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1. AGRICULTURE IN VIETNAM

1.1 General

In the 1990s, in addition to far-reaching reforms in agriculture involving de-collectivization, allocation of land to farmers and liberalization of prices and markets, there was also major investment in rural infrastructure. Consequently, agriculture, forestry and fishery sector growth averaged 4% over the period from 1991 to 1997. Performance in 1998 was disappointing with 2.8% growth due mainly to drought-affected low harvests, and partially to the effect of Asian economic crisis. A bumper rice crop, as well as growth in fisheries and livestock in 1999, boosted agricultural growth to 5.2%. Agricultural growth is estimated to have grown by around 4% in 2000.

The agriculture, forestry and fishery sector (agriculture sector) accounts for about 23.8% of GDP in 1999 at constant price of 1994, of which agriculture sub-sector accounts for about 81.8%, forestry for 4.4%, and fishery for 13.8% as shown in the following table. Approximately, half of the gross value of agricultural production comes from food crops, while industrial crop account for 16.7%, fruit crops 6.1%, vegetables and beans 5.9%, and livestock 18.7%.

Gross Output of Agriculture, Forestry &Fishery at constant price of 1994

(Unit: Bill. dong)

	1990			1999			1999/1990
	B. dong	%	%	B.dong	%	%	%
Agriculture	61,817.5	82.5	100.0	102,932.9	81.8	100.0	66.5
Cultivation	49,604.0		80.2	82,945.6		80.6	67.2
Food Crops	33,289.6		53.9	52,738.1		51.2	58.4
Industrial Crops	6,692.3		10.8	16,976.7		16.5	153.7
Fruit Crops	5,028.5		8.1	6,193.4		6.0	23.2
Vegetables & Beans	3,477.0		5.6	5,946.6		5.8	71.0
Livestock	10,283.2		16.6	17,337.0		16.8	68.6
Service	1,930.3		3.1	2,650.3		2.6	37.3
Forestry	4,969.0	6.6		5,415.1	4.4		9.0
Fishery	8,135.2	10.9		17,425.0	13.8		114.2
Agriculture, Forestry & Fishery	74,921.7	100.0		125,773.0	100.0		67.9

Source: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000.

Agriculture sector's share in GDP declined from 31.8% of GDP in1990 to 23.8% in1999, but the share of labor force engaged in agriculture sector has hardly changed over this period, remaining at about 70% of total labor force. The share of labor in agricultural sector is larger than the share of agriculture sector in GDP, an indication of low agricultural labor productivity. However, from the national economic point of view, agriculture sector is still very important. It accounts for the largest share of

employment (69%), a significant share of exports (40%), and about 80% of the population being directly or indirectly involved in agricultural activities live in rural areas.

Even though Vietnam has made remarkable progress in reducing poverty over the five years period from 1993-1998, poverty still affects a large share of the population. The consequence of a large share of agricultural labor coupled with low agricultural labor productivity is poverty in rural areas. Slightly less than half of all agricultural households are poor as discussed in detail in the later section of 1.3.

1.2 Present Agriculture Situation in Vietnam

1.2.1 Agricultural Household and Agricultural Land

A total agricultural household in Vietnam is 10,981,000 in 1998 increasing 32% from 8,315,000 in 1985. A total agricultural land is estimated at 8,080,000 ha increasing 16% from 6,942,000 ha in 1985. Thus, the agricultural land to the agricultural household is gradually decreasing to 0.74 ha in 1998 compared with 0.83 ha in 1985. While this down ward trend can be seen particularly in the Northwest and Northeast regions, the Southeast and Central Highlands regions have shown the noticeable increase of the agricultural land per household.

Agricultural land holding per household is generally larger in southern area than in northern area; the smallest is in the Red River Delta region of 0.25 ha, and largest is in the Central Highlands region of 1.82 ha as shown in the following table:

Agricultural Land and Agricultural Household by Regions

(Unit:1,000 h.h. ;1,000 ha)

	Agricultural Household			Agricultural Land			Agri. Land / Household		
	1985	1998	%	1985	1998	%	1985(ha)	1998(ha)	%
Red River Delta	2,112	2,647	25.3	733.9	671.8	-8.5	0.35	0.25	-28.6
Northeast	1,159	1,773	53.0	958.6	885.4	-7.6	0.83	0.50	-39.8
Northwest	162	324	100.0	328.0	314.9	-4.0	2.02	0.97	-52.0
North Central Coast	1,283	1,681	31.0	756.6	675.9	-10.7	0.59	0.40	-32.2
South Central Coast	736	911	23.8	416.6	446.8	7.2	0.57	0.49	-14.0
Central Highlands	199	404	103.0	315.4	737.0	133.7	1.58	1.82	15.2
Southeast	683	958	40.3	991.3	1,644.4	65.9	1.45	1.72	18.6
Cuu Long Delta	1,973	2,283	15.7	2,442.0	2,704.0	10.7	1.24	1.18	-4.8
Whole Country	8,315	10,981	32.1	6,942.2	8,080.2	16.4	0.83	0.74	-10.8

Source: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

As shown in the succeeding table, most rural households in Vietnam have access to land and the population of landless is quite low of 1.2% of the total farm households. However, most farmers are extremely small, with 88% of farmers having on average less than one hectare of agricultural land, particularly in the Red River Delta, northern uplands, and Central Cost regions, where more than 80% of farmers having less than 0.5 ha.

The small size of Vietnamese farm households is further compounded by land fragmentation with an average of 6.2 plots per farm household, a situation resulting from population pressure and, particularly in the northern regions, the process of land

allocation after the dismantling of the cooperative system.

Farm Household Distribution by Region

(Unit: %)

Region	No Land	<0.2	0.2-0.5	0.5-1.0	1.0-3.0	3.0-5.0	5.0-10.0	>10.0
Red River Delta	0.8	45.5	50.4	3.2	0.1	0.0	0.0	0.0
Northeast	0.8	27.4	51.1	16.1	4.4	0.1	0.0	0.0
Northwest	1.0	14.2	37.5	23.3	21.4	2.2	0.4	0.0
North Central Coast	2.3	30.7	54.7	11.1	1.1	0.0	0.0	0.0
South Central Coast	1.5	30.9	48.7	15.5	3.3	0.1	0.0	0.0
Central Highlands	0.8	10.4	32.1	32.0	23.2	1.2	0.2	0.0
Southeast	1.5	9.7	29.0	30.3	26.4	2.3	0.6	0.1
Cuu Long Delta	0.7	6.2	25.7	30.7	32.5	3.6	0.7	0.1
Whole Country	1.2	27.0	44.0	16.2	10.5	1.0	0.2	0.0

Source: GSO, Agricultural Census 1994.

1.2.2 Land Resources and Agricultural Land Use

(1) Land resources and soil

Vietnam has a total area of about 329,241km^2. Lowland occupy only around 69, 000 km^2, about 21% of the country's area. The rest is characterized by hills, mountain ranges, and upland plateaus. The highest peak is 3,143 m above mean sea level. The lowland extends mainly in two major delta areas, the Red River delta in the north and the lower Cuu Long delta in the south. These two delta areas cover 79% of the total lowland and the remainder is scattered in the major river valleys along the narrow coastal plains located between the two deltas.

Article 11 of the Land Law, approved by the National Assembly on 14 July 1993, specifies 6 categories of land in Vietnam: agricultural land; forestry land; land for residential area; urban land; specialized land, and unused land.

The succeeding table shows the recent land use condition in the country. Generally, one third of the country is forestland and almost one third is agricultural land. The share of forestry land is higher in the northern mountainous regions and Central Highlands region than in other regions, particularly in both Delta regions.

In addition to the above, there are about 10 million ha classified as unused land or barren lands, which cannot be used for agriculture. Of which 7.7 million ha are hilly and mountainous lands and is located mostly in the northern mountainous regions and central coast regions.

(With respect to the total agriculture land in 1999, there are two different figures: the one is 9,345.4 thousand ha shown in the Statistical Year book 2000 (General Statistical Office: GSO); and the other is 8,080.2 thousand ha in the Statistical Data of Agriculture, Forestry and Fishery 1975-2000 (GSO). The later figure is used in this Report).

Land Use in Vietnam by Region

(Unit: Thousand ha)

	Total		Agriculture		Forestry		Homestead		Specialized	
	Area	%	Area	%	Area	%	Area	%	Area	%
Red River Delta	1,478.8	100.0	857.6	58.0	119.0	8.0	91.3	6.2	233.0	15.8
Northeast	6,532.6	100.0	897.9	13.7	2,673.9	40.9	58.8	0.9	204.2	3.1
Northwest	3,563.7	100.0	407.4	11.4	1,037.0	29.1	15.5	0.4	58.5	1.6
North Central Coast	5,150.1	100.0	725.3	14.1	2,222.0	43.1	52.8	1.0	231.3	4.5
South Central Coast	3,306.7	100.0	545.6	16.5	1,166.3	35.3	32.4	1.0	211.9	6.4
Central Highlands	5,447.6	100.0	1,233.6	22.6	2,993.2	54.9	33.1	0.6	137.1	2.5
Southeast	3,473.3	100.0	1,707.8	49.2	1,026.2	29.5	58.1	1.7	233.3	6.7
Cuu Long Delta	3,971.3	100.0	2,970.2	74.8	337.8	8.5	101.2	2.5	223.5	5.6
Whole Country	32,924.1	100.0	9,345.4	28.4	11,575.4	35.2	443.2	1.3	1,532.8	4.7

Source: Statistical Yearbook 2000, General statistical Office

Soil resources in Vietnam vary according to topographic and geological characteristics. Predominant soils are yellowish-red and yellowish-red humus type in mountainous areas which, together, cover about 64% of the country, followed by alluvial soils of 11%, sulfate soils (5.7%) and degraded gray soils (5.5%), and saline soils (3.0%), occupying about 26% which all lie in the lowland areas. Among alluvial soils, those of the Red River delta are of alluvium originated from the surrounding limestone mountains and are the most productive soils with some restrictions due to the effect of salinity and the presence of acid sulphate layers. Soils in the Cuu Long delta are also alluvial but adversely affected by drainage, acid sulphate and salinity problems in many places. The central part of the country is geologically characterized by sandstone formations resulting in the extensive distribution of sandy, porous, and infertile soils.

The area of main soil groups by region in Vietnam is shown in Table D.1.

(2) Agricultural land use

Of the total agricultural land of 8,080.2 thousand ha, paddy land accounted for 52.1% and the remaining is used for other purpose, particularly for upland crops. However, the share of paddy land versus upland varies considerably by regions. As shown in the succeeding table, both deltas of the Red River and the Cuu Long, where the lands are flat and the soils are quite fertile, are the major production areas of paddy and their share of paddy land accounts for a high rate of 85.8% and 76.3%, respectively. Then North Central Coast and Southeast regions having flat plains in their coastal parts follow at 58.4% and 51.7%, respectively. In the Cuu Long delta, it is possible to harvest three crops of paddy per year, whereas in the Red River delta farmers usually grow two crops of paddy and one of maize. Vegetables and some fruits are also grown in the delta areas. In other agro-ecological zones, the valleys are usually cultivated with paddy, vegetables, sugarcane and fruit. At mid altitude and in the highlands, a large amount of land is under degraded secondary forest and is used for grazing and for slash-and-burn cultivation with low value crops such as cassava, maize and upland rice. These lands are poorly managed and are susceptible to serious soil erosion. A small but increasing proportion of the uplands are under perennial crops which comprise a variety of fruit trees,

tea in the northern and central highlands and coffee and rubber in the central coast and the central highlands.

Seasonal availability of water varies widely, particularly in the central regions, which has been affected for many years by cycle of drought and flooding. While linked to climatic phenomena, irregular water availability patterns have been exacerbated by significant deforestation of the upper watersheds.

Share of Crops' Land to total agricultural Land by Regions in 1998

(Unit: 1,000 ha)

	Total Agricultural Land		Annual Crop Land				Permanent Crop Land**		Others	
			Paddy		Others*					
	Area	%	Area	%	Area	%	Area	%	Area	%
Red River Delta	671.8	100.0	576.4	85.8	44.5	6.6	10.1	1.5	40.8	6.1
Northeast	885.4	100.0	457.4	51.7	224.3	25.3	82.7	9.3	121.0	13.7
Northwest	314.9	100.0	58.7	18.6	204.8	65.0	31.3	9.9	20.1	6.4
North Central Coast	675.9	100.0	394.4	58.4	123.3	18.2	46.5	6.9	111.7	16.5
South Central Coast	446.8	100.0	205.8	46.1	142.9	32.0	34.6	7.7	63.5	14.2
Central Highlands	737.0	100.0	94.6	12.8	253.7	34.4	333.3	45.2	55.4	7.5
Southeast	1,644.4	100.0	363.4	22.1	397.5	24.2	799.3	48.6	84.2	5.1
Cuu Long Delta	2,704.0	100.0	2,062.7	76.3	158.6	5.9	327.9	12.1	154.8	5.7
Whole Country	8,080.2	100.0	4,213.4	52.1	1,549.6	19.2	1,665.7	20.6	651.5	8.1

Note: * includes annual industrial crops and vegetables.
** includes permanent industrial crops and fruits trees

Source: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

1.2.3 Structure of Agricultural Employment

According to official estimates, 38.7 million people or 50.5% of the total population were employed in 1999, and around 80% of the active labor force were self-employed, of whom over 60% were self-employed farmers[1].

Though the national population has been growing at 1.7% annually in the period of 1990-1999, there is a wide difference between the annual growth rates of population in urban area and in rural area. The difference also can be seen between the annual growth rates of population during the first part of 1990s and second part of 1990s: for the urban area the annual growth rates are 3.0% in 1990-1995 and 4.5% in1995-1999; for rural area are 1.4% in 1990-1995 and 0.1% in 1995-1999. This low growth of rural population, particularly in agricultural population, will be considered to be as the result of lower growth of population and shift of labor force away from agriculture to other activities.

Even though the recent low growth rates in rural area, the total share of the population engaged in agriculture is still very high at 69% as shown in the table below:

[1] World Bank, Country Economic Review of Vietnam, November 2000

Employment by Sector in 1999

(unit: 1,000 persons)

	State		Non-State		Total	
Agriculture, fisheries and forestry	232	0.6%	26,457	68.4%	26,689	69.0%
(Agriculture, fisheries and forestry)					(26,689)	(100.0%)
(Agriculture)*					(25,773)	(96.5%)
(Fishery)*					(98)	(0.4%)
(Forestry)*					(818)	(3.1%)
Industry and construction	1,199	3.1%	3,443	8.9%	4,642	12.0%
Services	1,934	5.0%	5,415	14.0%	7,349	19.0%
Total employment	3,365	8.7%	35,315	91.3%	38,680	100.0%
Total employment as % of population		4.4%		46.1%		50.50%

Source: World Bank, Country Economic Review, Nov. 2000, and GOS, Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975-2000.

In combination with extremely small land holding, as shown in the following table, the agricultural active population has increased annually at high rate of 9.4%, 3.8% and 2.2% during 1995-1999 in each Central Highlands, Northwest and North Central Coast region. These increases will mainly be caused by the implementation of Government's transmigration projects. On the contrary, in the Cuu Long Delta, Northeast and Red River Delta regions, the annual growth rates of agricultural active population decreased considerably in the later part of 1990s and it seems to be lower than that of population growth in respective region. This will be a phenomenon caused by transmigration from rural areas to urban areas through the recent development of service and industrial sectors in Hanoi and Ho Chi Minh cities and their surrounding areas.

The employment structure in urban and rural areas is shown in the succeeding table. According to the table, about two-third of agricultural active population is categorized in either "Farm self-employment" or "Farm self-employment and Wage earner", though the share of these two types has decreased gradually with increasing in the type of non-farm employment.

Agricultural Labor Force by Region

(Unit: 1,000 Person; %)

Region	1990	1995	1999	Annual Growth Rate 1990-1995	Annual Growth Rate 1995-1999
Red River Delta	3,578	4,874	5,047	6.20	0.83
Northeast	2,287	4,035	4,155	8.56	0.71
Northwest	385	756	878	11.53	3.76
North Central Coast	1,960	3,410	3,712	7.93	2.20
South Central Coast	1,250	2,237	2,309	8.89	0.11
Central Highlands	379	766	1,092	14.48	9.42
Southeast	1,608	2,392	2,515	4.11	1.08
Cuu Long Delta	4,769	6,301	6,468	3.27	0.36
Whole Country	**15,665**	**24,771**	**26,689**	**6.34**	**1.24**

Source: GSO, Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975-2000

Share of Peopled Employed in Farm, Self-employed and Wage-work

	Urban		Rural	
	1992-'93	1997-'98	1992-'93	1997-'98
Wage earner	32.73	36.89	4.27	5.06
Farm self employment	12.34	9.98	55.10	53.07
Non-farm self employment	36.10	38.80	4.95	4.93
Farm self employment and Wage earner	6.27	5.24	16.27	18.26
Non-farm self employment and wage earner	3.81	3.38	0.95	0.92
Farm self employment and non-farm self employment	7.18	5.30	15.27	15.68
All three types	1.59	0.41	3.23	0.29
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: GSO, Vietnam Living Standards Surveys in 1992-93, and 1997-98.

