.3- 1.4 tons of latex yield will be attainable.



**Contents.** Diversification is introduced for rubber planters so that they can sustain living during the embryonic period, as well as secure the outlet of future produce through the consolidation of marketing and processing channels/facility of latex. The program will also cover to form an aggregate planting area at a scale of 4,000 - 5,000 ha with a latex collection system and a processing mill.

**Justification.** Because rubber is a strategy crop coupled with forest restoration, all the plantation should be duly protected by the state sponsored supporting program, giving benefits to settlers, who planted and take care of it.

**Scale and Area.** Presently, the planting develops in Quang Tri and T.T.Hue Provinces, along with mercesii pine (for log and resin) and other afforested trees. It will take about 6 - 7 years from seedling planting to latex tapping, implying that planters have to sustain their living by other means during the embryonic period. Latex collection and drying need a transport means and a mill that in turn should enjoy advantage of the scale merit.

**Social Implication.** Settlers have contributed to the society because they alleviated heavy burden of population density by leaving from their native places. Now, they are facing various risks amidst remote areas. Therefore, they should have the privilege of receiving systematic support, that is essential to lead economic zone policy to success.

## **8) Coffee/Tea Planting**

**Objectives.** The program is to improve the currently operating production - processing system into a modernized enterprise capable of producing quality products competitive with other exporting countries, including remodeling or rationalizing of existing state farms.

**Contents.** Aggregation and diversification of commodities and wavering of price risks by establishing a provincial compensation fund.

**Justification.** The same principle of scale merit can be applicable to these tropical beverages. These commodities are subject to wider fluctuation of international market prices, so the inevitable risk should be dissipated by coupling with other, more stable crops. Coffee trees, in particular arabica types prefer cooler climate, but are at the same time susceptible to frost damages. Tee trees are more resistant to coldness but bud yield is affected by cold spells. They can be planted over sloped land where their root system helps prevent soil erosion. Both of these planting need processing facilities near harvesting fields; bud fermenting mills for tea and cherry coffee grain mills for coffee.

**Scale and Area.** The program sets the target at hilly areas in Quang Tri and T.T.Hue Provinces where aggregate plantation complex models are created, diversifying export oriented crops to dissipate price risk.

**Social Implication.** In addition, the future role of the existing state farms is desirable oriented to settlers and minority support rather than converting into state enterprises.

## **9) Cashewnut Tree Planting**

**Objectives.** To establish a new mill for cashew nut and by-product processing.

**Contents.** This fruit tree is planted quite sporadically along coastal sandy area, as it can resist against dry soil condition. A new mill will be necessary if the acreage is further expanded under NFIEC. The new mill can try to produce juice from cashew apple by-product. Besides, cashew shell liquid can be extracted to serve for resin materials.

**Justification.** Suitability of growing climate and stable export outlet.

**Scale and Area.** Suitable sites would lie in QN-Da Nang and Quang Ngai Provinces. A widely spread silica sand area is a potential planting area for expansion, and this situation should be counted in the determination of the mill site.

## **10) Vegetable Garden Development in the Suburbs of Cities**

**Objectives.** To establish a gardening area per Provincial urban center.

**Contents.** The program will cover from the land consolidation to marketing network with a view to establish a modern system.

**Justification.** As a cash crop earner, vegetable cultivation will be promising as demand arises from urban population. An aggregate vegetable supplying area can be developed in an irrigable area around the urban center, coupled with piggery or poultry so that waste can be fed while manure can be used as fertilizer.

**Scale and Area.** 150 - 200 ha according to the size of urban population. The sites can be determined by the intention of farmers, availability of irrigation, environmental conditions on transport, pollution and so on.

**Social Implication.** Vegetable growing has been women's specialty, and cooperatives can manage activities of gardening aggregates, whose initiatives should be taken by the representatives of women.

## **11) VAC Program**

**Objectives.** To establish an efficient and sustainable VAC system.

**Contents.** Creation of VAC model farms are promoted that have a labor intensive base on cash crops through the provision of loans.

**Justification.** VAC has been extended throughout Vietnam owing to various merit from environmental and economic points of view, but the bottleneck exists in small holding of the majority. Even though a farmer wish to excavate a fish pond, he has to sacrifice the fairly big portion of his paddy field. Accordingly, VAC can be realized on some specific conditions, and peri-urban vegetable growing farmers need only some sao (1 sao = 500m<sup>2</sup>) for raising vegetables and a pond is useful for an emergency water source in drought spells.

**Scale and Area.** Both in the periphery of urban centers and in settler's residential areas, representative area for VAC development can be chosen where 10 - 20 model VAC farms are voluntarily established by granting loans to the volunteer farmers. Regular studies on the VAC performance should be made by the Provincial Department.

**Social Implication.** Agriculture has potential pollution source especially in livestock sector. VAC offers quite rational way of avoiding occurrence of pollution, creating a sound environment. In promoting VAC, farmers must find a sustainable form of the recommended system and these examples serve as the standard.

## **12) Promotion of Beans in Crop Rotation System**

**Objectives.** Recommending that beans and other leguminous crops are employed more in the crop rotation system, to economize the use of chemical fertilizers and to create sustainable soil fertility.

**Contents.** Provincial subsidy on the purchase of leguminous seed by farmers, who introduce a rotation system with leguminous crops. The province establishes a rhizome inoculation center where inoculated bean seeds are provided to distribute among applicants at the subsidized prices. Foreign aid is asked for fund and equipment.

**Justification.** Provision of a provincial engineers recognize the effect of this system on economizing fertilizer doses, but farmers are reluctant to apply due to ignorance, tradition and high cost of bean seed. This program tries to remove these inhibiting factors affecting bean growing.

**Scale and Area.** Upland and hilly areas, 500 ha for each Province.

**Social Implication.** Beans provide vegetable protein and oil, thus they are valuable in human nutrition. Their plant residue serves as enriched feedstuff for livestock, therefore, if farmers make it a rule to incorporate beans into rotation, their social asset will be increased.

## **5.18 PRIORITY PROJECTS IN THE AGRICULTURAL SECTOR**

Among the recommended projects shown in the long list, the following three should be considered as priority projects in the agricultural sector.

### **Project 1 : Water Resources and Agricultural Development Project by Medium and Small Scale Reservoir in Zone A**

The key project presented here aims at multi-crop production covering flat land and some hilly areas adjacent to it. The main objective of which lies in maximization of flat land use by introducing double/triple paddy cropping and diversified crops through a complete irrigation and drainage system. In order to procure the highest possible rate of food self-sufficiency in the study area, implementation of land consolidation is indispensable against various kinds of constraints surrounding the granary areas. This includes middle and small scale reservoirs and canal construction, such as Bao Dai dam that was designed in Vin Linh.

### **Project 2 : Industrial Crop Promotion and Afforestation Program in Zone B**

Industrial crops will form an important source of cash and foreign currency earning within the study area as well as will serve as a substitute of imported commodities. Growing importance should be attached to new economic zones, where industrial crops stand as mainstay in their economic activities that can feed additional population immigrated from densely populated urban areas to the new economic base. However, the settlers still suffer from lack of capital funds and inputs, of basic techniques, of processing units and other supporting systems. To tackle these problems, it is suggested to establish a supporting package available to settlers. The set of package comprises a technical institute where demonstration plots for tree crops, a model unit for processing harvested materials of agro-industry and training course for settlers.

### **Project 3 : Sugarcane Promotion Project in Zone A and C**

Quang Ngai province has a sophisticated sugar mill in the outskirts of Quang Ngai city with an industrial complex. The state run facility will undergo privatization and will contribute to agro-industrial development in zone A and C (coastal). The proposed project aims at solving problems currently encountered by this processing unit. Mainly, it provides land consolidation within the material supplying area, encompassing 50 km distant from the mill.

## **Potential Industrial Crops**

### **1) Future Technical Requirement**

The Zone B in the study area has many constraints and narrow room for expansion. In order to overcome these and making the area competitive with other areas in Viet Nam or other producing countries, specific strategies will have to be provided to catch up with and surpass them. These can be articulated as follows:

- pursuit of quality rather than quantity of the produce
- crop diversification and the use of catch crops during the initial gestation period
- soil conservation against water and wind erosion over the surface of planted field

The first strategy is obvious from the land availability point of view, namely, however hard the planners may make effort, the available acreage for new reclamation is quite limited, while price difference among different quality or different varieties of these industrial crops. Therefore, ample labor and suitable natural conditions should be utilized for obtaining higher quality products rather than elevating mere yield levels.

Quality improvement ranges from the best choice of varieties to soils and topography in the site of plantation, optimum crop husbandry to rational way of post-harvest treatment.