1.2.4 Agricultural production

(1) General

The production structure of agriculture in Vietnam is dominated by rice, which accounts for half the gross value of agricultural output.

In 1985, Vietnam cultivated only 5,718.3 thousand ha of paddy with an average yield of 2.77 ton/ha and an output of 15,859.3 thousand tons, then in 1999, these figures are 7,648.1 thousand ha, 4.10 ton/ha, and 31,393.8 thousand tons. For 13 years, paddy area, yield and output have increased by 33.7%, 48.0%, and 97.9%, respectively. These achievements are considered as the results of the reforms in agricultural mechanisms and policy in line with Resolution No.10 (1988) so called as “Doi Moi”; paddy land is allocated to farmers for long-time use; farmer households are considered as independent economic units. Thus, the output of rice allowed Vietnam to become one of great export countries. The exported quantity has increased from 1.4 million tons in 1989 to 3.8 million tons in 1998.

Planted Area and Production Volume in 1999 by Regions

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

	Paddy			Other cereals			Industrial Crops			
							Annual**		Permanent***	
	Area	%	Output	Area	%	Output*	Area	%	Area	%
Red River Delta	1,048.2	13.7	5,692.9	141.7	11.6	426.9	66.9	7.5	3.9	0.3
Northeast	690.3	9.0	2,574.1	318.9	26.1	709.6	108.5	12.2	49.9	4.0
Northwest	133.0	1.7	379.2	135.5	11.1	258.1	36.7	4.1	9.6	0.8
North Central Coast	677.8	8.9	2,652.8	233.2	19.1	476.8	147.5	16.5	48.1	3.9
South Central Coast	435.1	5.7	1,704.3	87.9	7.2	171.6	101.3	11.3	52.1	4.2
Central Highlands	134.2	1.8	413.6	100.1	8.2	278.9	74.6	8.4	337.1	27.0
Southeast	542.8	7.1	1,696.1	164.0	13.4	488.4	221.4	24.8	614.8	49.3
Cuu Long Delta	3,986.7	52.1	16,280.8	39.0	3.2	49.8	136.0	15.2	132.2	10.6
Whole Country	**7,648.1**	**100.0**	**31,393.8**	**1,220.3**	**100.0**	**2,860.1**	**892.9**	**100.0**	**1,247.7**	**100.0**

Note: * Paddy equivalent
** Includes cotton, jute, rush, sugarcane, soybean, and tobacco etc.
*** Includes tea, coffee, rubber, pepper, coconut, and cashew, etc

Source: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

While rice and other cereals (mainly maize) remain the most important component of agricultural production, there has been some diversification to industrial crops in recent years. Their share in the gross value of agricultural production has gone up from 13.5% in 1990 to 20.5% in 1999 or 2.5 times during the same period as shown in the following table.

The major producing areas of specific crops at present are: the Cuu Long Delta and the Red River Delta for rice, the Central Highlands and Southeast regions for coffee; northern mountains and midland areas for tea; Southeast region for rubber, Southeast, the Cuu Long Delta and some northern provinces for fruits, and Lam Dong Province in Southeast region and the Red River Delta region for vegetables.

Gross Output of Agricultural Crops (At constant price of 1994)

(Unit:Bill. dongs)

	Total		Food Crops		Vegetable and Beans		Industrial Crops		Fruit Crops	
	Value	%	Value	%	Value	%	Value	%	Value	%
1985	41,951.3	100.0	28,079.5	66.9	2,852.9	6.8	5,717.5	13.6	4,179.7	10.0
1990	49,604.0	100.0	33,289.6	67.1	3,477.0	7.0	6,692.3	13.5	5,028.5	10.1
1999	82,945.6	100.0	52,738.1	63.6	5,946.6	7.2	16,976.7	20.5	6,193.4	7.5
1999/1985	2.0		1.9		2.1		3.0		1.5	
1999/1990	1.7		1.6		1.7		2.5		1.2	

Source: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

As shown in the table below, the planted areas under paddy and cereals crops increased by 1.3 and 1.1 times respectively, while the area under annual and permanent industrial crops increased by 1.7 and 1.9 times respectively.

Change of Planted Area between 1990-1999 by Regions

(Unit: Times)

	Paddy Planted Area	Other cereals Planted Area	Industrial Crops (Annual**) Area	Industrial Crops (Permanent*** Area	Fruit Planted Area
Red River Delta	1.04	0.97	1.27	1.26	1.50
Northeast	1.04	1.16	1.36	1.61	4.30
Northwest	0.92	1.47	1.87	1.12	7.19
North Central Coast	1.00	1.10	2.08	2.21	1.59
South Central Coast	1.05	0.83	1.96	1.47	0.90
Central Highlands	0.98	1.57	2.32	3.38	1.48
Southeast	1.31	1.28	1.58	2.12	2.56
Cuu Long Delta	1.55	0.87	1.42	0.79	1.33
Whole Country	**1.27**	**1.14**	**1.65**	**1.90**	**1.76**

Source: GSO, Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000.

Sugarcane, coffee, and rubber production recorded the fastest growth: Coffee production more than tripled from 119.3 thousand tons in 1990 to 397.4 thousand tons in 1999. Vietnam is the third largest coffee producer after Brazil and Colombia and the largest producer of robusta coffee. In addition, coffee is now Vietnam's second highest agricultural export earner after rice, contributing around 6% of export revenues. Sugarcane production increased from 130.8 thousand tons in 1990 to 350.8 thousand tons in 1999 or 2.7 times during the same period. Rubber production increased 78% over the period 1990 to 1999.

(2) Rice Production

Since the most important crop related to the water resources development is paddy, the followings provide more detail information pertaining to the paddy production in Vietnam.

(a) Salient traits of rice production in Vietnam

As stated above, paddy area, yield and output for 13 years from 1985 to 1999 have increased by 1.34, 1.48, and 1.98 times, respectively. These achievements are considered as the results of the reforms in agricultural mechanisms and policy in line with Resolution No.10 (1988) in keeping with the following physical and technical advancements:

- Almost paddy land area has remained at the same level of or rather decreased from 4,297 thousand ha in 1985 (4,213 thousand ha). However, paddy planted area has been considerably increased as stated above. Thus, the increase of rice in Vietnam has been achieved through intensive use of limited land.
- Regarding the increase of paddy yields, the greatest contributor seems to be the utilization of HYVs' seeds (High Yielding Varieties) united with the massive use of fertilizers. According to the data, a ratio of new varieties has

increased from 47.5% in 1990 to 87.2% in 1998 throughout the country[2].

- State projects for irrigation, reclamation, sea-encroachment, and land improvement were implemented over the past decades, particularly in Cuu Long Delta, concentrated on Dong Thap Muoi, Long Xuyen Quadrilateral, West of Hau River. As shown in Table D.13, remarkable increase of paddy planted area can be seen only in the Cuu Long Delta through enlarging winter-spring and summer/autumn paddy planted areas, accounted for about 90% of the total incremental paddy area of the country in 1985-1999.

Incremental Paddy Planted Area from 1985 to 1999 by Region

	1985 (1,000 ha)	1999 (1,000 ha)	Balance (1,000ha)	%	Times of 1999/1985
Red River Delta	1,005.3	1,048.2	42.9	2.2	1.04
Northeast	658.1	690.3	32.2	1.7	1.03
Northwest	144.1	133.0	-11.1	-0.6	-0.94
North Central Coast	708.3	677.8	-30.5	-1.6	1.01
South Central Coast	421.9	435.1	13.2	0.7	1.05
Central Highlands	130.1	134.2	4.1	0.2	1.03
Southwest	399.6	542.8	143.2	7.4	1.28
Cuu Long Delta	2,250.9	3,986.7	1,735.8	89.9	1.63
Whole Country	**5,718.3**	**7,648.1**	**1,929.8**	**100.0**	**1.29**

Source: GSO, Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

- While paddy production is increased mainly by enlarging planted area in the Cuu Long Delta, increasing yield is the decisive factor for increasing paddy production in the Northern regions in general and the Red River Delta in particular through analyzing both tables shown above and below, respectively.

Incremental Paddy Planted Area from 1985 to 1999 by Region

	1985 (tons/ha)	1999 (tons/ha)	Times of 1999/1985
Red River Delta	2.99	5.43	1.82
Northeast	2.32	3.73	1.61
Northwest	1.77	2.85	1.61
North Central Coast	2.13	3.91	1.84
South Central Coast	3.28	3.92	1.20
Central Highlands	2.14	3.08	1.44
Southwest	2.61	3.12	1.20
Cuu Long Delta	3.05	4.08	1.34
Whole Country	2.77	4.10	1.48

Source: GSO, Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

- The following table shows the per capita availability of paddy/rice by regions. When the export volume of 4.5 million tons of rice in 1999 (equivalent to 6.9 million tons of paddy) is deducted from the total production of 20.4 million tons of rice (31.4 million tons of paddy), a national per capita rice

[2] JICA Follow-up Study for the Assistance toward Market Oriented Economy in Vietnam, Vol. 3, 1999.

consumption is estimated at 176 kg on an average. Thus, except the Cuu Long and Red River Deltas, almost all regions are categorized as rice-importing ones. This situation also seems to be reflected to the disparity in rice price among the regions.

Paddy/Rice Availability, and Price Disparity by Region in 1999

	Production (1,000 tons)	Population (1,000 people)	Availability (kg/Pers.) Paddy	Rice*	Price of Rice (Dong/kg)
Red River Delta	5,693	16,871	337	219	2,410
Northeast	2,574	8,853	291	189	2,400
Northwest	379	8,853	43	28	2,400
North Central Coast	2,653	10,031	264	172	2,350
South Central Coast	1,704	6,546	260	169	2,315
Central Highlands	414	4,096	101	66	2,349
Southwest	1,696	11,777	144	94	2,465
Cuu Long Delta	16,281	16,184	1,006	654	1,950
Whole Country	**31,394**	**76,597**	**410**	**266**	**2,200**

Note: *Milling rate is 65% of Paddy.

Source: GSO, Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

(b) Paddy's farming practices

- Almost all paddy fields in the northern and central regions particularly the Red River Delta are of transplanting with seedlings raised in either permanent nurseries or in sections of the paddy fields. Seedlings raised for each crop are sown in one month before for transplanting. Farmyard manure, a little super phosphate, and sometimes urea are applied to ensure healthy, vigorous seedlings. Direct seeding with high seed rates is common method in the Cuu Long Delta.
- The most common paddy's cropping pattern in northern areas is two crops in a year: Winter-Spring Paddy from January to April/May and Rainy Season Paddy from July to Oct./Nov. In southern areas, the common cropping pattern also is two crops in a year: Summer-Autumn Paddy from April/May to July/August and Winter-Spring Paddy from December to March. However, in fully irrigated areas in the Cuu Long Delta where water is available year round, some farmers grow three paddy crops in a year: Winter-Spring, Summer-Autumn and Autumn-Winter crop (August/September to November/December).
- In Vietnam, there are some hundred types of modern rice varieties such as IR series, OM series, and MT series, etc. about 95% of paddy land in fully irrigated area, and 70% of paddy land in partially irrigated area have been planted with modern rice varieties. Average seed rate is 150 kg/ha for transplanting, and 100-300 kg for direct seeding.
- Power sources of land preparation are tractor, tiller, and animal (buffaloes or cattle). Tractors in paddy cultivating areas particularly in the Red River and

the Cuu Long Deltas have gradually replaced buffaloes and cattle in part as draft animal. According to the data of GOS, the mechanization rate of land preparation has seen increased from 22% in 1996 to 36% in 1999.

- Fertilizer and manure application are common, but usually lesser application than that of recommendations under the "data of main cropping pattern and planted crops model in 9 ecological zones" from the National Institute of Agricultural Planning and Projection (NIAPP). The average amount of fertilizer applied per hectare in the Cuu Long Delta is 165 kg (N), 90 kg (NPK), and 100 kg (DAP)[3]. Generally, farmers on irrigated paddy land applied fertilizer 2-4 times per cropping season.
- The farming community in most areas is aware of the need to control pests and diseases when crop damage becomes significant. While control chemical were available at highly subsidized rates until 1988, farmer now have to pay market prices and this has led to a significant reduction in chemical use. On the contrary, resistant varieties have been used commonly to control outbreaks of a major disease of rice blast. In the Cuu Long Delta, some study revealed that about 70% of farmers spray pesticide whenever pests are present, 10% of farmers spray pesticide when pest infestation is heavy, and 20% of farmers only spray pesticide after 40 days of seeding.
- Harvesting is normally done by the use of sickles in northern areas while in the Cuu Long Delta, where farm sizes are much bigger, the leasing of mechanical harvesters is becoming common practice.

  Mechanical threshing is used in the northern and southern areas, though more common in the South. The number of motorized threshers has increased significantly and the increase is expected continue.
- Natural drying in the open air is the traditional and most common method used in Vietnam. The paddy is spread out in a layer of around 5 cm and dried during 2-3 days while being stirred frequently with a rake in order to obtain uniform drying. Drying problems are most severe in the southern areas. In the Cuu Long Delta, the harvesting of the summer-autumn crop takes place in the rainy season, and thus drying is a problem recurring every year.

1.2.5 Animal Production

The value of livestock production increased 68.6% or annual growth rate of about 4.4% on average over the period 1990 to 1999. However, its share in the gross output value of agricultural production registered only a modest increase from 16.6% in 1990 to 16.8% in 1999 (refer to table in **page 1.7-2**).

The poultry increased drastically with an average annual growth rate of 6.8% from 98,249

[3] Rice Market Monitoring and Policy Options Study, IFPRI, 1996

thousand heads in 1990 to 166,382 thousand head in 1998.

Regarding livestock, while the number of pigs increased moderately by 33% during 1990 to1999, the number of buffaloes and cattle has remained at almost the same level with 1990. A notable tendency can be seen in the table below that tractors have gradually replaced buffaloes raised as draft animal. Tractors in paddy cultivating areas particularly in the Red River and Cuu Long Deltas have gradually replaced buffaloes and cattle in part as draft animal.

Number of Livestock by kind , by Region

(Unit:1,000 head)

Region	Buffaloes			Cattle			Pigs		
	1990	1999	99/'90	1990	1999	99/'90	1990	1999	99/'90
Red River delta	276.8	173.3	-37.4	263.4	313.7	19.1	2,678.8	3,639.0	35.8
North East	1,111.3	1,345.9	21.1	425.3	546.3	28.5	2,667.3	3,509.2	31.6
North West	253.9	365.0	43.8	123.6	128.9	4.3	620.2	728.5	17.5
North Central Coast	568.7	668.5	17.5	642.0	831.7	29.5	2,025.4	2,636.9	30.2
South Central Coast	151.8	127.4	-16.1	845.6	835.8	-1.2	1,343.4	1,626.1	21.0
Central Highlands	61.8	51.8	-16.2	342.0	468.6	37.0	577.6	847.0	46.6
North East South	138.5	147.6	6.6	215.3	483.6	124.6	515.4	1,681.4	226.2
Cuu Long Delta	291.3	75.8	-74.0	259.7	184.0	-29.1	1,805.4	2,797.2	54.9
Whole Country	**2,854.1**	**2,955.7**	**3.6**	**3,116.9**	**3,638.9**	**16.7**	**12,260.5**	**16,306.4**	**33.0**

Source: GOS: Statistical Data of Vietnam; Agriculture, Forestry and Fishery 1975-2000

According to the data of MARD, Vietnamese consume a modest amount of livestock products: 21 kg of live meat/person/year whereas the world average amount is 45 kg.

In the Strategy for Agriculture and Rural Development prepared by MARD, livestock development strategy for 2010 is as follows:

- Regarding pig and cattle raising, to run well veterinary services, improve breeds toward high lean proportion, process animal feed and assist households with large livestock herds of 30-50 heads up;
- To develop daily herd with the strains suitable to tropical conditions to reduce gradually imported milk; and
- To develop garden poultry with good-quality meat, on the basis of household farms, to enable chicken export, and to take advantage of coastal and plain land so as to develop husbandry for leather and meat export.

1.2.6 Fishery Production

Vietnam has 29 coastal provinces with 3,200 km of coastline. While more than 50% of protein intake comes from fish, productive marine and coastal natural resources are declining. Mangrove deforestation, destruction of wetlands, species extinction, urban and industrial pollution, and over exploitation of inshore and near shore fisheries threaten the livelihood of the more than 20 million people living along the coastline. Many of the coastal inhabitants (and particularly fishing communities) are among the poorest income strata in Vietnam, and depend on sustainable coastal resource management for

maintenance and improvement of their living conditions.

Fishery sector, though accounting for only about 14% of the total agricultural output, has become a major exporter of the economy, accounting for 31% of the agricultural export value and about 9% of the total export value of the country. Exports increased on the average of around 17% per year for the 10 years by 1999. The fishery sector's output increased by 7.3% at constant price of 1994, of which the aquacultural output rose at the rate of 8.7% per year. In 1999, the fishery output came up to 1,882 thousand tons; export value reached US$ 971 million. Aquacultural areas covered over 535 thousand hectares as shown below.

Gross Output of Fishery (At Constant price of 1994)

	1989	1999	Annual Growth Rate
Total	**7,845.0 Bill. Dong**	**17,425.0 Bill. Dong**	**7.3%**
Aquaculture	2,363.0 Bill. Dong	5,448.0 Bill. Dong	8.7%
Catching	5,482.0 Bill. Dong	11,977.0 Bill. Dong	8.0%

Source: GSO, Statistical Data of Vietnam Agriculture, Forestry and Fishery, 1975-2000

Area of Aquaculture by Province

	1989	1999	Annual Growth Rate
Red River Delta	35,700 ha	58,100 ha	5.0%
Northeast	27,700 ha	35,800 ha	2.6%
Northwest	2,500 ha	3,200 ha	2.5%
North Central Coast	18,600 ha	30,200 ha	5.0%
South Central Coast	7,700 ha	17,900 ha	8.8%
Central Highlands	3,000 ha	3,600 ha	1.8%
Southeast	51,000 ha	35,300 ha	-3.6%
Cuu Long Delta	150,400 ha	350,900 ha	8.8%
Whole country	**296,600 ha**	**535,000 ha**	**6.1%**

Source: GSO, Statistical Data of Vietnam Agriculture, Forestry and Fishery, 1975-2000

According to the Strategy for Socio-Economic Development 2001-2010, a target of fishery production for 2010 is 3.0-3.5 million tons, of which one third comes from aquacultural production, and the export turnover of fishery product is US$ 3.5 billion.

1. 3 Agricultural Marketing

Under the central planned economy, the Vietnam government implemented subsidy policies and monopoly in food business. Circulation and distribution were managed centrally under the top down system. The agricultural market was highly controlled and free trading among regions was prohibited. In such a highly controlled market, private sectors were not given the opportunity and conditions to operate freely.

Since the late 1980s when domestic trade and prices were deregulated: enabling farmers to sell through private sector based on market signals. Fertilizer subsidies were withdrawn, although remote mountain areas still enjoy a transport subsidy; Rice

procurement at predetermined prices was discontinued; Restrictions on the trade of agricultural commodities across provincial boundaries were removed in 1992. The Government principally has not regulated the trade of agricultural commodities except rice and fertilizer. Thus, agricultural markets have developed rapidly under the market-oriented economy.

Nowadays, agricultural marketing has basically been operating by the three major players: a) SOEs (state owned enterprises), b) Private sector, and c) Public sector enterprises (provincial and district level).

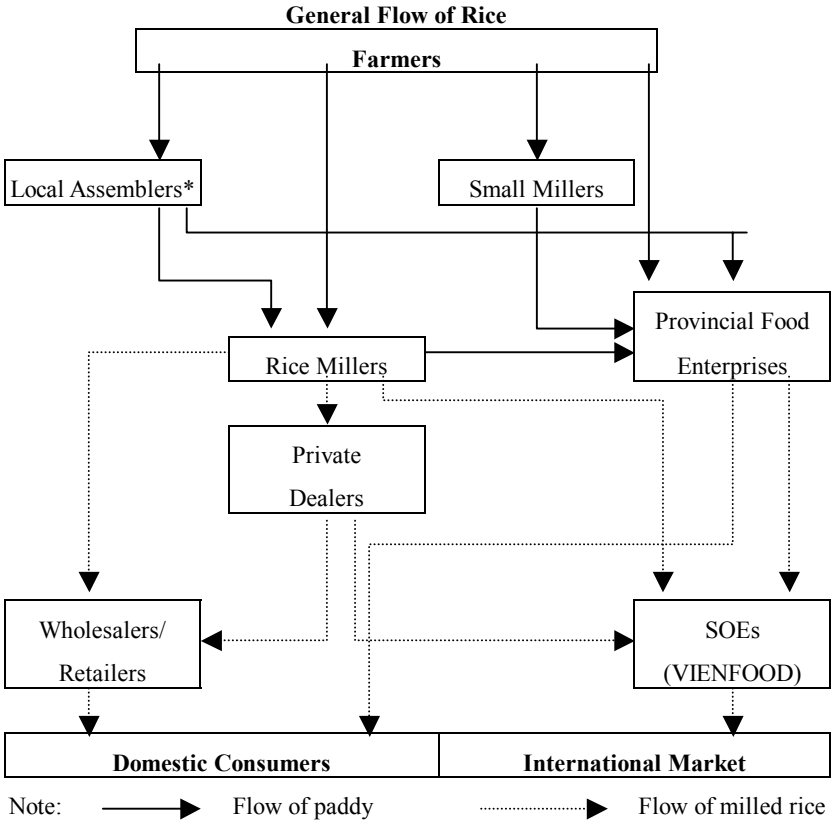
1.3.1 Marketing of paddy/rice

Since 1989, when the Government abolished the monopoly and subsidy policies, state food companies have been rearranged into two systems: central companies and local ones. At the central level, there are two corporations: VINAFOOD-I and -II, which manage the network of lower level companies. At the local level, there is one company in each province directly managing stores, selling and buying agencies as well as wholesaling and retailing in the province: In the northern and central regions, there are VIENAFOOD-I and provincial food companies. Their major functions are to balance regional food supply locally and to stabilize food prices through their market operations under co-existing with the food business of private sector since these regions are rather of food shortage. On the contrary, in the south region especially in Cuu Long delta, VIENAFOOD-II and provincial food companies' major business activities are concentrated on exporting rice and importing fertilizers. They also engaged in the commercial business as wholesalers or retailers of agro-inputs for local consumption.

Rice marketing in each province/region, however, varies substantially depending on the rice production and food-balancing situation in the area. In the north and central areas, purchasing and distributing activities are mostly handled by the private sector, and the state-owned units play a very minor role. In the South, the state-owned enterprises purchased almost all of the volume of commercial paddy to export domestically and internationally. However, the volume procured directly from farmers is small, accounting for only about 10% of commercial rice, and the remaining volume is purchased through local assemblers include rice millers. In this regard, ADB's study[4] revealed the high level of commercialization achieved by rice farmers, particularly in the two deltas. Contrary to conventional wisdom, SOEs play a negligible role in buying paddy from farmers. Private traders dominate assembly, local wholesaling, and retail sales, although SOEs play an important role in exports.

The general flow of paddy and rice is shown in the following chart:

[4] ADB's consultant report under TA 2224-VIE, title of "the rice market monitoring and policy option study"



* includes assembler/wholesaler and assembler/retailer

Source: JICA Study Team, based on the Study report of "The Rice Market in Viet Nam" by Nguyen Tien Manh and Nguyen Dinh Long.

In many areas, paddy farmers sell mainly to local assemblers who transport and, in some cases, mill the paddy for on-ward sale to the private dealers, consumer market and/or public sector enterprises.

By and large, the majority of private rice marketing players including assemblers and rice millers have little contact with or knowledge of markets outside their territories within 10 km of their place of business. Long-distance trade in rice is limited, being confined mainly to the activities of the SOEs.

Domestic rice trade results often in greater regional disparities in price due mainly that the opportunities for spatial arbitrage are limited and the poor national road conditions contribute to high transporting costs of rice from the South to the North.

In Vietnam, the importance of cooperatives in agricultural produce marketing is still insignificant. Some 8,850 agricultural cooperatives have been registered under the new cooperative law, but their functions are concentrated on irrigation management and to some extent inputs procurement.

1.3.2 Marketing of industrial crops

Most industrial crops undergo some type of processing before they reach the final consumers. In principle, processors should be in a good position to provide information to producers about markets and input use as well as obtaining seasonal credit.

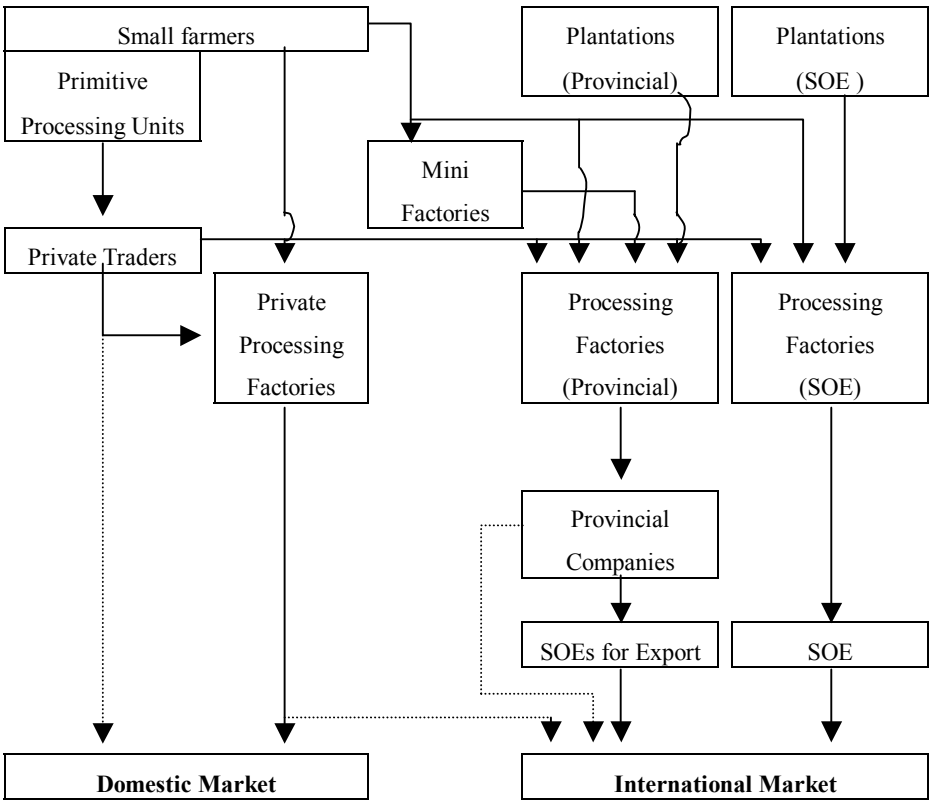
Until the renovation, production of the most of industrial crops was dominated by the

SOEs and a number of provincial/district crop's companies that mainly produced final produces for export and/or domestic use. In addition, a number of small holders grew and processed crops for the local market. Over the last decade, major changes have taken place in these sub-sectors. All specific crops plantations (state farms) have been broken up and the their land has been allocated to the workers. Thus, private investment in production and a certain extent processing has expanded. However, essential services such as processing, storage and transport, have remained in the public sector. Actually, large/medium agro-processing plants are still under SOEs, and many state-owned factories, particularly public sector enterprises, continue to operate with old and inefficient equipment though they are facing increased competition from small-scale private processors.

The farmers being allocated state farm-land have continued their agricultural production under the two principal systems: company managed plantations operated by contract farmers and small-holder production. Contract farmers are specialized in the specific crop growing on the plantations and have limited involvement in other agricultural activities. In contrast, the specific crop production by small-holders is undertaken as part of a wider farming system involving various agricultural activities. Contract basis farmers can be found typically in the case of coffee, tea, sugarcane, and rubber growers. Such contract agreements specifies the variety, volume, and price, and may also specify production methods, the timing of delivery, and sometimes terms of credit for inputs.

The general flow of industrial crops is shown in the following chart:

General Flow of Industrial Crops



Source: JICA Study Team

Tea and coffee are the typical industrial crops and very important crops for the farmers in mountainous area. The following are the marketing situations of both crops as samples:

(1) Viet Nam National Tea Corporation (VINATEA)

The VINATEA is the largest and only a national tea company in Vietnam with around 24 factories. While its main operations include management of processing companies and tea exports, VINATEA has responsibility of research and extension for the development of tea in Vietnam.

Tea is mostly grown in the Northern and Central highland. In many growing areas of tea, farmers perceive tea as a major cash crop and have made substantial investments in recent years to expand area and develop small scale processing units.

Black tea processing is mainly undertaken by VINATEA. In addition, there are a number of provincial tea companies in main producing areas (about 26 factories). Furthermore, there are a growing number of private factories in which process large and semi-twisted leave known as OPA. The OPA have to be reprocessed or refined before final sale. The tea produced is usually re-processed in larger units under VINATEA or provincial companies.

Most green tea is processed using very basic equipment (open pans or drums for firing) in

household backyards. Rolling is still mostly done by hand, but increasingly numbers of households are purchasing electric rollers.

Green tea of small holders sell either to private traders after preliminary processing in their units for domestic consumption or processing factories for material of black tea.

(2) Viet Nam National Coffee Corporation (VINACAFE)

Vietnam coffee has been concentrated on the production zones in the Central highland and East-Southland. The coverage of coffee is about 400,000 ha, and the output was 382,000 tons in 1998.

The VINACAFE is responsible for promoting and regulating the coffee industry but also participates in the sector as a large-scale grower, processor, and exporter. A study of coffee processors in Dak Lak[5] revealed that central (VINACAFE) and provincial state enterprises accounted for over 90% of the exports and over 80% of the processing capacity.

Most small-holders' coffee sell to private traders and/or processing factories for drying, sorting and grading.

1.3.3 Marketing of fruits and vegetables

(1) Fruits

In Vietnam, main producing areas of fruits are concentrated on East Southland, the Cuu Long Delta and some Northern Provinces of 425,000 ha of fruit trees with about 3,800 thousand tons per year. Most fruit is consumed domestically, but mangoes, and dried lychee and longan are exported to China. The exported volume of fresh and processed fruit is estimated at only 1% of the total production.

Prior to liberalization, fruits such as pineapple, banana, and to some extent citrus, were grown mainly on state farms owned by the Vietnam National Fruit and Vegetable Corporation (VEGETEXCO) for export to the former USSR and Eastern Europe. In addition to the production, most state farms also had factory units for fruit and vegetable processing, which together with fresh fruit were destined for export markets. Other fruits, such as durian, longan, lychees and mangoes, were mainly grown by farmers in their gardens for home consumption or sale in local market. VEGETEXCO continues to operate a number of processing units but many are oversized and unable to operate at reasonable capacity, as they no longer have assured fruit supplies from state farms. Moreover, there is increasing competition from the private sector in which include small-scale backyard drying and preservation units and medium-scale factories producing canned fruits and juice.

Fruits marketing and distribution in Vietnam are relatively well developed. Most of the fruits are supplied by farmers directly to middlemen for onward sale to wholesalers and retailers. Reflecting the development of private sector, direct contracts for producing

[5] Minot and Golletti 1998, requoted from the Technical Report on Agricultural Sector Program, ADB TA 3223.

fruits between farmers and processors are observed, but direct sales to consumers through middlemen are still dominated. In view of strong demand, the price of most major fruit remains relatively high and competitive. Typical quantities and prices handled by local traders are shown in the table below.

Quantities and Prices Paid and Received by District Collectors/Traders

	Quantities Exported	Domestic Sales	Farm-gate Price	Wholesale Price
Mango	320 ton - 1,000 ton	1,500 ton	5,000 - 10,000 VND/kg	6.000-20,000 VMD/kg
Longan	500 ton - 700 ton	1,000 ton	10,000-15,000 VMD/kg	20,000 VMD/kg

Source: FAO/ADB, Crop Diversification and Export Promotion Project, Dec. 1998

The general flow of fresh fruits is similar to the flow of vegetables as shown in the succeeding figure.