The second recommendation is quite consistent with the first point, because if a farmer devotes and concentrates all his ability to a single crop, his success will be great but his failure will also get serious. Whereas, if a farming household chooses its best field for a crop and other field for other crops, it can expect various advantages, for example spreading of labor peak into two or more seasons, easier pest and disease control than the operation in mono-culture tracts where infection velocity is greater once epidemic damage outbreak occurs. We recommend to adopt leguminous, annual crops for catch crops to be planted in between rows of industrial crops while they continue to grow but not yet form a closed canopy, from a viewpoint that they will least deprive of soil nitrogen but capable of producing food and feed during the gestation period. Their water consumption is also not so large that negative effect of water competition with perennial industrial crops during dry seasons remains in a negligible extent.

The third article is essential for sustainable farming with perennial crops in undulated or inclined field. Soil erosion leads to a great loss in soil nutrient availability, soil water and also in labor efficiency on the crop plots. All the preventive measures should be employed in the plantation tracts to this end, ranging from creation of windbreak, contour line planting and the provision of terraces, employment of shade trees to vertical drops in runoff ditches or mulching over inter-rows with hay or straw. Reclamation into a completely denuded tract with earth stripping machinery is better avoided from economic as well as land conservation points of view. Windbreak planting can minimize soil and water loss especially in northern provinces where Laotian wind blows for months taking field moisture away from soil surface.

### **2) Points to be Regarded for Planting, Husbandry and Processing by Crop**

#### **(1) Sugarcane**

Varieties resistant to lodging by wind, with slim stalk (NCO, ROC and F series) fit the conditions in the study area. High yielding Chinese or Taiwanese varieties etc. do not always suit the planting sites. Presently, ROC 1, 10, 18 and 20, Cinnamon, C8-1967 (suitable to sandy soils) and My (suitable to hill-side plots and gravel soils) are introduced to aim at the annual cane yield of 80 tons/ha, with 12 - 13 % of sucrose content in cane. In Q. Ngai province, the main sugar producer in the study area, F156 brought from Cuba accounts for 70% of the total acreage under cane, and NCO 310 (originally African variety) does 10% and

CO290 (Indian variety) also does 10%, the rest shared by Taiwanese varieties like ROC1, RCO 10, and Cuban 115514, these minor ones are considered promising in future development.

The initial planting requires cane seedling preparation for transplanting, that takes around half a year from summer to winter. Once planted, the plant lasts for three successive harvests by ratooning, and the fourth year it is recommended to plant leguminous crops for a year. During this idle period, seedlings for renewed planting can be provided. In irrigated fields, this idle period can be skipped by applying heavy dose of organic manure. Continuous ratooning degrades the yield level, so replanting is recommended at the interval of three years, though the cost for seed cane is incurred. Leaf burning for defoliation is better avoided if harvesting labor force suffices. Farm road network is necessary to carry harvested cane as soon as possible to the mill to minimize loss of sugar in cane. Damages from rats should be prevented with zinc phosphate treated bait and other rodenticides. Cane top and defoliated leaves can be fed to cattle and buffaloes to produce manure for manuring cane field.

Sugarcane is desirably irrigated by a gravitational irrigation system and other inexpensive way of water supply to maintain higher yield, because the initial growth of shoots / ratoon aftermath or transplanted seedling is often coincided with dry period during which Laotian wind prevails depriving of soil water, while sugarcane is one of the crops with the highest water requirement.

It is recommended that the same variety is planted on a contract basis with adjusted planting date so that the cane supply can be secured for 5 to 6 months and the quality of sugar can be made homogeneous. Where the sugar-mill is not yet established, it should be simultaneously constructed with the development of cane cropping, covering at least 3,000 ha per mill.

As to pricing, state instruction would be necessary to guarantee share of producer farmers, or an alternative of this would be free price negotiation between farmers' representatives and sugar-mill management board. For example, the estimated production cost in which irrigation fee, road improvement cost, tax and remunerative farm labor wage are counted serves as the base for obtaining parity price. When this amounts to 7 million VND / ha, and the yield target is 70 tons / ha, the parity price is equal to 100 thousand VND per ton of cane. Then, if the consumer price of unrefined sugar fluctuate around 7,000 VND / kg, a remunerative price for farmers will come to 4,200 VND / kg (subtracting 15% equivalent for marketing cost, 25% equivalent for processing cost and 10 % for tax), or 389 VND per kg of raw cane, though producers receive only 120 - 200 VND per kg. Some countries adopted the floor price guaranteed for the producers, for sudden exposure from planned to a complete free economy will fatally damage small-scaled producers. Otherwise farmer producers never follow the advice given by the state, because they have the right to choose their crops under free economy.

International sugar price has held stable at around 302 US\$ per ton in late 1996, but market prospect in future says it does not keep firm trends because of surplus supply to effective demand in the long run.

## (2) Mulberry

Basically, mulberry silk production suits the area with ample manual labor supply because it is highly labor-intensive, requiring higher share of labor cost sometimes reaching 75 % or higher. Mulberry trees can be grown either from seed sowing that will take more than a year until the leaves or branches are harvested, or from proliferation by scion that takes less than a year. Every year, old shoots are cut off at the stump in winter, the height of which is less than a foot from the ground, and in spring new shoots are grown up from the same stump that provide mulberry leaves. The planting density ranges from 1m x 1m (10,000 stumps/ha) to 0.6m x 0.8m (20,000 stumps/ha), but the latter may be thinned to a half after a few years.

Mulberry trees require fertile soils to keep high leaf yield to feed silkworm, and the yield can be improved by irrigation. This is the reason why the production area is concentrated in fluvial or alluvial river terraces etc. Especially, the nitrogen requirement reaches as high as that of tea tree for a vigorous leaf production and for keeping numbers of shoot from a stump. As regards leaf yield, proper manuring coupled with irrigation allows to produce 30 tons of fresh leaves per hectare using big-leaf Chinese varieties like Sai-Ni-Lua. Four different mulberry varieties are adopted by Tan Lom Company in Q. Tri province according to soil and ambient

conditions. Bao Den variety (Q.N.D.N.) is resistant to drought, best grown on upland field. Bao Tram is suitable to sandy or alluvial soils deposited along streams. Tan Boi The (in Ha Bac province as origin), imported in 1993 from China is grown on plain area. Another imported variety, Tam Chung Quoc is employed for fertile alluvium and moist condition.

When farm labor supply becomes tight, the silkworm rearers can dispense leaf picking by giving the whole branch cut from the trunk to feed to well-grown worm. Conversion rate from mulberry leaf to raw cocoon (inclusive of weight of pupa) ranges 24 kg to ideally 15 kg, and from dry cocoon to raw silk (brown colored) does 1/13 to 1/8.5. Indigenous silkworm varieties came from Lam Dong province, the center of sericulture in Viet Nam.

Imported Chinese silkworm (bi-voltine) eggs are costly (a box with 15 grams of egg covering 200 square meter of mulberry field, producing 25 - 30 kg of cocoon, at maximum 35 kg but usually only 15 - 20 kg), sometimes accounting for more than 10 % of the production cost of cocoon, 50 - 55 thousand VND / box, or 2 - 3 times as much as domestically produced eggs of poly-voltine worm (20.6 thousand VND per box containing 17 grams of egg). Domestic production of bi-voltine eggs constitutes an important task to be achieved as soon as possible. Currently silkworm rearers hatch poly-voltine eggs five to six times a year, but the cocoon has smaller size and shorter length of filament (only 700 - 800 meters per cocoon as compared with 2000 meters of bi-voltine cocoon). Bi-voltine cocoon has superior quality to poly-voltine, i.e., bigger size of cocoon (longer filament length) and better luster.

Outlet of Vietnamese silk in the international market wholly depend on the cost of production and quality. To meet these requirement, it is advised to establish a complete domestic supply of high-class silkworm eggs in place of imported ones in collaboration with advanced countries (but not competitors). It is also recommended that processing and marketing sectors should protect producers by guaranteeing floor price for cocoon (according to the grades) so that sustainable material supply can be secured, otherwise producers become reluctant to continue laborious and unremunerative sericultural activities, leading to extinction of silk industry. As to targets for future expansion, sericultural research provides exploitation of artificial feeding materials like soybean protein for hatched worm, that are cheaper than mulberry leaf, more rational use of by-products, i.e., pupa and silkworm manure.

### (3) Rubber

Rubber trees need fertile soils like basaltic origin free from stone or gravel, organic/silty red-yellow ferallitic soils with deep surface layer, so it is dominantly distributed in Q. Tri province in the study area. It can be multiplied with seed by transplanting seedlings. The planting density ranges 500 - 700, or on average 2.5m x 6.0m. In Q. Tri province, RIM - 600 and GT-1 are planted as major varieties. Latex collection begins at 6th or 7th year after planting but the yield gets stable after 10th year to 15th or later. Some trees with retarded growth will die out and number of available trees for latex collection gradually decrease.

Cutting on bark for latex collection is done on the trunk about 60cm above the ground, hiding bark by indenting 4mm notch every other day by stimulating trees with proper stimulant agents. A skilled collecting person can deal with 220 - 250 stumps (or 0.4 - 0.5 ha) per day, collecting 10 - 30 kg of liquid latex that is sold to the mill at the rate of 2 thousand VND per kg. 10 kg of liquid latex derives 3 kg of dry latex. Quantity of latex exudation from a tree ranges 25 - 60 gram per cutting in the 2nd year. Cutting begins from 4 a.m. to 5:30 a.m. and after 5 hours collection starts from 9 a.m. to 10 a.m. In windy days latex secretion decreases and dust is often mixed in latex milk, deteriorating quality. This is one of the reasons why windbreak (Eucalyptus, Casuarina and Keo tree) should be planted in the periphery of rubber plantation.

Average dry rubber yield reaches over 1 ton per hectare from 11th year, while maximum yield of 1.3 tons per hectare is held from 14th to 17th years with the number of stumps around 400 / ha. Rubber trees can leave lumber 45 - 50 years after planting at the rate 0.6 cubic meter per tree at the density 150 stumps / ha, or 90 cubic meters per hectare, the value of which ranges 600 - 800 US\$ / m<sup>3</sup>, or 60 thousand US\$ per hectare. Younger rubber trees with the age 35 - 40 years after planting are traded at the price 50 US\$ / m<sup>3</sup>, or around 50 thousand US\$ / ha with a density of 200 stumps / ha. and a yield of 0.5 cubic meter per stump.

As by-product, rubber fruits produced from old rubber trees can be sold either as materials of seedlings or as oilseed from which rubber nut oil is extracted. The expected yield of nuts amounts to 1.2 - 1.5 tons per hectare, with the value of 9,000 VND per kg. However, young trees with the age of 10 - 15 years can produce only 0.9 ton or less. Rubber nut contains 22 - 23 % of oil in it and is processed into soap or paint solvent oil.

As to recent export price of rubber produced in Viet Nam, 313.3 US\$ for processed rubber and 175 US\$ for dried latex were recorded as per-ton FOB in 1995 - 96. Malaysian rubber stuck firmly at 490 US\$ in London commodity market in late October 1996. However, Vietnamese rubber has quoted cheaper, less 400 US\$ due to low processing quality.

#### (4) Coffee

Q. Tri province has the most suitable temperature regime and soils to coffee planting, and also in northern Q. Ngai province there are some new economic zones that began coffee planting. Catimore variety currently predominates that free from virus disease was imported from Cuba in Dac Lac province and later brought to Q. Tri, but in Thailand farmers also grow this variety. Three other arabica varieties, i.e., Catura, Catoway and No.1602 have virus disease. Robusta varieties, such as Mit (Jackfruit Coffee) has been planted but it takes 4 - 7 years after planting seedlings. Coffee seedlings are prepared by sowing ripe fruits into soil filled in poly-vinyl bags in spring - summer and irrigated under shade for a few months.

After transplanting, the initial density of which ranges 12,000 to 16,000 trees per hectare and thinning will be done as they grow, the first fruits ripe 2nd year giving 1 - 1.5 tons per hectare, then 3rd year the yield increases to 1.5 - 2 tons per hectare on cherry coffee basis. Both arabica and robusta can be planted without shading trees but in case of arabica, small bush type, some shading trees like Leucaena are desirable for avoiding sun-burn in open field.

Arabica coffee should have good color, bean shape and flavor because it's served as roasted beans instead of pulverized instant coffee made from robusta coffee. It follows that both way of harvesting and post-harvest treatment are very important to keep quality for better unit price. Current post-harvest practice employed by the producers settled in hilly and mountainous zone is not satisfactory from the quality point of view, for they spread picked cherry beans directly on earth ground to dry. To provide beautiful and homogenous quality beans, it's essential to pick only well-ripe beans and to dry them on artificial floor, or to treat beans with wet process before threshing into beans for roasting.

As to international market price of Vietnamese coffee, it was averaged at 1,818.2 US\$ /ton for all Vietnamese exports for 1995/96. However, local farm-gate price recorded around 11,500 VND / kg., while 9,000 - 9,500 VND is estimated as break-even price without any farm profit.

#### (5) Pepper

Pepper requires alive mother trees for pepper vines to climb, and often Jackfruit trees play this role. It also requires windbreak tree bush around the planted plots. The planting density is around 900 - 1,600 mother trees per hectare, or with an interval of 3m x 4m - 2.5m x 2.5m, with a height of 4 - 5m. Pepper vine has a high moisture requirement and sometimes irrigated by gravitational systems that may increase green pepper yield by 20 per cent. Flowering begins from the 2nd year after planting but usually harvest starts from 4th year and economic yield is obtained from 6th to 8th years. Life of vine lasts 12 - 15 years for economically viable operation, and over this period vines become too senescent to sustain stable yield.

As for current price level, since world pepper price experienced historical drop in mid-eighties, the demand has remained weak and the pace of price recovery has been sluggish. Dried grain is sold at 7 to 8 US\$ / kg in 1996.

#### (6) Tea

Tea grows fast to produce leaves from the second year of planting, or it takes only twenty months to develop thrived brush for leaf picking. Well developed tea garden allows to pick

25 to 30 times a year offering 6 - 12 tons of fresh leaves per hectare. Picking last for seven months from April to October.

Every winter all the shoots are cut off from their foot to renew shoots for picking buds. It is usually densely planted to reach 20 thousand or more stumps per hectare. It is multiplied by seed rather than using scion. In general, four tons of fresh tea buds are harvested from a hectare, and 15 % of the harvest is transformed into products, namely 5 % of the weight is processed into dried tea buds, and the rest 10 % into crude tea. Current yield level of fresh leaves remains as low as 2.7 tons / ha, but it can be raised to 150 % as much as the present level. Tea requires high dose of nitrogen fertiliser, annually 150 - 300 kg N equivalent / ha.

Price of black tea in London auction houses has been held at 0.67 US\$ / kg. for medium quality brews. Ex-factory price of domestically consumed green tea in Q.N.D.N. remains low except Thet (Vietnamese new year) season, mostly fluctuating about 32 thousand VND/kg. Tea processing mills buy fresh leaves from farmers at 7,500 VND per 5kg. or equivalent to 1kg of dried crude tea. A picking lady can pick at least 25 kg of fresh leaves per day, the value of which ranges from 0.8 - 1.6 thousand VND depending on the quality. Usually, long size picking can collect 100 kg per day by a picking lady for which only 800 VND /kg is paid, but short bud picking fetches only 30 - 40 kg per day per women, that offers 1.600 VND /kg.

### (7) Cinnamon

Distribution of cinnamon trees is largely limited in South-east Asia with less international competition. French people like to use cinnamon bark for cooking, but nowadays the U S market imports by far largest amount from Viet Nam. Cinnamon has two by-products with commercial value, these are leaves from which cinnamon oil (main constituent is cinnamaldehyde) is extracted to prepare incense for religious use, and lumber felled in 40 - 45 years after planting.

Initial planting density ranges 7,000 to 10,000 trees per hectare, but this canopy should be thinned as years proceed, so that the density finally approaches 2,000 trees per hectare for log. Cinnamon bark can be harvested from 8th years after planting, but leaves can be collected from 4th - 5th year. Intercropping with food crops is possible for two years just after planting. After forming canopy, a plant parasite often give damage to sapling, but the preventive measures have not yet been found. This parasite prefers shade and poor ventilation that is to say densely planted condition, possibly proliferates with spores that stick trunks of young trees, invading into xylem to form monstrous parasitic body alike aerial roots without leaf.

As regards price, FOB price of Vietnamese cinnamon bark dropped from 20 to 11 US\$/kg but this level is still fully profitable. Besides, cinnamon lumber or pole has high value of about 60 - 70 US\$ / m<sup>3</sup>,

### (8) Cashewnut

Cashew nut can adapt itself to poor soil and drought condition with a high survival rate. However, higher yield and better quality are brought from favorable growing conditions. In the study area, nut production is confined to southern coastal part of Q.N.D.N. and coastal area in Q.Ngai province. It has been planted on hills with gentle slope or on coastal white sand. Since soils are derived from granite and futile in hillside and aeolian deposits made of silica sand in marine coast, they tend to deplete both nutrient and soil moisture with higher risk of drought during spring - summer season. As to planting density, 800 - 900 trees per hectare is ideal. Harvesting season falls on July - August and farmers have to decapsule nuts before selling. In Q.N.D.N., VEGE-TEXCO factory in Tam Ky can annually process up to 1,500 tons of nuts, and buyers from HCMC also collect decapsuled nuts from producers.

Cashewnut has two by-products but they are badly under-utilized so far in the producing area. Namely, capsule of nut contains cashew oil used for painting while cashew apple can be used as fruit juice, material of wine and feedstuff for piggery. Flowering begins from the second year after planting (0.5 ton / ha), but harvest starts from 3rd year (1 ton / ha), and up to 3rd year canopy is open to allow inter-cropping with pine-apple etc. Yield of cashew apple



reaches more than ten times as much as nut yield, but now only children chew just after harvest and mostly wasted. In the field of futile soils, trees require heavy dose of chemical fertilizers, 2.5 kg NPK / tree with the frequency of application three times a year amounting 3 tons / ha.