(2) Vegetables

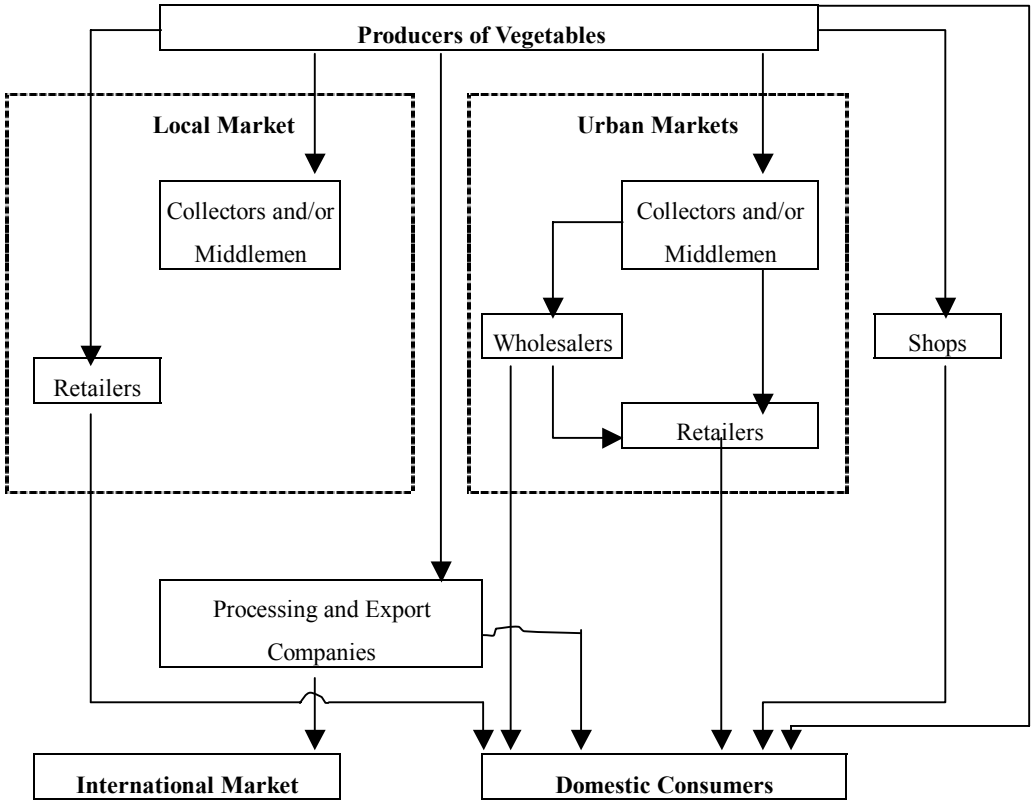
Presently, Vietnam has 377,000 ha of vegetables with output of about 5,600 thousand tons per year. Major producing areas of vegetables are confined in the vicinity of large consuming areas: the Red River Delta for Hanoi and East Southland particular in Lam Dong province for Ho Chi Minh city.

The marketing of vegetables is generally divided into four channels: (i) distribution through urban markets located in cities/towns; (ii) distribution through local markets located mainly in the suburbs of cities/towns and in villages; (iii) distribution combined with processing/export companies; and (iv) distribution connected directly with specific shops such as restaurant and supermarket.

The major distribution channels are the formers ones of (i) and (ii). The difference between the urban and rural markets seems to be whether wholesalers operate in the market or not rather than in its scale.

The general flow of vegetables is shown in the figure below.

General Flow of Vegetables



Source: Kazushige Tuji, Agricultural marketing, quoted from Vietnams Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office, March 2001.

Usually vegetables producing farmers sell their produce to collectors and/or middlemen at their farms, or carry their produce to urban or rural markets by themselves, and sell directly to retailers or wholesalers operating in the markets. Recently, however, larger traders in Hanoi come to major producing areas to buy vegetables directly from farmers and/or through the collectors entrusted in advance by these traders. Moreover, contract basis vegetables' production between an agricultural cooperative and a processing company established with foreign and Vietnam's investors jointly can be seen in some areas.

Regarding the farmers' transporting facilities, the following table indicates that bicycle with two baskets is the most popular means for farmers.

Transportation facilities of vegetable producing farmers

Means of transportation	Proportion
Motorcycle with two baskets	8%
Bicycles with two baskets	89%
Carrying pole	2%

Source: Mr. Kazushige Tuji. Agricultural Marketing in Vietnam, quoted from the Vietnamese Agriculture and Japanese Cooperation toward 21 Century, JICA Hanoi Representative Office, March 2001.

1.3.4 Exporting of rice and importing fertilizer

Currently, Vietnamese rice is exported to about 80 countries in the world, in which Asia is

the biggest market accounting for around 40% to 70%. The major countries exporting rice from Vietnam are Indonesia, Philippines, China, Iran and Peru. On the other hand, fertilizers are major imported items, which account for about US$ 200-500 million per year.

Exporting of rice and importing of fertilizers are still under the Government control. However, through the 1990s, rice exporting and fertilizer importing systems for which many restriction were imposed have been deregulated gradually taking the following step:

(Rice)

- In Feb. 1995, instead of the mandatory minimum price for export contracts, Ministry of Trade (MOT) implemented indicative minimum export prices for rice, based on an evaluation of domestic and world market conditions.
- MOT continues the practice of indicative rice export targets in lieu of rice export quotas (indicative target is 4 million tons for rice in 2000).

(Fertilizers)

- In Apr. 1994, import quotas on fertilizer were abolished though import targets and import licensing remain in place.
- Mar. 1997, MOT abolished the import licenses for fertilizer importers, and the selection of fertilizer importers is allocated to the provinces.

As shown in the above, MOT phased out mandatory minimum prices for rice exports in1995 and import quotas for fertilizer in 1994. As a result of this and other measures, rice exports and fertilizer imports expanded rapidly.

Furthermore, the target for rice exports has been adjusted quarterly instead of annually from 1999 and MOT has been very flexible on the price to encourage the competitiveness of Vietnamese rice. The minimum price is only applied in case of international price fluctuations. In addition, in mid-2000, the Government abolished limitations on the amounts that an eligible trader could export or import. However, the level of private sector participation in rice and fertilizer trade in the past five years has been very disappointing. According to the ADB estimation[6], only less than 10% of the fertilizer trade was in private hands: forty nine SOEs and only 3 private firms imported fertilizer in 2000. Similarly, in 2000, 42 SOEs and 10 private firms exported rice. The private firms account for less than 10% of the volume of rice exports. Prior to 2000, restrictions were placed on the number of eligible private traders and the volumes of trade allowed. These restrictions have been removed, but the criteria for eligibility include minimum capital for the export of 5,000 tons per shipment, two years experience in the industry, and suitable rice-processing infrastructure for export.

The criteria for a fertilizer importer include minimum capital for the import of 50,000 tons annually and an existing distribution network. These restrictions are limiting the

[6] ADB, Program Completion Report on the Agricultural Sector Program in the Vietnam, Nov. 2000

role of the private sector in rice and fertilizer trade.

Also in 2000, the Government ended the 5% import tariff on fertilizer. However, the Government seems to continue to maintain indicative targets on these two key commodities and has periodically increased these targets to reflect international demand and supply conditions.

1.4 Agricultural Supporting Institutions

1.4.1 Agricultural research

The agricultural research system involves a total of 32 research institutes of which 26 administrated by MARD (Table D.2). These institutes have responsibilities to carry out research and the dissemination of technical and technological advances to farmers contributing to agricultural and rural development. These operate through over 120 different locations or centers nationwide. The research system is very centralized with 18 of these research institutions being located in or near Hanoi and 3 in or near Ho Chi Minh. The other centers that are operated by the institutions also show a distinct tendency to be located near Hanoi and Ho Chi Minh. The remaining 8 research institutions are owned by the commodity State Own Enterprises (SOEs).

In MARD, the Committee of Agricultural Science and Technology has been established as a consultative organ. The committee provides overall guidance on the direction of research as well as giving the approval for the research program submitted from research institutes through the Department of Science and Technology and Product Quality (DSPTO). The DSPTO has the overall responsibility for the coordination of the research activities on these 24 research institutions.

In Vietnam, the overall responsibility of the compilation of the national research budget including agricultural research one is under the Ministry of Science, Technology and Environment (MOSTE). Therefore, the research system is complex with differing responsibilities for MOSTE and MARD, and tends to bring on a fact that the coordination of research activities is driven more by budgetary pressures than by the need to determine clear priorities for agricultural research in the future. The total budget related to the national science and technology under the MOSTE is around US$ 214 million in 2000 of which only 4% is allocated to agricultural sector[7].

The educational qualifications of the research staff are rather low level: only 7% of the staff have attained a doctorate level and 6% have been awarded Master degrees. A further 41% of the staff have first degrees, out of which only 24% have a post-graduate qualification[8].

Most research centers are involved in the production of seed of various categories, breeding of livestock and the production of commercial crops in order to mitigate budgetary constraints. It can be pointed out that the increased focus on commercial

[7] Vietnam Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office March 2001.

[8] ADB: Agricultural Sector Program, Phase II Technical Report. August 2000

activities inevitably results in a large portion of the staff becoming concerned with production rather than research activities.

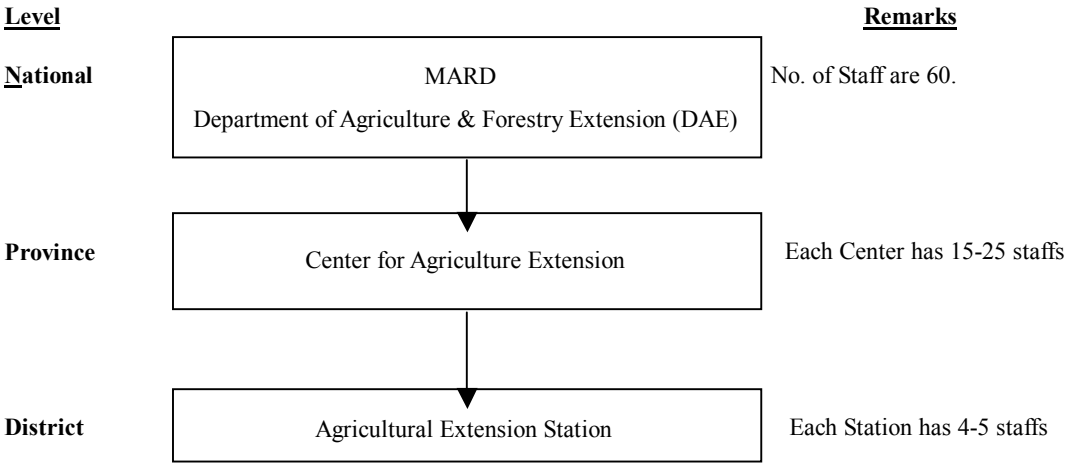
1.4.2 Agricultural extension institution

According to Decision No. 13 of the Government dated March 3, 1993, there are two kinds of extension institutions in Vietnam: State institutions and voluntary institutions in the agricultural (including forestry and fishery) extension system.

The State agricultural extension institutions are organized as a system from the central level to the local level. At the central level, there is the Department for Agriculture and Forestry Extension under the Ministry of Agriculture and Rural Development (MARD)[9]. Each province has a Center for Agricultural Extension. At the district level the Agricultural Extension Station belonging to the Center is also established, and there are extension workers in communes. There are about 3,000 extension staff members in the system throughout the country (MARD: 60, Province level: 800: District level 2,000).

The State agricultural extension system is illustrated as the following figure:

State Agricultural Extension System



Source: Study Team

The voluntary extension system consists of agricultural extension divisions pertaining to scientific research institutions, training centers, mass organizations, and state or private enterprises that would like to take part in extension activities.

(1) State agricultural extension

The Department of Agriculture and Forestry Extension (DAE) belongs to MARD is the top institution with about 60 official to monitor and supervise all agricultural and forestry extension activities throughout the country. DAE has the following functions:

a) Building the policies, goals and strategy for the development of extension.

b) Supervising the implementation of development policies and programs.

c) Supervising the extension activities and transferring advanced technologies.

[9] Regarding the fishery extension, there is a section in charge under the Ministry of Fishery.

At the provincial level, each province has an agricultural extension center, which is responsible for crop, livestock and forestry extension. The center is operated in line with the national extension system and has responsibilities to set up the goals and policies on extension for their provinces and to coordinate their activities with other related agricultural agencies that are in charge of agricultural production, irrigation, veterinary, etc. However, the center's main activities are to provide training and technical support to district and commune staff; assist in establishing farm level demonstration plots; prepare extension material and monitor activities. Each extension center has normally 20-30 extension staff. In addition, the provincial extension center has staff at district level (typically 3-5 staff in each district) and at commune level (usually one person). Most centers are housed in a separate building, which has class rooms and audio-visual equipment. In the past, to increase food output, extension in rice production was given high priority. Currently, however, although many provinces now attach greater importance to extension in other crops, the level of technical know-how in these crops and support from research remain weak.

The district extension stations and commune extension workers mainly implement actual extension activities to farmers. Of a total number of districts of 615 in the country, 470 extension stations or 87% of the total districts are established. Most communes have contact farmers who act as the main focal point for local extension efforts.

The level of education at district and provincial level is generally high with around 70% of staff having university degrees. District extension staff, however, are not specialized and generally cover a wide range of topics.

In addition to the governmental extension officers, some provinces have implemented their own extension activities through keeping supplemental extension workers, mainly progressive farmers, under the contract between the government of district and farmers. Major activities of them are to establish and operate a model farm and to provide such information as outbreak of pest and diseases to the station in time.

The budgetary arrangement of MARD to agricultural extension consists of current expenditures to cover the operating and administrative costs at the central level and part of the operating costs at the local level. The salaries of extension officers at the provincial and district level are paid from the provincial budgets. It can be said that local spending on agricultural extension is depending on the wealth of the province.

(2) Voluntary extension system

Most important voluntary extension activities have been carried out by SOEs. The SOEs includes Vietnam Coffee Corporation, Vietnam Tea Corporation, Vietnam Cotton Corporation, Vietnam Fruit and Vegetables Corporation, and so on. Generally, though the main operation of these companies include production, processing and marketing of the produces concerned, they are engaged in some appropriate extension activities servicing farmers, particularly contract farmers, to increase the production of raw materials for these enterprises. Some of them also provide fertilizer and pesticide to contract farmers, with the cost deducted from sale of raw crops.

In addition to the above, the following institutions and associations are conducting the extension activities:

(a) Scientific research and training institutions

Most of scientific research and training institutions carry out extension activities aimed at linking research and training with production through transferring and dissemination of technical and technological advances.

(b) Mass organizations

Mass organization such as the Farmers' Association, Veterans' Association and Women's Unions also take part in extension activities according to their specific fields. For instance, the Vietnam Women Union conducts the program for improving the household economy, and so on.

1.4.3 Rural financial institutions

Under the centrally planned economy, there was no commercial banking system in Vietnam. Credit to the farming community was provided indirectly in the past through the collective cooperatives that provided agricultural inputs and services, and was repaid after harvest in the form of specified quantities of outputs. As part of the economic restructuring process, the Government introduced in 1990 a two-tire banking system, under which some former departments of the State Bank of Vietnam (SBV) were converted into financially autonomous commercial banks under the supervision of the SBV. Among these banks, the Bank of Vietnamese Agricultural Development was established in 1988 with an initial equity of about $40 million. In 1990 it was renamed the Viet Nam Bank of Agriculture, and in 1996 it's name was again changed to the Viet Nam Bank of Agriculture and Rural Development (BARD).

According to the Vietnam Living Standards Survey in 1997-1998, the rate of households with outstanding loans is 50.2% on average: 36.5% in urban area and 54.2% in rural area; and the rate of reasons for loans ranks the highest in production development of on average 58.6%: 50.3% in urban area and 63.6% in rural area.

Share of households with outstanding loans by source

(Unit: %)

Sources	Total	Urban	Rural
Total	**50.20**	**36.35**	**54.15**
Private money lender	6.43	4.55	6.97
Relative	14.03	10.65	15.00
Other individual	11.05	13.04	10.48
Bank for poor	6.12	3.80	6.79
Other Government Bank	22.50	8.88	26.44
Socio-economic development programs	4.94	3.86	5.25
Revolving credit associations, cooperative & others	3.63	2.44	3.97

Source: GSO, Vietnam Living Standards Survey 1997-1998

Even though the share of the households who borrows from informal credit sources in

rural area accounts for around 30%, formal credit sources have recently made considerable progress in outstanding loans growth (according to the Vietnam Living Standards Survey in 1992-1993, the share of informal sources was about 73%, and formal sources accounted for only 27%). It means that the formal credit sources become more important for farmers, and close more to farmers.

At present, there are three major rural financial institutions in Vietnam: BARD, the Vietnam Bank for the Poor (VBP), and the People's Credit Fund (PCF). Of these, BARD and VBP dominate the rural finance sector. They are inter-linked at commune level with the People's Committees, and the "mass organizations", mainly the Farmer's Union and the Women's Union. The VBP uses the facilities and human resources of the BARD.

(1) The Viet Nam Bank for Agriculture and Rural Development

The BARD is the biggest rural one of 3 institutions providing the largest amount of investment capital to farming households. BARD is a state owned commercial bank (SOE) which is governed jointly by the State Bank of Vietnam and the Ministry of Finance. However, BARD has self-determining rights regarding its finance, self-responsibility on the results of its business as well as on maintaining and developing its capital.