Farm-gate price of cashewnut has been weak, hanging around 8,500 VND / kg as decapsuled bean in 1995, but suddenly dropped to only 1,000 VND / kg in 1996.

#### (9) Cacao

Cacao planting in economic scale is so far confined in Q.Ngai province where growth conditions for cocoa and its shading trees seems favorable. Chocolate processing demand thereof lately arisen from sugarcane industrial complex to manufacture sweet candy in Q. Ngai town triggered to establish cacao plantation in this province. Cacao harvesting takes more than four years after planting saplings. Planting density is limited to 500 - 700 trees per hectare, or 3 x 3m - 3.5 x 3.5m because a tree should be surrounded by four cover trees like *Leucaena*. Mature trees give 75 fruit per tree, or 38 thousand fruits / ha, weighing about 0.8 ton / ha. Cacao has two fruiting season, main one in March - April and September - October.

Cacao trees are very sensitive, attacked by many diseases and pests and only careful management can make it sustainable for a decade or two, and hardly recommended for ethnic minorities, just as rubber trees are not suitable for them to grow.

World market price of cocoa still remains low, London market quoted around 550 US\$ per ton owing to hefty crop and dumping sale by a major producer, Cote d'Ivoire. In the calculation by the study team, 800 US\$ / ton will be a reasonable price off-setting production and initial investment cost in Viet Nam.

## Conclusion of Cost-benefit Analysis

All tree crop production has low return structure though mostly feasible. Figure 1 shows the rate of initial investment cost for the selected crops. Sugarcane has the heaviest initial cost requirement if the field is reclaimed with irrigation facility for planting cane. Forest tree planting also requires heavy initial investment, followed by pepper, mulberry and coffee. In cashewnut, rubber, cacao and tea plantation, initial investment rate accounts for lower rate than other crops. The relative cost portion of crop husbandry is larger for cacao, cashewnut and cinnamon, but smaller for mulberry, rubber and forest tree planting. As to cost for harvest and post-harvest, rubber has by far substantial portion followed by mulberry and tea. These results imply that Initial investment as well as harvest and post-harvest cost comprise major part of cost requirement for these crops, and access to investment resources plays key role for developing these crops.

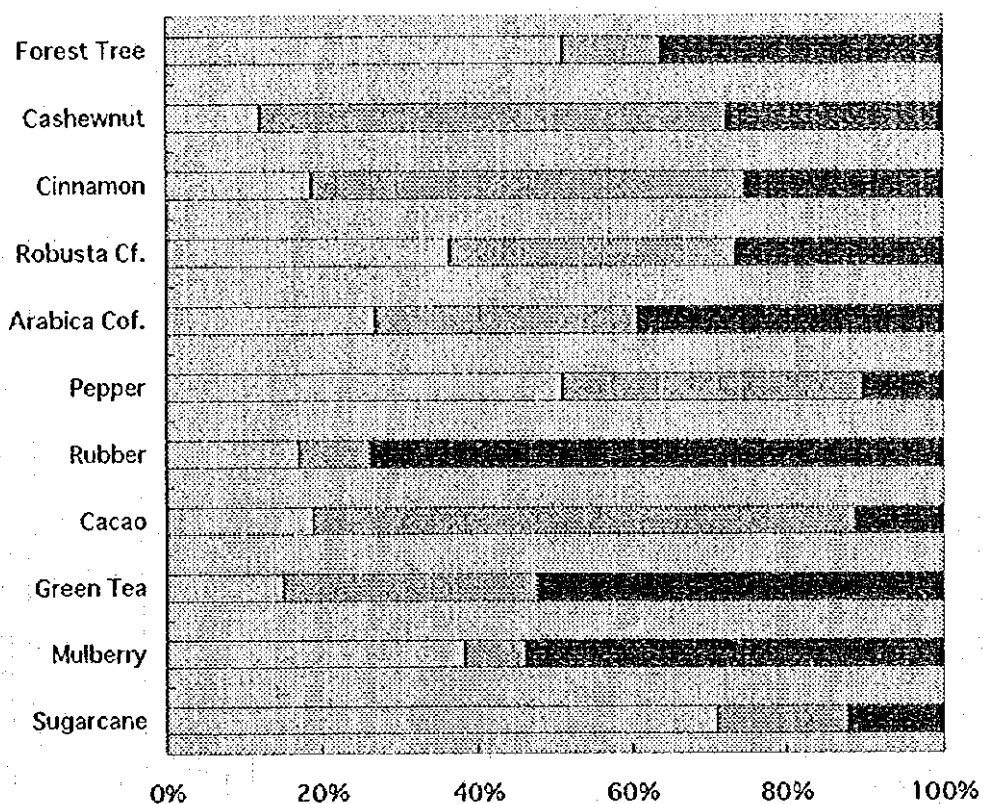
Figure 1 also indicates relative labor intensity of these crops, in which rubber shows highest labor consumption followed by coffee, tea and mulberry. Generally, all these crops have fairly labor intensive character and hence it is worth introducing in the area with ample idle labor force.

Figure 2 gives yield development profile by year after planting. the crops employed in this study are classified into three categories of yield development process. Sugarcane, mulberry and tea can develop their yield in a fastest way, while pepper, coffee, cacao and cashewnut take longer time to reach economic level of yields, and the peak yield levels do not last for a long time. Rubber and cinnamon has the longest gestation period and yields develop with slower pace, but the level last fairly long period. These yield development patterns are of course reflected in FIRR rather than in B/C ratios.

Finally, Figure 3 displays crop profitability based on current price regime. Coffee, rubber and cinnamon have higher rate of net profit as of late 1996, however, this trend will readily change as the prices fluctuate in the international commodity market and quality improvement. Crop diversification is thus necessary because the present trends in crop profitability do not last for a long time and some day mulberry, pepper or cacao would make larger profits in place of currently profitable crops.