In order to increase the amount of loans, BARD implemented various forms of fund mobilization. The biggest source was the fund mobilized by locally. The rest came from many other sources such as the transfer of the mobilized funds from urban to the rural areas, borrowing from international finance institutions, and guaranteeing enterprises so that they may borrow from abroad.

The BARD is of a nationwide network from the central to local levels. As of the end of 1999, it has 1,322 transactional agents and branches at all levels with 22,000 staff members in total. BARD's performance has been impressive: the loan portfolio has grown about 20% per annum and is currently about VND 23,437 billion, saving deposits total about VDN 25,313 billion, and out of 11.7 million rural households in Vietnam, BARD's has 4.7 million (40%) clients[10]. Because of being a universal bank, BARD has given loans to all types of economic units of the country including SOEs, non -state companies and households. However, it can be said that BARD has grown from a bank serving SOEs to one serving primarily farm households and rural private sector enterprises as shown in Table D.2.

The interest rate applying for rural areas is adjusted reasonably at each concrete step. From the beginning of 1998, the ceiling interest rate of lending has been equal both in urban and rural areas. Currently, BARD's interest rates are 1.0% per month for lending and an average of 0.4% per month for savings. Further, the State Bank of Vietnam announced a decision on August 2000 to replace the interest rate ceiling with a margin of 0.3% per month for short-term lending and 0.5% per month for medium- and long term

[10] ADB: Program Completion Report on the Agriculture Sector Program in the Vietnam, November 2000.

lending above the prime rate. This would be a step toward interest rate liberalization.

Farming households have been special clients who borrow and repay their loans fairly. Over the past ten years, overdue loans for these households have accounted for just approximately 4% of the total, which is much smaller than the figures of other borrowers[11].

The general outline of BARD's operation and its loan performance are shown in the following tables, respectively.

General Outline of BARD

(Unit: VND billion)

	1996	1997	1998
Mobilized Funds	22,069	23,304	25,313
Of which Cliental Savings	(7,905)	(10,779)	(11,871)
Outstanding Loans	18,735	21,918	27,382
Capital	405	619	2,112

Source: Annual Report of BARD,1999, quoted from Vietnam Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office March 2001.

Loan Performance of BARD by Client

(Unit: %)

	Sectors			Clients		
	Agriculture	Services	Fishing & Salt	Individuals & Priv. Enterpris	SOEs	Cooperatives & Other
1996	66.5	12.3	5.2	68.4	27.1	4.5
1997	76.7	7.9	4.4	59.4	27.3	13.3
1998	64.5	12.7	4.9	71.1	27.1	1.8

Source: Same as the table above

(2) The Vietnam Bank for the Poor (VBP)

The VBP has been established by transferring the Fund for Preferential Lending to the Poor from the BARD on 1st September 1995, and formally been in operation since 1st January 1996.

The VBP has provincial branches in all 61 provinces, and city and district branches in more than 500 districts, townships nationwide. However, VBP dose not have staff and infrastructure and operates as a special facility within BARD.

The VBP's operating objectives are to eradicate hunger and alleviate poverty not for the purpose of making profit. The bank has to maintain and develop its initial capital based on exploiting the sources of funds from aboard as well as domestic institutions and individuals, receiving credit from the State for poor, and other funds that are permitted by the State to establish loanable funds for the poor.

The rural poor are classified and treated separately from the rest of the population for the

[11] Nguyen Van Tiem, " To Strengthen the Service Institutions Supporting Agriculture and Rural Areas" quoted from JICA Study Report of "Vietnam Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office March 2001".

purposes of the rural credit system. This is done on the basis of criteria provided by the Ministry of Labor Invalids and Social Affaires (MOLISA). The People's Committee and the mass organizations assist those households on the poor listings in forming joint liability groups. They then apply to VBP rather than VBARD for loans. Under the VBP poverty is determined in accordance with the MOLISA criterion as the inability to provide for basic nutritional needs.

The operations of VBP are governed by Boards of Management also called Poverty Alleviation Committees from the national to the commune level, made up of officials from different ministries. The VBP lends directly to poor households for the purposes of production and doing business based on the list stated the above. The VBP enjoys certain privileges that are intended to ensure it could lend at below market interest rates, such as exemption from taxes and compulsory deposits. It pays BARD a monthly fee of 0.25% deemed equivalent to the costs of using BARD resources and 0.1% at the commune level to the leaders of the social organizations and the group leaders who facilitate its lending. The lending term is in line with the production cycle of each plant and animal, however, it must be not longer than 3 years. The maximum amount of loans cannot exceed VND 2.5 million for each household.

As of the end of May 1998, VBP mobilized total funds of VND 2,640 million, and the number of credit borrowers were 2,648 thousand. The credit share of the VBP accounts for more than 50% of poor households. Poor farmers repay their debts quite well, and the overdue loans accounts for 1.82%[12].

(3) The People's Credit Fund

In the period from 1956 to 1988, almost all of the communes in Vietnam had credit cooperatives with a total number of about 8,000. After implementing the renovation (Doimoi), the credit mechanisms of these cooperatives were no longer suitable for the market-oriented economy, due to mismanagement, lack of supervision and inappropriate interest rate policies that led to large losses; in particular, market liberalization and withdrawal of Government subsidies hastened the collapse. Thus, there were only 62 credit cooperatives left at the end of 1993.

Under the circumstances mentioned above, the Government has piloted a new model under decision No. QD-390TTg of 1993 by the Prime Minister regarding reforming credit cooperatives under the new model so called the People's Credit Fund (PCF). The reformation of credit cooperatives under the model of the PCF has diversified credit institution patterns in rural areas to fill the void left by the collapse of rural credit cooperatives.

By the beginning of 1998, 53 of 61 provinces formed communal-level 977 PCFs, 21

[12] Nguyen Van Tiem, "To Strengthen the Service Institutions Supporting Agriculture and Rural Areas" quoted from JICA Study Report of "Vietnam Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office March 2000"

regional PCFs, and a central-level PCF. The regional PCF is a union of PCFs that are established and operated within one province, and have a function for harmonizing funds among PCFs in the province. The central-level PCF (CPCF) was established under an operating license issued by State Bank of Vietnam in July 1995, as the apex organization of the PCF network. Its main functions are to provide funds to PCFs, to adjust funds among PCFs at the national level, and to act as an agent in clearing payments between PCFs and other Governmental and external agencies.

Operation of PCFs is generally small in scale with low registered capital under VDN 100 million. Furthermore, preparation and evaluation for lending are done poorly, and as a result overdue loans are of an increasing tendency.

Recently, there are some arguments regarding the valuation of PCFs, particularly for further development prospective. One side has raised pessimistic prospective for the low effectiveness and incapability of management of the PCF, etc. The other side stresses the importance of PCF as a channel for providing more loans in future and the necessity of strengthening PCF more.

1.4.4 Agricultural cooperatives

The agricultural cooperatives have been organized since 1955 in the North and 1977 in the South, and their functions have generally been regarded as an agricultural production unit (a collective production cooperative).

Notwithstanding the effort of the State and farmers for increasing agricultural productivity through cooperative movement, the production of crops, rice in particular, was decreasing year by year and Vietnam became a rice imported country.

After Resolution No. 10 in 1988 many laws, decisions, and directions have been issued to affirm the continuous renovation of the policies of the State. The main contents of the policies include: the farming household is considered as an autonomous economic unit; and the renovation of cooperatives and SOEs shall be based on the great potential and durability of the farming household economy.

In association with the above, the Cooperatives Law was established in 1996, defining cooperatives as autonomous peoples' organization. In order to help implement the law, three decrees were formulated in 1997 on (i) a model charter on agricultural cooperatives (Agricultural Cooperative Law); (ii) a development policy; and (iii) the conversion, registration, and operation of cooperative unions. The principles of the Cooperative Law are: voluntary basis membership, democratic management (one-man one-vote), mutual benefits of members and distribution of surpluses, which are considered internationally as the basic cooperative's principles.

After the enforcement of the agricultural cooperative law, many cooperatives have been newly organized or reorganized by transforming the former cooperatives to new ones. However, the formation of new cooperatives so far has been slow because farmers, by and large, are reluctant to join bureaucratic and politically-influenced cooperatives and prefer to continue their own individual production and marketing activities. The succeeding

table shows that a number of agricultural cooperatives are rather decreasing from 13,782 in 1996 to 8,850 in 2000. This means that the transformation of the former cooperatives under the Cooperatives Law is under the difficult process accompanied with establishment, coalition, or selection. On the other hand, the registration of cooperatives under the Cooperative Law is proceeding, and as of 30 June 2000 about 5,130 of the country's 8,850 agricultural cooperatives (58%) were registered. This process has been more successful in southern Vietnam, which has food surpluses and favorable market conditions. Less favorable market conditions in the northern and central regions appear to be inhibiting the rapid transfer of cooperatives to autonomous farmers' organizations[13].

Change of the Number of Agricultural Cooperatives

		Dec. 1996	Jun. 1999	Jun. 2000
Total		13,782	10,004	8,850
By Areas	**- Nothern Areas**	12,112	8,411	7,295
	- Southern Areas	1,670	1,633	1,555
By Types	**- Transformation**	-	9,007	7,531
	- Newly establishment	-	1,037	1,139
Registered under the Cooperative Law		-	39.1%	58.0%

Source: Vietnam Agriculture toward 21 Century and Japanese Cooperation, JICA Vietnam Office March 2001.

Regarding to the agricultural cooperative's movement, the following constraints can be generally pointed out:

- Most of cooperatives do not have enough funds and equipment/facilities to implement their services.
- Difficulty for getting operational funds from banks due to a lack of assets for mortgage.
- Shortage of cadres who have enough experience and managing skills for doing business.
- Many reorganized cooperatives have less income sources due to poor economic activities; their major economic activities are operation and maintenance of tertiary irrigation canals and other related facilities.

1.5 Poverty and vulnerability in Rural Areas

Even though Vietnam's economy has grown considerably during the 1990s, its GDP per capita is still low at Dong 5.22 million per person in 1999 (about $373). A significant proportion of Vietnam's population continues to live in impoverished conditions. Thus, poverty reduction is one of the key social policies given special attention from the government of Vietnam.

The current poverty situation and achievement of poverty reduction have already been

[13] ADB: Program Completion Report on the Agriculture Sector Program in the Vietnam, November 2000.

studied/analyzed fully by many studies implemented by Vietnamese government, World Bank, ADB and donor's countries, etc. However, these studies use the two nationally representative Vietnam Living Standards Survey carried out by GSO in 1993 and 1998 for the basic and indispensable data. The latest and full-scale study is a Vietnam Development Report 2000 on "Attacking Poverty" prepared by a joint Government-Donor-NGO working group in 1999.

The following are the fundamental topics regarding to the poverty and vulnerability in Vietnam gained by summarizing the report of "Attacking Poverty".

(1) The proportion of people with per capita expenditures under the total poverty line[14] has dropped dramatically from 58% in 1993 to 37% in 1998. The major factor of this success in poverty reduction is the strong growth performance during this period, underpinned by economic reforms, significant inflows of foreign investments, and continuation of market-oriented economic policies. In particular, liberalization of agricultural input and output markets has led to higher productivity and incomes in rural areas, where the bulk of population and of the poor are concentrated.

2) Poverty is mainly concentrated in rural areas, particularly in purely farming households. Over 90% of poor households live in rural areas, mainly work in agriculture or have unstable jobs, and have few off-farm employment opportunities. They tend to have a low level of education, limited professional and business skills, poor access to credit, and physical infrastructure and social services.

Trends in Poverty Rates

Housing Group		Poverty Rate		Change
		1993	1998	
Location	**Urban**	25%	9%	-64%
	Rural	66%	45%	-32%
Whole Country	**Northeast and Northwest**	79%	59%	-25%
	Red River Delta	63%	29%	-54%
	North Central Coast	75%	48%	-36%
	South Central Coast	50%	35%	-30%
	Central Highlands	70%	52%	-26%
	Southeast	33%	8%	-76%
	Cuu Long Delta	47%	37%	-21%

Source: Attacking Poverty, 1999

(3) The table above also shows that poverty is largely a rural phenomenon, with 45% of the rural population living below the poverty line, and is particularly concentrated in three regions: the Northeast and Northwest, Central Highlands, and North Central Coast. Poverty rates in three regions are on average 50% higher than the national average. These areas are characterized by harsh natural conditions, poor natural resources, poor physical and socio-economic infrastructure, or often suffer from

[14] As defined by a budget adequate to buy 2,100 calories of food per person per day and a modest amount of non-food purchases

natural disasters.

(4) The significant recent reduction in poverty has been accompanied by some increase in inequality, due mainly to widening gaps between the rich and the poor. According to the survey, the gap between the richest and poorest quintiles increased from 7.3 times in 1993 to 8.9 times in 1998. The gap in living standards between urban and rural areas also remain large.

(5) Such inequality also exists as the rural-urban gaps. As shown in the following table, the income level and living standards of the rural people are generally low and are painfully low in certain areas, especially in the Northeast and Northwest, and North Central Coast regions. The rural-urban gap increased from 2.5 times in 1993 to 3.7 times in 1998.

Monthly Income Per Capita by Urban, Rural and by Region

(Unit: Thousand dongs)

	1993		1998	
Region	**Income**	**Urban/Rural**	**Income**	**Urban/Rural**
Whole Country	168.1		295.0	
Urban	359.7	2.5	832.5	3.7
Rural	141.1		225.0	
Red River Delta	163.3		280.3	
Northeast and Northwest	132.4		210.0	
North Central Coast	133.0		212.4	
South Central Coast	144.7		252.8	
Central Highlands	197.2		344.7	
Southeast	275.3		527.8	
Cuu Long Delta	181.7		342.1	

Source: GOS, Vietnam Living Standard Surveys in 1993, and 1998

6) Poverty is much common among farm households than others. Almost half of the households (48%) for which agriculture is the main source of incomes are poor compared to less than a quarter of the households whose main source of income is outside agriculture.

In Vietnam there is not enough arable land available per capita to provide farm families with sufficient income from agriculture to escape poverty.

Poor households have lower agricultural productivity than other households. The paddy yield of the poorest quintile (the poorest 20% of the households) is on average 3.37 tons/ha while the richest quintile is 4.11 tons/ha. Furthermore, poor households have less land per capita as shown below:

Farm Land and Paddy Productivity by Quintile

	Paddy Yield (tons/ha)	Farm Land (m^2/capita)
1st quintile	3.37	1,131
2nd quintile	3.84	1,413
3rd quintile	3.92	1,411
4th quintile	4.09	2,457
5th quintile	4.11	2,033

Source: GSO, Vietnam Living Standard Survey 1998

7) Poverty is greatly correlated with the highest level of schooling achieved by household members. Almost 90% of the poor have education at lower secondary level or below.

8) Poor households generally have larger families and a large proportion of children. The child dependency ratio for the poorest quintile is 0.95 and decreasing with expenditure level; at the richest quintile, the dependency ratio is 0.37.

9) Poverty rates are higher among most of the ethnic minorities. Language barriers, less favorable land, and lower educational achievement contribute to this pattern.

As stated above, the causes of poverty are many. In short, hungry and poor households tend to have large numbers of children and few gainfully employed workers. They tend to be headed by single women or depend on women. Members of poor households tend to have a low level of education and lack production and business facilities. These poor households are highly vulnerable to seasonal difficulties and unanticipated shocks as well as natural disasters such as flooding. Poor households are likely to fall into vicious debt traps. Households that have little land and practice monoculture tend to have less capacity to generate a stable income. Poor households in remote areas are usually isolated and have very limited access to technical and social infrastructure and information.

1.6 National Agriculture Development Strategy

1.6.1 Socio-Economic Development Strategy for 2001-2010

In the late 1980s, Vietnam introduced a series of economic and financial reforms that energized the economy and established the conditions for sustained economic growth. Then, in the early 1990s, the country embarked on its move from a centralized to a market-based economy. As a result, GDP has more than doubled (2.07 times) during the last decade. Such growth has made a positive shift in the country's economic structure. In GDP, the share of agriculture dropped from 38.7% in 1990 to 24.3% in 1999, that of industry has risen from 22.7% to 36.6%, and that of services, from 38.6% to 39.1%.

The ninth congress of the communist party of Vietnam, held on 19-22 April 2001, decided upon the Socio-Economic Development Strategy for 2001-2010. The Government envisions Vietnam to become a modern-oriented industrialized country by 2020, with an annual GDP growth rate of at least 7% during the period, and proportionally higher growth in industry and the urban areas. Among the social goals, poverty

alleviation is targeted for basically no longer poor households by 2010. Additional quality of life targets by 2010 include achieving universal lower secondary education, reduce children malnutrition rate from one third to less than 20%, increased life expectancy from 68 to 71 years, near universal access to clean water in urban areas, and expanded forest cover from 28 to 43%. The Government is aware that, to achieve these goals, in the initial years significant emphasis will have to be placed on developing and diversifying the rural economy.

The Socio-Economic Development Strategy for 2001-2010 includes the following agriculture, forestry, fishery and rural economy sectoral development strategies:

- To speed up agricultural and rural industrialization and modernization geared toward forming a large-scale commodity agriculture relevant to market demands and ecological conditions of individual regions;
- To design a rational agricultural production structure;
- To enhance the scientific and technological potentials in agriculture, particularly biotechnology combined with information technology;
- To continue developing and basically complete the water conservancy system for protection from salinisation, freshwater conservation and flood control, ensuring safe and proactive irrigation and drainage for agricultural production and livelihood of farmers; and
- To vigorously develop industry and services in the countryside.

Through the implementation of the above strategies, the agriculture, forestry and fishery sector aims at the following targets:

- To ensure an average annual growth rate of 4.0-4.5% for agricultural output (including aquaculture and forestry).
- To attain a total food grains output of about 40 million tons by 2010.
- The share of agriculture in GDP shall be to amount to around 16-17 %
- To accomplish 5 million ha afforestation program.
- To attain US$ 9-10 billion of export turnover of agricultural, forest and aquatic products.

1.6.2 Agriculture and Rural Development in 2001-2010

Based on the Socio-Economic Development Strategy for 2001-2010 mentioned above, the Ministry of Agriculture and Rural Development (MARD) prepared the following two plans:

- Strategy for Agriculture and Rural Development for 2001-2010
- Five-year Plan on Agriculture and Rural Development in 2001-2005

(1) Strategy for Agriculture and Rural Development in 2001-2010

The Strategy for Agriculture and Rural Development in 2001-2010 has been formulated after fully evaluating the achievements in the preceding ten years, agricultural advantages and disadvantages in the country, and conditions for development.

The basic standpoint of the Strategy may be summarized as follows:

- To ensure food security and food staff to meet with high increasing domestic demand;
- To improve farmer's living standard through increasing agricultural productivity and increasing socio-economic effectiveness;
- To strengthening production relationship among sectors through integration such as between agriculture and forest, agricultural production and processing industry, etc;
- To consider adequate linkage between urban and rural in the process of modernization and industrialization in rural areas;
- To give fully environmental consideration in the process of agricultural and rural development for sustainable development of rural areas; and
- To assure people participation in agricultural and rural development.

Under the above basic standpoints, the development objectives to be attained by the year 2010 are as follows:

- To attain agricultural production growth of 4-4.5% per year and agro-processing industrial growth of 10-12%; Average production per capita will be 350-380 kg of food, 30-40 kg of all-kind of meats, 20-25 kg of fish, 120-140 kg of fruits, 12-15 kg of sugar; nutrition of 2,500-2,800 kcal/capita/day; 50% of working force is in agriculture and the remaining 50% is in industrial and services jobs through shifting from agriculture;
- To reclaim land for expanding more 1 million ha of arable land;
- To increase the forest cover up to 40-50% in general and 50-60% at vital points and watershed areas;
- To achieve agricultural, forest and fishery export turnover of US$ 10 billion, of which US$ 6-7 billion from agriculture and forestry and US$ 3 billion from fishery.
- To create jobs for 8 million labor in rural areas; to double farmer's income; to eradicate poverty households and to reduce poor households to 10-15%; and
- To structure a component rate on agriculture-industry-service sectors in rural area at 50-25-25 against 80-10-10 at present.

(2) Five-year Plan on Agriculture and Rural development in 2001-2005

The overall Goal set forth in the five-year development plan is:

- To ensure the achievement of a relatively high and stable growth rate so as to contribute to the overall national economic development;

- To improve productivity, quality and efficiency of production and business operations;
- To increase employment, eradicate hunger and reduce poverty, and improve the living standards of people; and
- To improve agricultural and rural infrastructure.

In the development plan, there are three scenarios regarding the growth rate: i.e. 4.8% (low scenario), 5.5% (medium scenario) and 6.0% (high scenario). The expected growth rates of each of the three sectors in the agriculture are shown in the following table:

Expected Growth Rate of Agriculture Sectors Under Scenarios

	Low Scenario	Med. Scenario	High Scenario
Agriculture, forestry and fisheries as a whole	4.8%	5.5%	6.0%
1) Agriculture	3.5%	3.9%	4.1%
a) Crops	2.6%	2.9%	2.9%
- Food production	1.0%	1.3%	1.3%
- Cash crops	7.0%	7.4%	7.5%
b) Livestock	6.8%	7.7%	8.5%
c) Agricultural services	2.8%	3.4%	3.8%
2) Forestry	4.1%	4.6%	5.0%
3) Fisheries	11.9%	13.6%	15.0%

Under the above plan, production targets of the major crops and sub-sectors in 2005 are as follows:

1) Food Crops: Food production is expected to reach 36.7-37.0 million tons by the year 2005. The composition of food crops is 34-34.2 million tons of paddy and 2.5-2.8 million tons of maize. The average annual growth rate is expected to be in the range of 1.2-1.4% over the five-year period. Given this output, after subtracting the amount to meet domestic demand, the country is expected to export about 4 million tons in each year. Eighty-five to 90 % of the increase in paddy production will be attributed by increasing planted area and the remaining 10-15% increasing productivity. The corresponding figures in the case of maize are 95% and 5%.
2) Coffee: By the year 2005, the planted area of coffee is expected to remain stable at 450 thousand ha, and its production around 860 thousand tons, of which 800 thousand tons will be for export.
3) Tea: Tea production is expected to expand by 105 thousand ha and an output of 100-105thousand tons in the year 2005. Of which, 60 thousand tons will be for export.
4) Fruit trees: The planted area of fruits trees is expected to maintain the level of 570 thousand ha and the production is projected to reach 2.98 million tons by the year 2005. A majority of which will be for domestic consumption and the remaining portion will be for export.

5) Vegetables: The total planted area of vegetables will be increased to 410 thousand ha from 345 thousand ha in 2000, and their production will reach to 5.2 million tons.

6) Livestock: The direction is to expand the production of livestock greatly. The targets are 4.5-5.2 million head of caws and cattle, 22 million head of pigs, and 250-300 million head of poultry.

7) Fisheries: The total production of fisheries is projected to reach 2.3-2.45 million tons in the year 2005, of which 1.2- 1.25 million tons come from fisheries exploitation and the remaining 1.1-1.2 million tons come from fisheries farming. The value of fisheries export is estimated at US$ 2.3-2.5 billion in that year.

2. AGRICULTURAL DEVELOPMENT IN 14 RIVER BASINS

2.1 Bang Giang and Ky Cung River Basin

2.1.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Bang Giang and Ky Cung River basin stretches over both Cao Bang and Lang Son provinces. Agricultural land in the basin is estimated to consist of 70 % of the agricultural land of Cao Bang province and 40 % of Lang Son Province. Both provinces are basically situated in the under-developed rolling and mountainous areas with strongly intersected topography.

There is about 69,100 ha of agricultural land in the basin of which 68,000 ha (98%) has been used for cultivated land, and remaining of 1,100 ha has not been developed yet. This potential cultivation land can be utilized for agriculture development in the future.

Of the 68,000 ha of cultivated land, 62,800 ha (92%) is for annual crop lands, and the rest is for perennial crop lands.

The annual crop lands of 57,800 ha in the basin are consisted of 36,000 ha of paddy fields and 21,800 ha of upland fields. Of the paddy fields, 25,000 ha or 57% of the paddy fields are irrigated and the remaining are cultivated under the rainfed condition.

Paddy is generally grown two times per year: winter-spring paddy (Jan.-May) and rainy season paddy (June-Oct.). While the rainy season paddy is planted on the whole paddy fields, the winter-spring paddy is planted only on 7,000 ha or 20 % of the total paddy areas. After harvesting rainy season paddy, almost paddy fields are used for subsidiary crops such as maize, cassava, potatoes and groundnut etc.

The annual upland fields of 21,000 ha are usually planted annual crops such as maize, cassava, and soybean, etc. On the perennial crop lands, fruit trees, tea and coffee are grown.

The present land use and prevailing cropping pattern in the basin are shown in Table D.3 and Figure D.1, respectively.

(2) Production and yield

Based on the existing statistical data* and other relevant documents, agricultural production and crop's yield in the basin are estimated as follows:

* includes Statistical Data of Vietnam 1975-2000 (GSO), Socio-Economic Statiscal Data of 61 Province, 2001 (GSO), and Agriculture in Vietnam-61 Provinces, 2001.

Crops	Cultivated Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	43,000		156,800
W-S (irrigated)	7,000	4.5	31,500
Rainy (irrigated)	25,000	4.0	100,000
Rainy (rainfed)	11,000	2.3	25,300
Maize	25,000		52,000
S-S (irrigated)	10,000	2.5	25,000
S-S (rainfed)	15,000	1.8	27,000
Cassava (rainfed)	10,000	6.5	65,000
Sweet Potatoes (irrigated)	2,000	6.5	13,000
Groundnut (irrigated)	1,000	1.2	1,200
Sugarcane	1,800		70,000
Irrigated	500	50.0	25,000
Rainfed	1,300	35.0	45,500
Fruits (rainfed)	4,500		
Tea (rainfed)	600	2.8	1,680
Coffee (rainfed)	100	0.7	70
Other	7,000		

2.1.2 Direction for Agriculture Development in the Bang Giang and Ky Cung River Basin

(1) National agriculture development plan for the Northern Mountainous and Midland Zone

The Bang Giang and Ky Cung basin is located in the Northern Mountainous and Midland Zone. The following are the direction for agricultural development in the Zone stipulated in the Strategy for Agriculture and Rural Development for 2001-2010 (MARD):

- Food production: Rainy season paddy shall be intensified by increasing food crop productivity to meet local food requirement: However, less productive paddy lands shall be converted partly into upland field to increase productivity of cereal and industrial crops. By 2010, area for rice production will be 668,900 ha with productivity of 4.1 million tones (6 ton/ha); area for maize plantation will be 390,000 ha and productivity of 1.45 million tones (4 ton/ha).
- Tea production: Tea production shall strongly be developed in the Zone through improving current tea-planted area and newly plant 35,000 ha to achieve a total tea area of 89,500 ha by 2010 to meet domestic demand and export. This Zone becomes a biggest tea producer in the country, expecting to obtain USD 150 million of export value by 2010.
- Arabica coffee production: Ecological conditions (climate in particular) are suitable for arabica coffee development. Son La and Yen Bai provinces have a promising potential for such development. It is planned to devote 50,000 ha for arabica coffee and kernel productivity of 27,200 tones by 2010.
- Fruit trees production: Develop semi-tropical and temperate fruit trees such as longan,

litchi, orange, mandarin, plump, etc. for supplying to domestic market firstly and then gradually expanding to world market. By 2010, it is planned to devote 200,000 ha for promoting fruit trees plantation and renovating existing ones. Major fruit production areas are: along the national road No. 6; plum and apricot plantation areas in Bac Ha and Ngan Son; litchi areas in Luc Ngan.

- Vegetable production: Develop an area of 5,000-7,000 ha in Moc Chau plateau for plantation of organic vegetables. Such vegetables include cabbage, cauliflower, etc.
- Animal husbandry: Develop the raising of pig, cow for milk and meat (Moc Chau and Son La), bee, goat, etc. Animal husbandry is not only traditional but also advantage of this Zone since it has a large area of 150,000 ha, occupying about 30% of the total national areas for husbandry. Forest areas can also be used for this purpose with an area of about 3.3 million ha. By 2010, it is expected to have 2,187,000 buffaloes and 1,027,000 cows. Cow for milk will be developed about 3,000 - 5,000 in Son La and some areas near to industrial centers and urban. Fresh fish, caged fish in reservoirs and rivers are also needed to develop.

(2) Bang Giang and Ky Cung River basin agricultural development plan

Taking the above national agricultural development plan and both the socio-economic development plans of Cao Bang and Lang Son provinces into account, the basin agricultural development plan may be summarised as follows:

The principal thrust of the agricultural development in the basin is to ensure the food security through increasing productivity of food crops. In addition to this, agricultural diversification shall be promoted by developing specific indigenous crops such as yellow tobacco, walnut, high quality soybean and specific fruits such as plum, litchi, persimmon, etc.

Production target of major crops in the basin is as follows:

- Food crops: The paddy area in the basin will be maintained at the present level. Food security shall be assured by increasing productivity of food crops. In order to increase productivity, it is necessary to promote intensive cultivation practices, to improve existing irrigation facilities in good conditions, and to change rainfed fields to irrigated fields as far as possible.
- Other annual crops: Other annual major crops in the basin are vegetables, soybean, groundnut, sesame and tobacco. These crops shall be developed positively both in planting area and productivity.
- Fruit trees: Fruits are the promising products for promoting agricultural diversification. Specific producing area of fruit's group shall be established: i.e. grapefruit area; Plum-peach-persimmon area, longan-litchi area.
- Tea and coffee: The basin areas except some specific areas are not necessarily suitable for growing tea and coffee due to climatic conditions. In such areas, in particular Lang Son province, a part of existing tea and coffee planting areas with low

productivity and low quality shall be converted into fruit trees and other suitable perennial plants. Thus, the development areas of tea and coffee will be limited only to some specific areas suitable for growing both crops.

2.1.3 Potential for Agriculture and Irrigation Development

The agricultural sector will be declined gradually replacing by rapid increases in industry and trade. Nevertheless, the basin has substantial untapped potential for integrated economic development in agriculture and forestry. About 90% of the basin area are covered with forest, much of which have been removed or destroyed due to slash-and-burn farming and other nomadic agricultural practices. In such areas, afforestation and expanding cash crop production would best utilize the favorable land and water resources availability and conditions in the basin.

The basin has unique trade advantages of easy accessibility to China's market adjoining the basin. Furthermore, climatic and topographic characteristics of the basin provide the diversified production advantages for producing fruits tree (apricot, plum, litchi and longan) and walnut tree, and industrial crops such as sugarcane, tobacco, soybean and groundnut, etc.

The present irrigation infrastructure in the basin consists mainly of numerous gravity and pumping schemes to irrigate small-scale schemes of 10-100 ha. Most of these infrastructures were built 30-40 years ago, and are in need of upgrading. According to the World Bank Study[**], the total design irrigation areas in the basin are 36,000 ha, and the effective irrigated areas amount to 25,000 ha, which cover 70% of the design capacity. The remaining 11,000 ha could be irrigated through rehabilitating/improving existing irrigation schemes, and constructing additional new small reservoirs and/or weirs.

2.1.4 Agricultural land use plan for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.4 and Figure D.2, respectively.

2.2 Red River Basin

2.2.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

The Red River basin is consisted with two agro-ecological zones: the Red River Delta and the Northern Mountainous and Midland Zone. Red River Delta is a principal food center in the North. The Delta provides about20% of Vietnam's rice (6,355 thousand tones in 1999), and almost 66% of the basin's paddy area lies in the Delta. On the other hand, the Northern highlands area have a poor socio-economic infrastructure and only 11% of its total area has been developed for agricultural production, representing the

[**] Vietnam: Water Resources Sector review, A Joint report by WB, ADB, FAO, UNDP and the NGO. 1996

lowest land use ratio in the whole country.

The basin covers the whole area of the Red River Delta consisted of 11 provinces* and the 12 provinces** in the Northern Mountainous and Midland Zone. Thought the later zone is consisted of 14 provinces, both Cao Bang and Lang Son provinces are belong to the Bang Giang and Ky Cung river basin. Furthermore, about 45% of the agricultural land of Bac Kan province is considered to belong to the Ban Giang and Ky Chung river basin, and 15% of Lai Chau, 35% of Son La and 30% of Hao Binh provinces belong to the Ma river basin, respectively.

There is about 1,628,000 ha of agricultural land in the basin of which 1,485,000 ha (91%) has been used for cultivated land and remaining of 143,000 ha has not been developed yet. Of the cultivated land, 1,307,000 ha (88%) is for annual crops lands and the rest of 178,000 ha is for perennial crop lands.

The annual crop lands of 1,307,000 ha are consisted of 1,006,000 ha of paddy fields (77%) and 301,000 ha of upland fields. The agricultural land use of both zones has a distinctive feature: a ratio of paddy land to upland is 91 to 9 in the Delta and 45 to 55 in the Mountainous area.