Figure 1 Cost Composition by Stage of Plantation

Initial Investment Cost / Maintenance Cost / Harvest & Post-Harvest Cost



Labor Intensity of Crop Husbandry

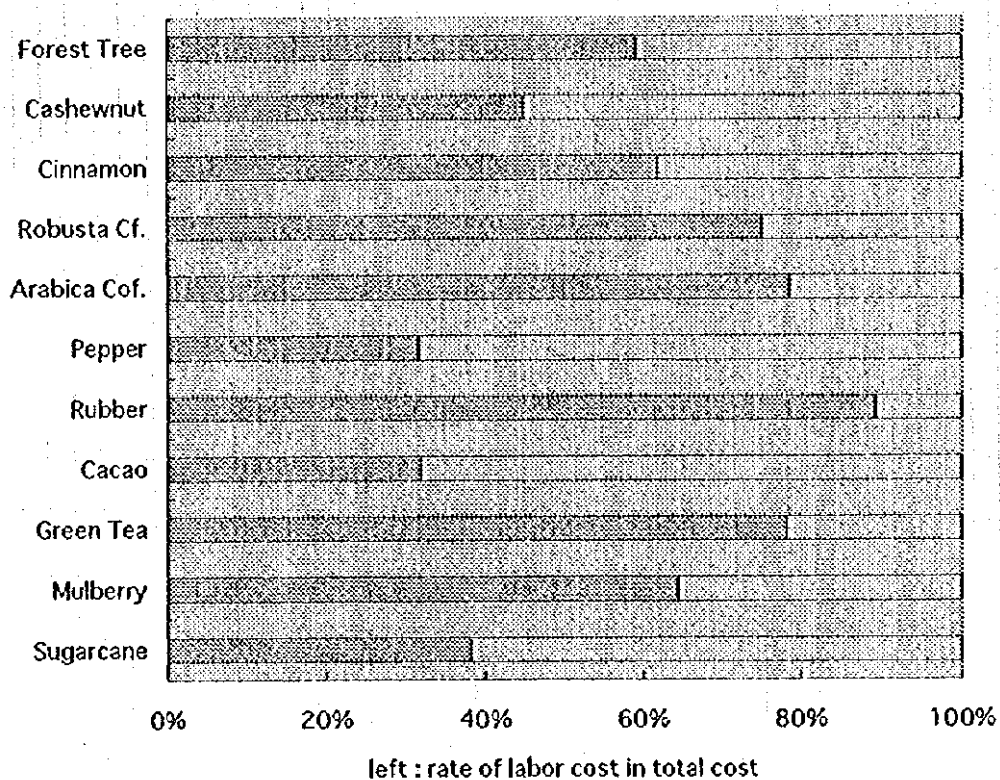


Figure 2 Crop Yield Development Profile

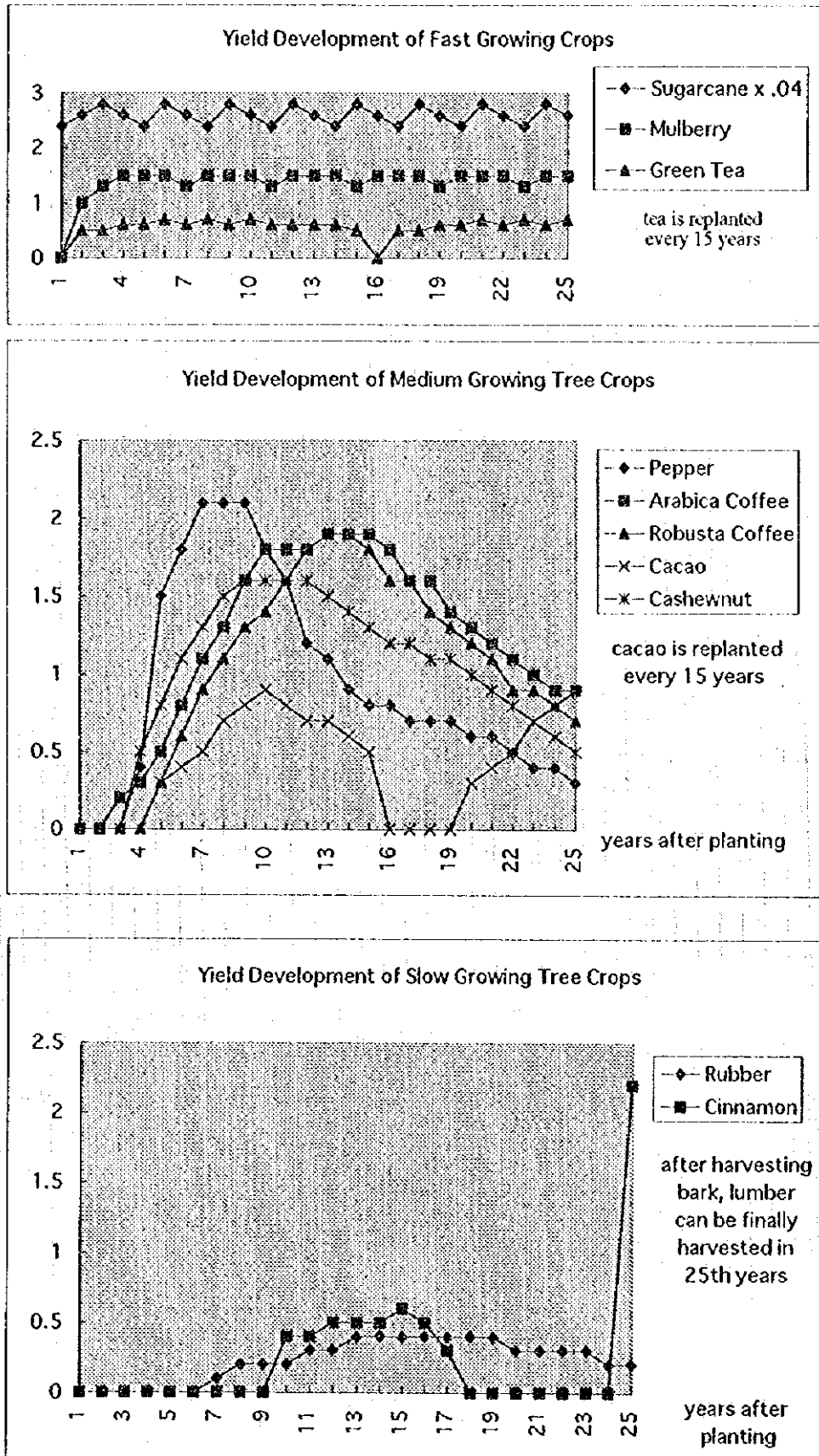
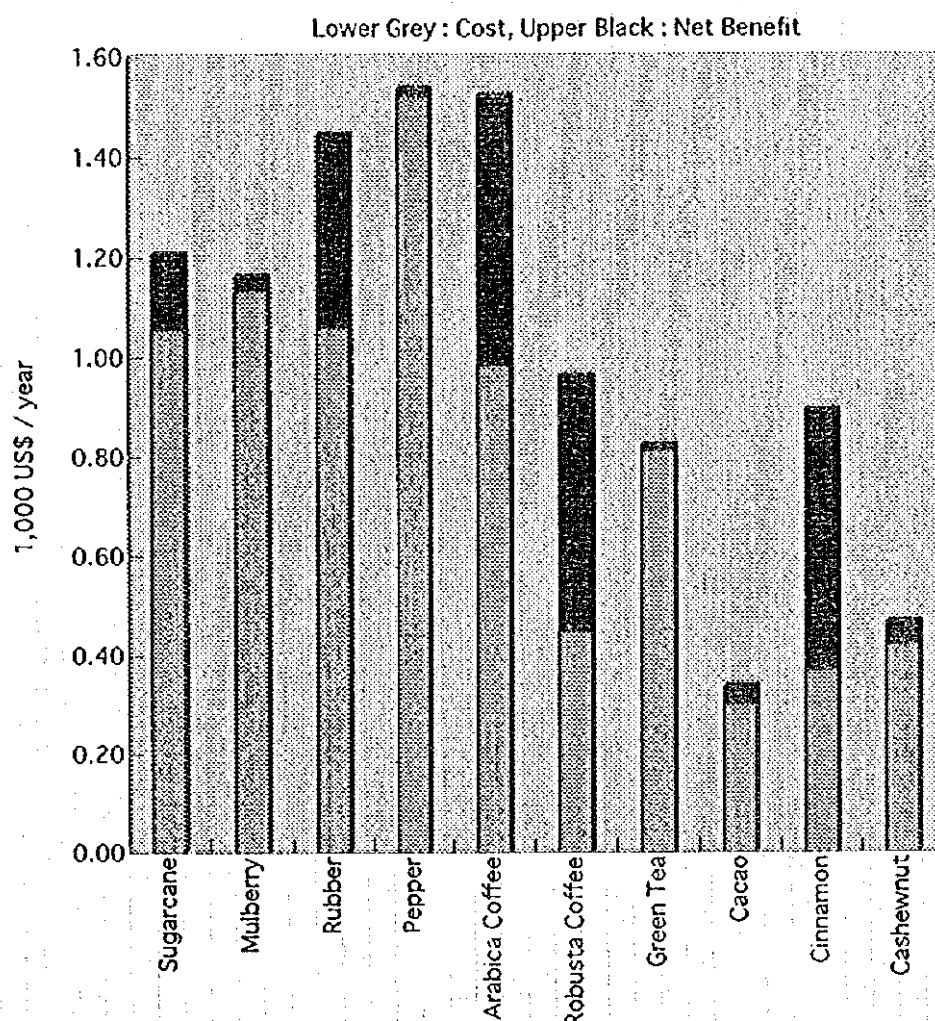


Figure 3 Benefit and Cost Structure of Industrial Crops





## CHAPTER 6    FORESTRY

### 6.1    PRESENT CONDITION

#### 6.1.1 Forest Land

##### 1)    General

Table 6.1 provides the current forest status of forest land, including the area composition, the breakdown of which give the area of bare land and forest covered area.

**Table 6.1    Forest Status of Forest Land by Province**

(Unit: sq. km.)

Forest status	Quang Tri	T.T.Hue	Q.N.Da Nang	Quang Ngai	Total
Special-use forest	11	339	625	52	1,027
Forest covered area	6	231	347	2	586
Bare land	5	108	278	50	441
Protection forest	1,453	1,553	3,007	3,002	9,015
Forest covered area	600	971	1,958	645	4,174
Bare land	853	582	1,049	2,377	4861
Production forest	1,600	1,479	5,310	895	9,284
Forest covered area	475	513	2,607	819	4,414
Bare land	1,125	966	2,703	76	4,870
Total forest land	3,064	3,371	8,942	3,969	19,346
Total forest covered	1,081	1,715	4,912	1,466	9,174
Total bare land	1,983	1,656	4,030	2,503	10,172
Total provincial area	4,592	5,009	11,989	5,856	27,446
Forest coverage (%)	(24)	(34)	(41)	(25)	(33)

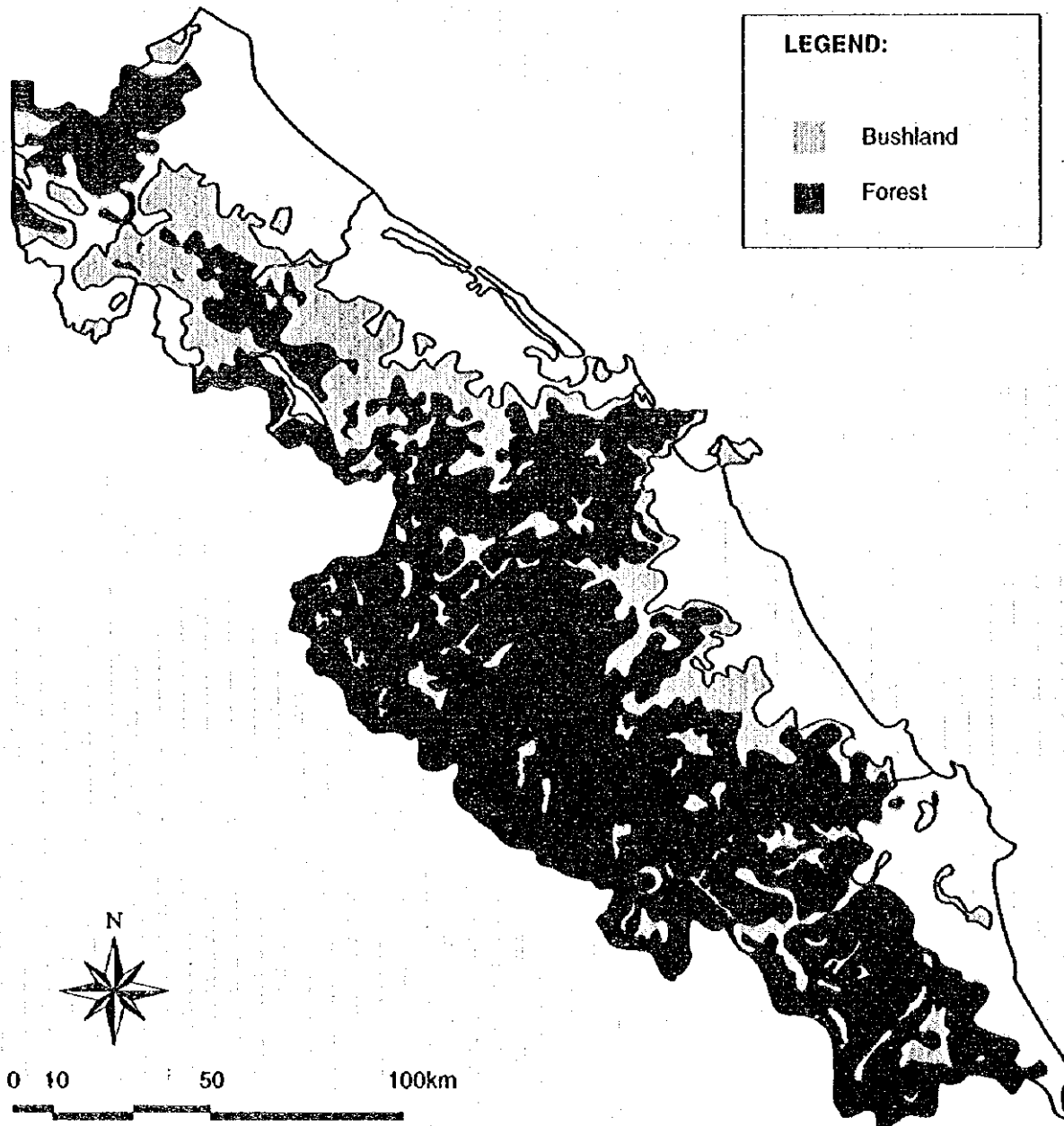
Source: Forestry Department of Each Province, 1994

According to Table 6.1, the area under bare land accounted for a higher percentage than forest land. For example, 65% in Quang Tri, 40% in T.T.Hue, 45% in Q.N.Da Nang and 63% in Quang Ngai. On the other hand, the rate of forest coverage by Province ranges from 24% in Quang Tri, and 25% in Quang Ngai (as against 28% for the state average) to 34% in T.T.Hue and 41% in Q.N.Da Nang, the latter two Provinces have higher than national average rate.

## 2) Satellite Imagery

Figure 6.1 shows the state of forest cover in the study area, interpreted from a set of satellite imagery. From this map, remarkable deforestation is observed in Quang Tri and T.T.Hue Provinces.

Fig. 6.1 Forest Cover Map of the Study Area





### 6.1.2 Quang Tri Province

1) Total Area: 4,592 sq. km.

2) Forest Land

Table 6.2 Forest Land of Quang Tri Province

	Total	Forest-covered Area	Bare Land
Special-use forest	11 (100)	6 (55)	5 (45)
Protection forest	1,453 (100)	600 (41)	853 (59)
Production forest	1,600 (100)	475 (30)	1,125 (70)
Total	3,064 (100)	1,081 (35)	1,983 (65)

Source: Forestry Department of Quang Tri Province

- Forest coverage: 24 %
  - Natural forest: 811 (26)
  - Man-made forest: 270 (9)
  - Non-forested land: 1,983 (65) (Bare land and open land)
- Total: 3,064 (100)

#### 3) Man-made Forest

- + Concentrated afforestation: 270 sq. km.
- Eucalyptus spp.: 120 sq. km.
- Pinus spp.: 90 sq. km.
- Acacia spp.: 35 sq. km.
- Casuarina spp.: 20 sq. km.
- Others: 5 sq. km.

#### 4) Annual Forestry Production

**Table 6.3 Annual Forestry Production in Quang Tri Province**

	Unit	1991	1992	1993	1994
1) Production value (Fixed value in 1989)	million dong	13,695	12,719	15,245	16,087
State owned	million dong	1,063	1,544	2,104	1,072
a) Value of planting and protecting	million dong	3,084	2,889	3,526	4,396
- Planting	million dong	2,143	2,284	3,014	3,806
- Protecting	million dong	929	455	422	590
- Up grading	million dong	12	15	90	-
b) Forest products exploiting	million dong	10,163	9,069	10,565	10,535
in which exploiting wood	million dong	1,440	1,182	2,582	2,590
c) Other products	million dong	448	761	1,154	1,556
2) Main products					
a) Planting	ha	4,399	4,451	6,551	6,543
- Concentrated planting	ha	799	2,111	3,311	4,154
- Scattered planting	ha	3,600	2,340	3,240	2,389
b) Protecting	ha	5,464	2,730	3,267	4,822
c) Up grading	ha	80	1,000	600	-
	Unit	1991	1992	1993	1994
d) Forest products exploiting					
- Log	m3	12,000	9,850	21,516	21,588
- Fuelwood	Ste	108,000	108,600	279,208	288,693
- Pine resin	Ton	15	38	59	91
- Rattan	Ton	450	1,600	2,721	742
- Muoil seeds	Ton	1	2	52	-
- Bamboo	1,000Pcs	3,900	3,800	783	788
- Bamboo sprout	Ton	440	320	15	10

Source: Statistics of Quang Tri Province 1995

#### 5) Planting Area

**Table 6.4 Annual Planting Area in Quang Tri Province**

	Unit	1991	1992	1993	1994
1) Concentrated planting area	ha	799	2,111	3,311	4,154
In which - State own	ha	270	170	927	820
- Group and Individual	ha	530	1,942	2,384	3,334
2) Scattered planting	1000 Trees	7,200	4,681	6,481	4,778
3) Take care forest area	ha	5,465	2,730	3,267	4,822
4) Concentrated planting by district					
- Dong Ha	ha	50	36	68	75
- Quang Tri	ha	-	10	10	-
- Vinh Linh	ha	90	360	450	746
- Gio Linh	ha	70	342	504	370
- Cam Lo	ha	-	324	411	360
- Trieu Phong	ha	60	400	397	380
- Hai Lang	ha	90	290	426	1,070
- Huong Hoa	ha	40	80	120	333
- Other organization	ha	130	-	-	-

Source: Statistics of Quang Tri Province 1995

## 6) Exploiting Forest Products of State Own Forestry Industry

**Table 6.5 Annual Exploiting Forest Products in Quang Tri Province**

	Unit	1991	1992	1993	1994
1) Exploiting					
a) Log	m <sup>3</sup>	4,879	5,390	7,333	2,549
b) Fuelwood	Ste	560	300	450	-
c) Pine resin	Ton	15	38	59	91
2) Consumer goods					
a) Log	m <sup>3</sup>	5,000	4,190	8,193	2,958
b) Fuelwood	Ste	660	300	450	-
c) Pine resin	Ton	10	31	59	91
3) In depot					
a) Log	m <sup>3</sup>	166	1,366	506	97
b) Fuelwood	Ste	-	-	-	-
c) Pine resin	Ton	8	15	15	-

Source: Statistics of Quang Tri Province 1995

### 6.1.3 Thua Thien Hue Province

1) Total Area: 5,009 sq. km.

2) Forest Land

**Table 6.6 Forest Land of T.T.Hue Province**

(Unit : sq. km., (%))

	Total	Forest-covered Area	Bare Land
Special-use forest	339 (100)	231 (68)	108 (32)
Protection forest	1,553 (100)	971 (63)	582 (37)
Production forest	1,479 (100)	513 (35)	966 (65)
Total	3,371 (100)	1,715 (51)	1,656 (49)

Source: Department of Forestry T.T.Hue Province

- Forest coverage: 34 %

3) Natural Forest

**Table 6.7 Natural Forest of T.T.Hue Province**

Natural Forest Land	1,547 sq. km.
- Dense forest	378 sq. km.
- Average forest	398 sq. km.
- Poor forest	611 sq. km.
- Regenerated forest	160 sq. km.

Source: Department of Forestry, T.T.Hue Province

Total amount of growing stock: 17 million cubic meters. At present, the dense and average forest left over are mainly concentrated in remote, steep and uninhabited areas in Nam Dong and A Luoi districts. The fauna and flora are diversified and various.