Of the paddy fields, about 75 % (755,000 ha) of the paddy fields are irrigated and the rest are under rainfed condition. Regarding upland fields, about 287,000 ha (60%) is irrigated.

Paddy is generally grown two times a year: winter-spring paddy and rainy season paddy. While the planting period of paddy varies considerably within the basin areas due to the difference of climatic conditions, standard planting period for winter-spring paddy is from January to May and June to October for rainy season paddy. After harvesting rainy season paddy or some paddy fields where are no rainy season paddy are used for subsidiary crops such as maize and vegetables.

Major annual upland crops in the basin include subsidiary crops such as maize, potatoes and vegetables, and annual industrial crops such as soybean, groundnut, sugarcane, jute, rush and mulberry. Major perennial crops are fruits, tea and coffee.

The present land use and cropping pattern in the basin are shown in Table D.5 and Figure D.3, respectively.

(2) Production and Yield

Based on the existing statistical data and other relevant information, agricultural production and crop average yield in the basin are estimated as follows:

* includes Ha Noi, Hai Phong, Vinh Phuc, Ha Tay, Bac Ninh, Hai Dong, Hung Yen, Ha Nam, Nam Dinh, Thai Binh, and Ninh Binh

** includes Ha Giang, Lao Cai, Bak Kan, Tuyen Quang, Yen Bai, Thai Nguyen, Phu Tho, Bac Giang, Quang Ninh, Lai Chau, Son La, and Hoa Binh

Crops		Cultivated Area (ha)	Yield (ton/ha)	Production (ton)
Paddy		1,884,000		10,255,500
	W-S (irrigated)	755,000	6.5	4,907,500
	W-S (rainfed)	251,000	2.5	627,500
	Rainy (irrigated)	659,000	6.0	3,954,000
	Rainy (rainfed)	219,000	3.5	766,500
Maize		170,000		512,500
	W-S (irrigated)	50,000	3.5	175,000
	W-S (rainfed)	35,000	2.0	70,000
	Rainy (irrigated)	65,000	3.5	227,500
	Rainy (rainfed)	20,000	2.0	40,000
Soybean		39,000		62,000
	Rainy (irrigated)	23,000	2.0	46,000
	Rainy (rainfed)	16,000	1.0	16,000
Groundnut		34,000		54,000
	W-S (irrigated)	10,000	2.0	20,000
	W-S (rainfed)	7,000	1.0	7,000
	Rainy (irrigated)	10,000	2.0	20,000
	Rainy (rainfed)	7,000	1.0	7,000
Sugarcane		16,000		910,000
Tea		82,000		277,600
Coffee		25,000		34,000
Other (fruits, vegetables,)		501,000		

2.2.2 Direction for Agricultural Development in the Red River Basin

The Red River basin is consisted with two agro-ecological zones: the Red River Delta and the Northern Mountainous and Midland Zone. The direction for agricultural development of each Zone described in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

(Red River Delta)

For the coming 10 years the Red River Delta shall be developed with a high technique agriculture, intensive labor use and high commodity productivity and quality, to meet the basin demand and export and to raise income value per hectare. Direction of agriculture and rural development in the Red River Delta by 2010 will be as follows:

- Food Production: Main task of this area is to secure food to meet basin demand. Continue to develop food production by increasing productivity with intensive farming practices and promoting the production of high quality rice. Besides, production of rice for export shall be recommended to improve paddy farmers' income. By 2010, targets of paddy production shall be 1,151,000 ha of paddy area with a total rice production of about 6.0-7.2 million tones. Of the total rice production, 1 million tones will be exported to abroad and another 1 million tones sold for domestic markets. The area for winter-spring maize planted shall be

expanded 200,000 ha by 2010, of the production 800,000 ton will be for export to other basin.

- Vegetable, flower, and semi-tropical fruit tree production: Vegetables are planted to serve for domestic consumption. Its planting areas by 2010 would be 150,000 ha with productivity of 2.7 million tones of which 0.5 million tones for export to other basins. Flower and ornamental tree production are one of promising advantageous crops for the Delta and expected to be USD 100 million per year. Fruit trees' planting shall be promoted for longan and litchi (33,000 ha), banana (20,000 ha), pineapple (2,000 ha) and citrus fruit trees (8,000 ha), respectively.
- Annual industrial crops production: These annual industrial crops comprise soybean, groundnut, mulberry, jute and rush. By 2010, these crops shall be expands their planting areas by 68,000 ha (soybean), 52,000 ha (jute), 3,000 ha (rush) and 4,000 ha (mulberry), respectively.
- Animal husbandry: Animal husbandry will be shifted from traditional ways to the modern large scale breeding by using improved varieties and assorted feed. The major livestock will be pig, poultry, buffalo and cow.

(Northern Mountainous and Midland Zone)

The direction for agricultural development of each Zone described in the Strategy for Agricultural and Rural Development for 2001-2010 is to be refer to Bang Giang and Ky Cung River Basin.

2.2.3 Potential for Agricultural and irrigation Development

(1) Potential for agricultural development

The Red River Delta is an important rice cultivation area with high percentage of intensive farming and agricultural land use compared to the notional level. Due to high population density and small and decreasing farming area per capita, however, it is still difficult to meet food demands. Furthermore, continuing pressures to sustain agricultural production in the delta are inevitable, because: (a) there is little scope to increase the cultivated area, or the irrigated area; and (b) the cultivated area is expected to decline over the next decades as agriculture land will be used gradually for urbanization and industrialization. The Red River Delta, however, has a lot of advantage for the development of agriculture: i.e. high irrigated ratio with abundant irrigation water, favourable geographical location located near the large cities as Hanoi and Hai Phong, endowed with transportation facilities (road, airport, harbour) for agricultural marketing, and huge labour force with high intellectual. There is high potential for agricultural development through applying highly advanced agricultural technology, labour intensive cultivation methods, and diversifying to high value crops.

Major problems in the delta area are erosion, flood control and flood diversion, saline water intrusion, water logging and drainage. Although available land resources suitable for new reclamation are limited, there are potential to increase the annual planted areas of

rice by provision of drainage facilities in waterlogged areas and introduction of appropriate rice varieties for the winter/spring season.

The Northern highlands areas have a poor socio-economic infrastructure and only about 13% of its total area has been developed for agricultural production, representing the lowest land use ratio in the whole country. Agricultural and forestry production in recent years is not commensurate with its land potential. Although the average available land area per capita is not small, the area had to import an increasingly large quantity of food products from outside. Shifting agriculture with low yield and production is expanding. However, it is estimated that there are land resources of at least 140,000 ha suitable for cultivation of perennial tree crops, annual industrial crops, and paddy. Furthermore, the climate is suitable for a wide range of crops and the land is fertile, and many areas, if supported by the appropriate infrastructure and technology could produce higher value cash crops. In the future, this area will be able to become self-sufficient in food and contribute significantly to the supply of some specific products to the whole country by promoting upland farming, increasing the ratio of industrial crops in existing cultivated areas, and introducing improved seeds, fertilizer, and intensive cropping.

(2) Potential for irrigation development

Unlike the other river basins in Vietnam, water in the Red River basin is abundant for now and the near future. Waterways are close to irrigated lands, so there is little need for large, long conveyance canals.

In the Red River Delta, the irrigation and drainage system has played an essential role in the Delta basin development. Nearly all paddy-cultivated areas in the Delta are supplied with irrigation. Thus, only small areas of land could be serviced with new irrigation systems. On the other hand, considerable parts of low-lying areas have drainage constraints. The World Bank's Study estimated* that about 230,000 ha on an average are subject to water-logging every year.

According to the World Bank Study, the irrigation system relies heavily on pumping. Currently, irrigation pumping covers nearly 500,000 ha, and drainage pumping covers 450,000 ha. The remainder of the irrigated area is supplied and drained by gravity. However, much of the system, which was built in the 1960s and 1970s, has deteriorated and requires systemic renovation and modernization. The difference between the actual pumping capacity and the design capacity is believed to be 30-40 %. Thus, the areas of opportunity are likely to be to: (a) improve irrigation and drainage efficiencies to close the gap between the design and actual irrigation command areas; (b) increase the delivery efficiency from the canals to the fields; and (c) upgrade existing systems.

In the Mountainous and Midland areas, the paddy fields are mainly located on the bottom areas of valleys. The share of irrigated paddy fields is estimated at only about 40 %, or 155,000 ha of a total paddy area of 377,000 ha in the mountainous area of the basin.

* * * Vietnam: Water Resources Sector Review, A Joint report by WB,ADB,FAO, UNDP and NGO in cooperation with IWRP, 1996

The World Bank's Study also estimated* that there are about 79,200 ha of the potential for irrigation development in the mountainous area through constructing small reservoirs and dams, and installing pumping stations.

2.2.4 Agricultural land use plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.6 and Figure D.4, respectively.

2.3 Ma River Basin

2.3.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

While the Ma Basin covers the eastern part of Son La and Lai Chau provinces located in the North West Mountainous Zone, almost all of agricultural land is mainly belong to Thanh Hoa province located in the North Central Coast Zone. In calculating of a total agricultural land area in the Ma river basin, it is estimated at 105% of the total agricultural land of Than Hoa province because the river basin includes a small portion of agricultural land area of Hoa Binh and Nghe An provinces.

Mountains where there is virtually no arable land cover more than 80% of the basin area. Flat lands are located along the river valleys and estuaries. The total cultivated lands are estimated to be about 247,000 ha. In addition to the cultivated lands, it is also estimated that there are about 75,000 ha of potentially arable land in the upper-middle basin.

Of the 247,000 ha of cultivated land, about 218,000 ha is for annual crop lands and the rest of 29,000 ha is for perennial crop lands. The annual crop lands are consisted of 143,000 ha of paddy fields and 75,000 ha of annual upland fields. The annual crop lands have been fully utilized for paddy and subsidiary crops (maize, cassava, sweet potatoes, groundnut and other) and sugarcane.

Of the paddy areas, 106,000 ha or 74% of paddy areas are estimated to be irrigated and the remaining are cultivated under rainfed condition. Paddy is generally grown two times per year: winter-spring paddy (from Jan. to May/ June) and rainy season paddy (from July to Nov./Dec.). Regarding to the irrigation for upland areas, only about 6% of upland fields (6,000 ha of sugarcane lands) has been irrigated.

The present agricultural land use and prevailing cropping pattern in the basin are shown in Table D.7 and Figure D.5, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant information, agricultural production and crop's yield in the ma basin in 2001 is estimated as follows:

Crops	Cultivated Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	266,000		1,024,200
W-S (irrigated)	91,000	4.7	427,700
W-S (rainfed)	32,000	2.5	80,000
Rainy (irrigated)	106,000	4.0	424,000
Rainy (rainfed)	37,000	2.5	92,500
Maize	42,000		105,000
W-S (rainfed)	21,000	2.5	52,500
Rainy (rainfed)	21,000	2.5	52,500
Cassava (rainfed)	13,000	5.5	71,500
Sweet Potatoes	28,000		168,000
W-S (rainfed)	14,000	6.0	84,000
Rainy (rainfed)	14,000	6.0	84,000
Groundnut	16,000		22,400
W-S (rainfed)	8,000	1.4	11,200
Rainy (rainfed)	8,000	1.4	11,200
Sugarcane	18,000		984,000
Irrigated	6,000	70.0	420,000
No-irrigation	12,000	35.0	564,000

2.3.2 Direction for Agricultural Development in the Ma River Basin

(1) National agricultural development plan for North Central Coast Zone

The Ma river basin is located in the North Central Coast Zone. The direction for agricultural development in the Zone stipulated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

The main objectives to develop agricultural and forestry production in this Zone by 2010 are to accelerate commodity-based production, and to promote advantages for achieving an average growth rate of 4-5% a year with shifting economic pattern through increasing ratio of animal husbandry, processing industry and services.

- Food production: Paddy land shall be maintained under good conditions, though some areas under inferior conditions and less productivity will gradually be shifted to the area of high value upland crops, fruit trees, fish ponds etc. By 2010, area of rice production will be 679,000ha with productivity of 3.1 million tones. Area for maize production will be expected to140,000 ha with productivity of 595,000 tones.
- Groundnut: Groundnut production shall be promoted both in area and productivity. Major producing areas are Thanh Hoa, Nghe An and Ha Tinh provinces. By 2010 total area for groundnut production will be expected to 99,500 ha.
- Sugar and sugarcane: Establish specific sugarcane production areas in 4 provinces for developing the sugar industry, of the 4 provinces Thanh Hoa and Nghe An provinces may occupy high ratio of nearly 70% in the total sugarcane areas. By 2010, the total area of sugarcane plantation expects to be 79,100 ha with productivity of 5.9 million tones.
- Rubber: By 2010 the area for rubber production will reach at 66,000 ha, mainly in

Thanh Hoa, Nghe An, Ha Tinh and Quang Tri provinces. There are great lands for rubber development in those provinces.

- Arabica coffee: Arabica coffee production will be focussed in 2 provinces: Nghe An and Quang Tri provinces with a total potential area of around 30,000 - 36,000 ha. In the years to come, arabica coffee is recommended to increase by 40,000 - 43,000 tones of kernel.
- Tea: Tea shall be mainly developed in 3 provinces of Thanh Hoa, Nghe An and Ha Tinh and replaced old tea gardens with new high quality varieties. It is expected to be 12,700 ha of tea by 2010.
- Pepper: By 2010 the area for pepper production expect to be 2,730 ha with new good varieties.
- Fruit tree: Develop specific fruit trees with high economic value such as grapefruit, persimmon, etc. Establish concentrated fruit tree area under condition of production-transport-processing. Area for fruit tree by 2010 expected to reach 80,000 ha.

(2) Ma river basin agricultural development plan

Taking the above national agricultural development plan and the socio-economic development plan of Thanh Hoa province into consideration, the basin agricultural development plan may be summarized as follows:

1) Basin economic development goals and priority

The overall basin economic development goals and priorities are to: continuously create favorable conditions for agricultural development to keep pace with the average national per capita income; and solve basic problems on poor households for the purpose to attain the national average living standard.

2) Agricultural development direction for major crops.

In order to attain the above goals, farmer's income and living standard shall be increased based on an effective agricultural production under the stable and efficient irrigation and intensive farming.

Production target of major crops in the Ma basin is as follows:

- Food security: Food production is very important to ensure the local people's demand for food. Highly intensive paddy cultivation shall be promoted through spreading more high yielding varieties of paddy and maize and intensifying agricultural land use, in particular double cropping.
- Agricultural strategic major products selected for the development in the basin are: sugarcane, groundnut, coffee, rubber, and tea. To promote the production of these crops, specialized-production zones shall be formed for efficient production and export. Sugarcane areas are in 3 areas of Thanh Hoa province (Southwest, North and Lam Son areas with a total area of 34,000 ha in 2010). Groundnut is mainly in

Tinh Gia, Nga Son, Hoang Hoa and Hau Loc districts with a total cultivated area of 20,000 ha in 2010. Coffee, tea, rubber and fruits trees will mainly be increased in the mountainous and hilly areas where unused land exists with a target area of 7,500 ha for coffee, 9,000 ha for tea, 11,000 ha for rubber, and 23,000 ha for fruits, respectively, in 2010.

2.3.3 Potential for Agricultural and Irrigation Development

In the Ma basin area, mountainous areas cover approximately 80% of the total area. Farm land distribution per capita, in particular paddy cropping area, is the lowest in the country, and lands have low soil fertility and are frequently subjects to typhoons and floods. The potential for agricultural development through expansion is limited by the rugged topography of the basin and climatic and hydrological factor constraint. Despite these factors, for the time being, in the absence of a promising industrial and service sector prospects, raising of living standards in the Ma basin will depend almost exclusively on agricultural growth. Therefore, potential cultivated lands of about 75,000 ha mentioned earlier shall be put into agricultural production positively for extension of industrial crop cultivation including coffee, tea and rubber, etc.

Based on the information*, the irrigation and drainage conditions in the basin are summarized as follows:

- The amount of runoff varies greatly during the year with a variation from 4 –10 m between the dry and flood seasons. Existing water supplies in March - April are usually unable to meet the demand from cultivation of the spring crop;
- Water in upstream of the Ma river basin can satisfy water users. However, some water conveyance structures will be needed to construct and upgrade;
- Middle and lower areas of the Ma river basin usually lack water in dry season;
- In the southern area of the Chu river, water shortage often occurs in dry season, causing serious salinity intrusion at estuaries of the Ma and Len rivers resulting in difficulties in cultivation of 17,800 ha in Ha Trung and Nga Son districts;
- The regularly waterlogging areas in Thanh Hoa province plain are 13,666 ha;
- There are 560 gravity schemes (small reservoirs, weirs) in the upper Ma to irrigate 75,000 ha, and some 800 pumps (250 pumping stations) in the lower Ma to irrigate 61,000 ha. While the design areas of these schemes are 224,000 ha, the actual irrigated areas are only 60%. The system is 30 - 80 years old and has deteriorated badly.
- Only 90,000 ha of the above irrigated area of the 136,000 ha is provided with drainage facilities. Of this, 19,000 ha is drained mechanically by pumps, and 71,000 ha is drained by gravity. However, due to a deterioration in the system, the area

* Feasibility Study of Cua Dat Multipurpose Project in Chu River of Ma River Basin, 1999, Province of Thanh Hoa and W.B's Water Resources Sector Review, 1996.

actually drained is only 27,000 ha, that is 30% of the design areas.