#### 4) Man-made Forest

**Table 6.8 Breakdown of Man-made Forest**

Concentrated afforestation	292 sq. km.	(until 1994)
- Eucalyptus spp.	88 sq. km.	
- Pinus spp.	98 sq. km.	
- Acacia spp.	72 sq. km.	
- Casuarina spp.	22 sq. km.	
- Others	12 sq. km.	

Source: Department of Forestry, T.T.Hue Province

#### 5) Gross Products of Forestry

**Table 6.9 Gross Products of Forestry in T.T.Hue Province**

	(Fixed value in 1989, Unit: 1,000,000 Dong)			
	1991	1992	1993	1994
Total	16,445	19,952	22,794	22,071
In which: state own	2,284	191	2,618	5,461
1) Planting and protecting	2,047	2,597	4,068	4,747
a) Concentrated planting	805	1,227	1,964	2,126
b) Scattered planting	1,013	900	1,409	1,463
c) Take care forest	229	443	672	1,093
d) Reforestation	-	-	24	65
2) Forestry exploitation	12,947	13,453	12,421	13,076
a) In which:				
- Log	3,477	2,542	3,701	3,387
- Fuelwood	5,336	5,258	5,223	4,806
- Bamboo	2,978	3,570	1,840	1,882
3) Collecting	1,452	3,928	6,305	1,538
In which :				
- Aquilaria	1,014	3,485	1,594	1,434
4) Forestry services	-	-	-	2,71

Source: Department of Forestry, T.T.Hue Province

## 6) Planting and Take Care of Forest

**Table 6.10 Planting and Take Care of Forest in T.T.Hue Province**

	Unit	1991	1992	1993	1994
1) Concentrating planting	ha	1,298	1,979	3,168	3,430
In which : state own	ha	531	349	978	1,010
2) Scattered Planting	ha	2,250	2,000	3,131	3,250
In which: state own	ha	-	-	-	-
3) Take care of forest	ha	1,062	2,051	3,110	5,060
In which : state own	ha	1,062	727	1,000	2,007
4) Reforesting	ha	-	-	235	435
In which : state own	ha	-	-	235	435

Source: Department of Forestry, T.T.Hue Province

## 7) Forestry Products

**Table 6.11 Forestry Products in T.T.Hue Province**

	Unit	1991	1992	1993	1994
1) Exploiting forestry products					
- Log	m <sup>3</sup>	28,978	21,187	30,844	28,333
In which: state own	m <sup>3</sup>	13,187	10,617	11,045	12,333
- Fuelwood	Ste	355,700	350,500	348,193	320,369
- Bamboo	1,000Pcs	2,978	3,570	1,840	1,882
- Short bamboo	1,000Pcs	1,200	1,500	1,929	1,780
- Pine resin	Ton	14	6	9	9
- Rattan	Ton	6,555	8,750	6,705	5,719
- Bamboo sprout	Ton	500	475	554	577
2) Collecting and hunting products					
- Aquilaria	Kg	1,195	4,100	1,875	1,687
- Wooden goods	Ton	2	2	3	3
- Bird meat	Ton	25	27	25	28
- Bone and feather of Animals and birds	Ton	1	2	2	2

Source: Statistics of T.T.Hue Province 1995

#### 6.1.4 Quang Nam - Da Nang Province

1) Total Area: 11,989 sq. km.

2) Forest Land

**Table 6.12 Forest Land of Q.N.Da Nang Province**

(Unit : sq. km., ( % ))

	Total	Forest-covered Area	Bare Land
Special-use forest	625 (100)	347 (56)	278 (44)
Protection forest	3,007 (100)	1,958 (65)	1,049 (35)
Production forest	5,310 (100)	2,607 (49)	2,703 (51)
Total	8,942 (100)	4,912 (55)	4,030 (45)

Source: Forestry Service of Q.N.Da Nang

+ Forest coverage: 41 %

**Table 6.13 Forest Type of Q.N.Da Nang Province**

- Natural forests	4,424 (50)	
- Man-made forests	488 (5)	
- Non-forested lands	4,030 (45)	(Bare land and vacant land)
Total	8,942 (100)	

Source: Forestry Service of Q.N.Da Nang Province

Quang Nam - Da Nang's forest has many specious wood as: *Sindora cochinchinensis*, *Hopea pierreii*, *Erythrophleum pordii*, *Parashorea stellata*, *Talauma gioi*, *Dipterocarpus* spp. and so son. and specious forest products as *Cinamomum cassia*, *Aleurites montana*, Rattan and pharmaceutical products and so on.

#### 3) Man-made Forest

1) Concentrated afforestation: 488 sq. km

- Eucalyptus spp 355 sq. km
- Pinus spp. 32 sq. km.
- Acacia spp. 51 sq. km.
- Casuarina spp. 47 sq. km.
- Others 3 sq. km.

#### 4) Main Indicators of Forestry

**Table 6.14 Main Indicators of Forestry of Q.N.Da Nang Province**

	Unit	1993	1994
1) Gross output (Fixed value in 1989)	million dong	37,883	39,920
a) Planting and protecting	million dong	6,295	8,665
b) Exploiting forestry products	million dong	31,302	30,525
c) Other forestry industries	million dong	286	730
2) Main products	-	-	-
a) Concentrated planting	ha	2,572	5,795
+ State own	ha	2,039	5,458
+ Non state own	ha	533	337
b) Scattered planting	1000 Pcs	19,294	18,027
c) Exploited log	1000 m <sup>3</sup>	126	137
In which state own	m <sup>3</sup>	34	36
d) Exploited fuelwood	1,000 Ster	836	760
In which state own	1,000 Ster	-	-
e) Cinnamon product	Ton	415	229
f) Betel product	Ton	79	215

Source: Statistics of Q.N.Da Nang Province 1995

#### 5) Main Products of Forestry in 1994 (Divided by Economic Sector)

**Table 6.15 Main products of forestry in 1994**

	Unit	Total	Divided		
			State	Group	Individual
1) Planting and protecting	-	-	-	-	-
a) Concentrated planting	ha	5,795	5,459	182	154
b) Scattered planting	ha	9,014	-	-	9,014
c) Take care forest	ha	3,330	3,330	-	-
d) Reforesting, tinding	ha	2,520	2,520	-	-
2) Exploiting forest products	-	-	-	-	-
a) Log	m <sup>3</sup>	136,619	35,936	8,450	92,233
- From natural forest	m <sup>3</sup>	57,781	35,936	222	21,623
- From man-made forest	m <sup>3</sup>	78,836	-	8,228	70,610
b) Fuelwood	Ster	760,215	-	9,424	750,791
c) Rattan	Ton	4,740	1,280	667	2,793
d) Cashew nut	Kg	7,807	-	75	7,732
e) Cinnamon	Kg	228,599	-	-	228,599
f) Betel	Kg	214,706	-	-	214,706
g) Small bamboo	ng.c	1,758	-	-	1,758
3) Collecting forest products	-	-	-	-	-
a) Bamboo sprout	Ton	1,107	-	-	1,107
b) Honey	Kg	23,637	-	24	23,613
c) Loong boong	Kg	56,232	-	520	55,712
d) Cardamom	Kg	991	-	-	991
e) Nut of rattan	Kg	1,832	-	-	1,832
f) Pharmaceutical products	Kg	27,148	-	1,600	25,548

Source: Statistics of Q.N.Da Nang Province 1995

### 6.1.5 QUANG NGAI PROVINCE

1) Total Area: 5,856 sq. km.

2) Forest Land

**Table 6.16 Forest Land of Quang Ngai Province**

(Unit : sq. km., ( % ))

	Total	Forest-covered Area	Bare Land
- Special-use forest	52 (100)	2 (4)	50 (96)
- Protection forest	3,022 (100)	645 (21)	2,377 (79)
- Production forest	895 (100)	819 (92)	76 (8)
Total	3,969 (100)	1,466 (37)	2,503 (63)

Source: Agricultural Forestry Department of Quang Ngai Province

- + Forest coverage: 25 %.
- Natural forests 956 (24)
- Man-made forests 510 (13)
- Non-forest-covered lands 2,503 (63) (Bare land and vacant land)
- Total 3,969 (100).

Natural forests : Total amount of growing stock : 11 million cubic meters. Dense forest is 7 % of the natural forests, the fauna and flora are diversified and various.

### 3) Man-made Forests

- Concentrated afforestation (by 1994): 270 sq. km.  
In 1994: planted 52 sq. km.
- Planted tree species : Eucalyptus spp. ( around 35 % )  
Cinnamomum spp. ( around 25 % )  
Casuarina spp., Acacia spp. and others
- Planted scattered trees (by 1994): 200 million trees  
In 1994 planted: 12 million trees



#### 4) Product Value of Forestry

**Table 6.17 Product Value of Forestry of Quang Ngai Province**

(Fixed Value in 1989, Unit : Million Dong)			
		1993	1994
	<b>Total</b>	<b>19,099</b>	<b>17,862</b>
1) Divided by control rank			
- Government		-	-
- Province		19,099	17,862
2) Divided by economical sector			
- State own		2,200	4,864
- Group		-	-
- Private, individual		16,899	12,998
3) Divided by field			
a) Planting and protecting forest		5,352	6,041
- Concentrated planting		2,896	3,104
- Scattered planting		1,878	1,728
- Take care forest		578	1,209
- Reforesting		-	-
b) Exploiting forest products		12,083	10,242
In which :		2,774	2,599
- Log		-	-
- Fuelwood		5,638	5,412
- Bamboo, Small bamboo		880	780
- Cinnamon		2,000	1,120
- Charcoal		55	52
- Rattan		364	249
c) Other forest field		14	14
In which:		4	5
- Honey		-	-
- Aquilaria		-	-
- Cardamom		2	2
- Gecko		-	8
d) Forestry service		1,650	1,565

Source: Statistics of Quang Ngai Province 1995

## 6) Main Forestry Products

**Table 6.18 Main Forestry Products of Quang Ngai Province**

	Unit	1993	1994
1) Planting, Protecting			
- Concentrated planting	ha	4,827	5,174
- Scattered planting	ha	4,173	3,840
- Take care forest	ha	3,042	6,363
- Reforesting	ha	-	-
2) Exploiting forestry products			
- Log	m <sup>3</sup>	25,686	23,745
In which:			
+ Eucalyptus	m <sup>3</sup>	16,231	14,500
- Fuelwood	Ster	375,850	360,800
- Bamboo, Small bamboo	1,000Pcs	880	780
- Cinnamon	Ton	625	350
- Charcoal	Ton	363	345
- Rattan	Ton	1,040	710
3) Other forestry fields			
- Honey	Ton	1	2
- Aquilaria	Kg	-	-
- Cardamun	Kg	170	182
- Gecko	Kg	865	750

Source: Statistics of Quang Ngai Province 1995

## 6.2 POTENTIALS AND CONSTRAINS

**Table 6.19 Forest Land of Study Area**

Forest Land	Study Area Total	(Unit: sq. km.) Of Which Bare Land
Special use forest	1,027	441
Protection forest	9,015	4,861
Sub total	10,042	5,302
Production forest	9,284	4,870
Grand total	19,326	10,172

Source: Forestry Department of Each Province, 1994

Table 6.19 shows the area of bare land included in the forest land within the study area, as the sum by forest status.

It is desired that priority be given to afforestation in bare land, with a view to activate the function of forest as public welfare in the following manner:

- 1) Bare land in Special use forest (441 sq. km.) should be planted to serve for tourism and amenity by preserving landscape in National Parks and so on.
- 2) That distributed in Protection forest (4,861 sq. km.) be planted as windbreaker for shifting sand control as well as for soil and water conservation.
- 3) Bare land found in production forest (4,870 sq.km.) has potential of creating forest resources, soil and water conservation, employment opportunities, chance of future wood processing industry development, through afforestation.

However, such inhibiting factors as shortage of fund for afforestation and under developed infrastructure (especially local road and feeder road network) limit afforestation.

On the other hand, the existing wood processing industry, except for that of wood chip, receives logs from the existing natural forest. From now it will be necessary to minimize log

supply from it in order to check deforestation that deteriorate further the forest reserve, and to rehabilitate it so as to enhance forest function properly.

#### **6.2.1 Qang Tri Province**

Forest land in Quang Tri Province accounts for 67 % of the total Provincial area, in which forested area occupies 35 % of the forest land, and the rest 65 % remains as bare land or vacant land area.

Forest coverage in the area accounts for 24 percent of the total Provincial area. This coverage rate is lower than the national forest coverage, i.e. 28 percent of the territorial area.

The natural forest area covers 811 square kilometers in which over 8 million cubic meters of wood are reserved as the total growing stock. Although around 3,000 cubic meters of log are produced here per year, increment in yield volume can hardly be expected for several years because 62 % of the total forest area has been preserved as natural forest where felling is restricted.

On the other hand, there exists 270 square kilometers of man-made forest, mainly consisting of fast growing species, where 5,000 - 6,000 cubic meters of pulp wood are produced annually. Also, bare land or vacant land cover 1,983 square kilometers where high potential of increasing forest resources through afforestation can be recognized.

However, such inhibiting factors as shortage of fund for afforestation and under developed infrastructure (especially local road and feeder road network ) limit afforestation.

#### **6.2.2 Thua Thien Hue Province**

Forest land in Thua Thien Hue Province accounts for 67 % of the total Provincial area, in which forested area occupies 51 % of the forest land and the rest 49 % remains as bare land or vacant land. The area under actual forest coverage accounts for 34% of the total land area in this Province.

The natural forest area covers 1,547 square kilometer, in which 17 million cubic meter of wood are reserved as the total growing stock and around 10,000 - 12,000 cubic meter of log are produced here per year. Dense forests and average density forests as classified under natural forest are mainly distributed in remote, steep and uninhabited areas. In these forests, exploitation should not be expanded because of conserving forest land and preserving the natural forest. Hence the potential of wood production from natural forest is limited.

Afforestation has been implemented in an area of 292 square kilometers by 1994, a part of which has been harvested along with planted scattered trees, and utilized as pulp wood and fuel wood. High potential is found in bare land and vacant land, accounting for 49 % of the total forest land, to create wood resources through afforestation.

However, such inhibiting factors as shortage of fund for afforestation and under developed infrastructure (especially local road and feeder road network ) limit afforestation.

#### **6.2.3 Quang Nam Da Nang Province**

Forest land in Quang Nam - Da Nang Province accounts for 75 % of the total Provincial area, in which forested area occupies 55 % of the forest land, and the rest of 45 % remains as bare land or vacant land. The area under actual forest coverage accounts for 41 % of the total land area in this Province. The natural forest area covers 4,424 square kilometers, accounting for 50% of the total forest land and producing 60 thousand cubic meters of log on average per annum.

However, it is located in mountainous area with steep slope, so exploitation should not be expanded to the extent that affects conservation, implying that there is a limit in the potential production from it.

Afforestation has been implemented in an area of 488 square kilometers by 1995, a part of which has been harvested along with planted scattered trees and utilized as pulp wood and fuel wood. High potential is found in bare land or vacant land, accounting for 45% of the total forest land, to create wood resources through afforestation.

However, such inhibiting factors as shortage of fund for afforestation and under developed infrastructure ( especially local road and feeder road network ) limit afforestation.

#### 6.2.4 Quang Ngai Province

Forest land in Quang Ngai Province accounts for 68 % of the total Provincial area, in which the forested area occupies 37 % of the forest land and the rest of 63 % remains as bare land or vacant land. The area under actual forest coverage accounts for 25 % of the total land area in this Province.

In Quang Ngai Province, the area of protected and special-use forests accounts for 77 % of the total forest land, in which already forested area covers only 21 %, while the rest 79 %, or 2,427 square kilometers, still remain bare land or vacant land. Therefore, it requires urgent afforestation, as measures of water and soil conservation.

The area under natural forest extends over 956 square kilometers, with the total growing stock amounting to 11 million cubic meters, from which log is produced at the rate of 4,000- 5,000 cubic meters per year. However, the production potential has a limit in natural forest, because of the necessity of water and soil conservation in the up-stream basin of mountainous areas.

Afforestation has been implemented in an area of 510 square kilometers by 1994, a part of which has been harvested along with planted scattered trees, and utilized as pulp wood and fuel wood. High potential is found in bare land and vacant land, accounting for 63 % of the total forest land, to create wood resources through afforestation. However, such inhibiting factors as shortage of fund for afforestation and under developed infrastructure (especially local road and feeder road network) limit afforestation.

### 6.3 DEVELOPMENT PLAN

The policy and direction in the forestry sector within the study area are focused on environmental conservation as well as sustainable development of forest resources. For the systematic formulation of a development plan, the study area is divided into three sub-areas, namely 1) the coastal area, 2) the mountainous and hilly area with intervening scattered plains and 3) the mountain area. In each of these areas, a development plan is formulated so that existing open land and barren hills can be afforested through various, relevant planting methods, and both natural and man-made forests are properly managed so that they can be rehabilitated to realize a new and proper ecological balance, thus enriching and augmenting forest resources therein.

#### 6.3.1 The Coastal Area

In the coastal area, the protection forest system is of extreme importance, aimed at attenuating storm severity and wind velocity, protecting from exposure to cold wind during the winter period and preventing sand blowing that causes sand encroachment into paddy fields. In order to carry it out, on-going PAM projects will be promoted in an intensive and expanded way by the Forest Department in close collaboration with the Agriculture and Irrigation Department.

In Quang Tri Province, existing reclamation and resettlement projects will be expanded in cooperation with the Irrigation Department by constructing polder dikes and afforestation with *Casuarina* spp. and *Acacia* spp.. As to development of shifting sand control forests, cashew nut tree (*Anacardium occidentale*) orchards will be established along the coastal area of Quang Nam Da Nang and Quang Ngai Provinces, where silica sand patches are widely distributed, in addition to the on-going projects in which *Casuarina* spp. (locally called Philao) is employed as