JICA Study team estimated the present irrigation status of the basin: The total irrigation design areas cover virtually all the paddy land (143,000 ha) in the basin. But only 106,000 ha or 74% of total paddy land is actually irrigated due mainly to the deterioration of the irrigation facilities.

In order to secure more irrigation water and effective drainage, and to improve flood control and saline water intrusion, it will be essential and crucial for repairing and upgrading the existing irrigation structures for exploiting their capacity to full extent, improving and constructing supplemental structures for irrigation and drainage, and constructing new structures necessary for irrigation.

2.3.4 Agricultural Land Use Plan for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.8 and Figure D.6, respectively.

2.4 Ca River Basin

2.4.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

The Ca basin area stretches over both Nghe An and Ha Tinh provinces. Agricultural land in the basin is consisted of 95% of the agricultural land of Ha Tinh province and 85% of Nghe An Province.

There are about 242,000 ha of agricultural lands in the Ca basin of which 194,000 ha 188,000 ha have been cultivated (80%), the rests have not been developed yet.

The cultivated lands consisted annual crop lands and perennial crops lands of which annual crops land occupy about 91% of the cultivated lands and perennial crop lands occupy only 6,000 ha.

Of the annual crop lands, 147,000 ha (78%) of paddy fields and 41,000ha (22%) of upland fields where are cultivated annual subsidiary crops and industrial crops. The perennial crop fields are used for planting rubber, tea, coffee and fruits trees. The unused agricultural lands of 54,000 ha will be reclaimed to use for cultivated lands in future, particularly for upland crops.

Of the paddy areas, 88,000 ha or 60% of paddy areas are estimated to be irrigated and the remaining are cultivated under rainfed conditions. Paddy is generally grown two times: winter- spring paddy (January-May) and summer-autumn paddy (May/June-Sep./Oct.) or rainy season paddy (July-Oct./Nov.). The summer-autumn paddy is planted a little bit earlier than the rainy season paddy to avoid heavy flood in the basin. After harvesting summer-autumn paddy or rainy season paddy, some fields are used for subsidiary crops

such as maize, soybean, groundnut, etc.

The annual crop upland fields have been cultivated mainly maize, soybean, sweet potatoes, and others including sugarcane and vegetables.

The present land use and prevailing cropping pattern in the basin are shown in Table D.9 and Figure D.7, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin in 2001 are estimated as follows.

Crops	Cultivated Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	261,000		924,100
W-S (irrigated)	67,000	4.6	308,200
W-S (rainfed)	47,000	2.3	108,100
S-A (irrigated)	47,000	4.6	216,200
S-A (rainfed)	32,000	2.3	73,600
Rainy (irrigated)	41,000	4.0	164,000
Rainy (rainfed)	27,000	2.0	54,000
Maize	22,000		47,000
W-S (irrigated)	1,000	3.5	3,500
W-S (rainfed)	10,000	2.0	20,000
Rainy (irrigated)	1,000	3.5	3,500
Rainy (rainfed)	1,000	2.0	20,000
Sweet Potatos	18,000		56,000
W-S (irrigated)	1,000	5.5	5,500
W-S (rainfed)	5,000	4.5	22,500
Rainy (irrigated)	1,000	5.5	5,500
Rainy (rainfed)	5,000	4.5	22,500
Groundnut	12,000		9,300
W-S (irrigated)	500	2.3	1,150
W-S (rainfed)	3,500	1.0	3,500
Rainy (irrigated)	500	2.3	1,150
Rainy (rainfed)	3,500	1.0	3,500
Sugarcane	8,000		498,000
Irrigated	1,000	85.0	85,000
Rainfed	7,000	59.0	413,000
Rubber	3,000	0.7	2,100
Tea	2,000	3.5	7,000
Coffee	1,000	1.0	1,000
Other	12,000		

2.4.2 Direction for agricultural development in economic zone (North Central Coast Zone)

(1) National agricultural development plan for North Central Coast Zone

The Ca basin is located in the North Central Coast Zone. The direction for agricultural development in the Zone is clearly indicated in the Strategy for agricultural and Rural development for 2001-2010. The basic development direction is to be referred to Ma River basin.

(2) Ca basin agricultural development plan

Based on the both Nghe An and Ha Tinh provinces development plan (agricultural sector) and fully considering the above national agricultural development plan for the North Central Coast Zone, the basin agricultural development plan may be summarised as follows:

- Food crops: While a small portion of rainfed paddy areas of about 6,000 ha located in Nghe An province will be converted to subsidiary crop fields, paddy fields shall basically be maintained the same level as at present. The increase of food production shall be attained through increasing productivity. In order to do so, dissemination of new advanced cultivation technologies and improving/constructing irrigation facilities are essential. Maize will increase in mountainous areas with a high growth rate through expanding its planting area and increasing productivity. Cassava and sweet potatoes are the main food products in hilly and mountainous areas, particularly in Ha Tinh province. These crops shall be converted into high value crops as far as possible.
- Industrial crops: Major industrial crops in the basin are groundnut, sugarcane, coffee, tea, and rubber. These products can be exported to domestic and international markets.

  Main development thrusts of groundnut are to improve its cultivation method more intensively, to expand planting areas into under perennial trees, and establish a rotational planting system with sugarcane. Thus, production of groundnut in 2010 will be expected to increase by three times for exporting.

  Sugarcane shall be increased by improving productivity using new high yielding variety and expanding planting area.

  Tea and coffee are considered as effective crops planted in the hilly areas of the basin. Present planting areas of both crops shall be increased substantially up to 2010 under the support of central government.

  Rubber was planted over 30 years with high efficiency on basalt soil area in the basin. Rubber planting area shall be increased substantially up to 2010.
- Breeding: Breeding plays an important role in household economy and the basin has many advantages to develop breeding sector. Cattle breeding (buffalo, cow, deer and goat) shall be developed in mountainous and hilly areas and pig and poultry are in plain area.

2.4.3 Potential for Agricultural and Irrigation Development

The economy of the Ca basin is underdeveloped. The basin economy is dominated by agriculture, which produces 60% of the basin GDP.

At present, the agricultural lands are estimated to be 220,000 ha. About 194,000 ha are currently used for cultivated lands with a cropping intensity of 200%.

There is some potential for increasing agricultural production, because the development of high value crops is still at an early stage, and unused potential cultivation land of 25,000 ha will be able to use for agricultural development, particularly for high value crops such as coffee, rubber, tea, sesame, mulberry, orange, and lemon.

The Ca river basin has some other potential for agricultural expansion. Crops are limited by regular droughts during May and June and floods during September and October: the summer/autumn crops are constrained by regular droughts in May and June, and are threatened by typhoons and floods in September and October. The high spatial variation of rainfall and considerable seasonal variations of runoff, accompanied by inadequate water resources infrastructure for drainage and flood protection, make it difficult to stabilize agricultural production. Thus, in order to fully explore the agricultural potential and then sustain agricultural production in the basin, better control over the basin's water resources becomes necessary, as water continues a major bottleneck in the basin's heavily agricultural economy.

According to the World Bank Jointed Study*, the irrigation systems in the basin are relatively well-developed, represented by several major systems- Nham Hung Nghi, Dien Yen Quynh, Nghe An and Linh Cam. While the total paddy area covers 147,000 ha, the Study Team estimated the actual irrigated areas to be 88,000 ha or 60% of the total paddy areas, due to either sever deterioration of the existing irrigation system or no irrigation facilities.

Given that the irrigation and drainage infrastructure is relatively well-developed but not effectively utilized, there is scope to increase agricultural production through improving the existing system and increasing the irrigated areas.

The World Bank Jointed Study* pointed out that the potential for rehabilitation of the irrigation network is some 50,000 - 60,000 ha. The area near the lower Hieu River has been identified by MWR to have good agricultural development potential, and investments in water resources infrastructure in the area will offer quick returns.

2.4.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.10 and Figure D.8, respectively.

* Vietnam, Water Resources Sector Review, A joint report by WB, ADB, FAO UNDP and the NGO, 1996

2.5 Thach Han River Basin

2.5.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

The Thach Han river basin has three ecological regions, mountains and hills, plains, and sandy coastal. The plains are mostly at an elevation of 0.1 to 3.5 m and about 2,200 ha of plains are at an elevation of 7 – 10 m.

The basin extends into Quang Tri province, which belongs to the North Central Coast Zone. The agricultural land of the basin is estimated to be about 32,000 ha or 40% of the total agricultural land of Quang Tri province.

The agricultural lands are categorized into four: paddy lands of 10,000 ha, 4,400 ha of annual crop lands, 6,600 ha of perennial crop lands and potential cultivated land of 10,000 ha. The last category will be used for the cultivated land in future.

Of the paddy area, 4,000 ha or 40% of the total paddy land has been irrigated and the rest is under rainfed condition. Paddy is generally grown two times: winter-spring paddy (Dec.-April) and summer-autumn paddy (May-Sept/Aug.) or rainy season paddy (June/July-Oct./Nov.). The summer-autumn paddy is planted a little bit earlier than the rainy season paddy to avoid heavy flood in the basin.

The annual crop lands are cultivated mainly maize, groundnut, sugarcane, vegetables and other crops including sweet potatoes, cassava, etc. Major perennial crops are rubber, coffee and fruits trees.

Of the annual and perennial upland lands of 11,000 ha, 1,000 ha or about 10% of the total upland fields has been irrigated.

The present agricultural land use and cropping patterns in the basin are shown in Table D.11 and Figure D.9, respectively.

(2) Production and Yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin in 2001 are estimated as follows:

Crops	Cultivated Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	19,000		70,000
W-S (irrigated)	4,000	5.5	22,000
W-S (rainfed)	6,000	2.5	15,000
S-A (irrigated)	3,000	5.5	16,500
S-A (rainfed)	4,000	2.5	10,000
Rainy (irrigated)	1,000	4.5	4,500
Rainy (rainfed)	1,000	2.0	2,000
Maize	1,000		2,000
W-S (rainfed)	500	2.0	1,000
Rainy (rainfed)	500	2.0	1,000
Groundnut	1,600		2,200
W-S (irrigated)	300	2.0	600
W-S (rainfed)	500	1.0	500
Rainy (irrigated)	300	2.0	600
Rainy (rainfed)	500	1.0	500
Rubber (rainfed)	4,400	0.7	3,080
Coffee	1,200		970
Irrigated	100	2.0	200
Rainfed	1,100	0.7	770
Other	6,700		

2.5.2 Direction for Agricultural Development in the Thach Han River Basin

(1) National agricultural development plan for North Central Coast Zone

The Thach Han river basin is located in the North Central Coast Zone. The direction for agricultural development in the Zone is clearly indicated in the Strategy for agricultural and rural development for 2001-2010. The basic development direction is to be referred to the Ma River Basin.

(2) Thach Han River Basin agricultural development plan

1) Basin economic development goals and priority

The overall basin economic development goals and priorities are to: 1) construct Rao Quan dam, 2) generate hydropower of 70 MW, 3) irrigate for 12,200 ha of paddy and 1,600 ha of upland crops, 4) supply water to Quang Tri towns, and 5) control flood to reduce 20 cm of peak flood at downstream.

2) Agricultural development direction of major crops for the year 2010

- Food security: Food production is very important to ensure the inhabitant's food demand in the basin. Highly intensive paddy cultivation shall be promoted in Hai Lang, Trieu Phong, Vinh Linh, and Gio Linh districts to attain a yield of 4.5 tons/ha in 2010. Other food crops shall also be expanded through introducing advance technology and new crop varieties: maize in Huong Hoa, Trieu Phong, Cam Lo districts; sweet potatoes in Trieu Phong, Vinh Linh, Hai Lang, Gio Linh districts.

  Special attention should be paid to irrigation works to supply water adequately.

- Rubber: Rubber is weighed up as the first strategic plant of the basin in terms of economic benefits and environmental protection. Development direction for the year 2010 is to increase its planted area and yield by 17,3000 ha and 19,500 tons, respectively.
- Arabica coffee: Coffee production shall be increased to an area of 11,800 tons in 2010 through expanding planted area to 7,500 ha and improving cultivation and irrigation technique.
- Pepper: Pepper production shall be expected to be an area of 2,300 ha with a production of 3.000 tons.
- Aquaculture: Aquaculture outputs for the year 2010 expects to be 800 tons (of which 100 tons of shrimp).
- Breeding: Expectation of livestock to 2010 is 42000 heads for buffalo; 85000 heads of caw of; 240 000 heads of pig; 256 000 heads of duck and 6.41 million eggs.

2.5.3 Potential for Agriculture and Irrigation Development

In the basin area, there are about 10,000 ha of potential cultivation land. The basin is endowed with natural resources, especially for the basalt soil prevailing longitudinally on National Route No.9 that would well nourish perennial industrial crops such as rubber, pepper, and coffee. Therefore, this potential cultivation land shall be used positively for promoting high value industrial crops (annual and perennial). In addition to the promotion of the perennial industrial crops, there are some potential for increasing both in area and productivity of annual crops such as paddy and subsidiary crops through the expansion of irrigated land.

In the basin area, the total irrigated area is only 40% of the total paddy land of 10,000 ha and the rest is under rainfed condition. Thach Han Irrigation Scheme is the biggest scheme in the basin at present, and all existing irrigated fields in the basin are under the scheme. Thach Han weir is the most important source of irrigation water for the irrigation scheme. Main problem of the scheme is lack of irrigation water caused by insufficient irrigation facilities and water resources. Because the Thach Han weir was built in 1978 when the war just stopped so there was not adequate conditions to complete the canal system, besides canals were built on sandy soils resulting in serious deterioration and degradation.

According to the information[*], there are in the basin 16 small and medium reservoirs including ponds on sandy soils to keep irrigation water for dry season, 11 combined irrigation and drainage pumping stations with capacities of 540 to 1,000 m^3/ha. There is also Cua Lac salinity prevention weir located in O Lau estuary flowing to Tam Giang lagoon. Regarding to the drainage, drainage is mainly by gravity, pumping is used at

[*] Vietnam, Water Resources Assistance Programme: Central Coast River Basin Development and Management, WB, 2000.

end of the winter-spring crop when tides are high and low fields are inundated. During early flood period (end of August) when the summer-autumn crop is going to be harvested, drainage is necessary.

The rainfed paddy land of 6,000 ha in the basin can be irrigated through improving/renovating the existing irrigation facilities and developing water resources in the basin.

2.5.4 Agricultural Land Use Plan for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.12 and Figure D.10, respectively.

2.6 Huong River Basin

2.6.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

About 80% of the Thua Thien-Hue province are occupied by mountainous area, and low plain areas extend between the coastal area and upstream of the highway No.1. Since agricultural lands are mostly located in the low-lying flat plains of the Huong river with ground level ranging between -1.5m and +1.0m, it is conveniently used for paddy cultivation. Agricultural lands in the hill side or located at the elevated areas even in the plain are used for upland crop cultivation.

Agricultural lands of 43,000 ha in the Huong river basin are estimated to cover 95% of a total agricultural lands of Thua Thien Hue province. Of the agricultural land in the basin, about 97% (39,500 ha) is for annual crops lands and the rest (3,500 ha) is for perennial lands. The annual crop lands are consisted of 26,000 ha (66%) of paddy fields and 13,500 ha of upland fields planted subsidiary crops such as cassava, sweet potato and groundnut, and sugarcane.

Of the paddy fields, 18,000 ha or 72% of total paddy area has been irrigated and the remaining is cultivated under rainfed condition. Due to the natural condition and production custom, only two main crops of winter-spring paddy (from December to May) and summer-autumn (from May to August) are grown in the paddy fields of the Huong river basin. Any cropping is not practiced for three months from September to November during the major flood period due to prolonged deep inundation of farmlands. Moreover, paddy is often damaged by flood and inundation during early flood period (May-June) and by drought and saline water during drought period (March-August). Severe drought usually occurs in July and August.

Other annual crops are also planted in two crop seasons of winter-spring and summer-autumn: maize and beans are grown from December to April and from April to June; Vegetables are grown from January to September. Of the upland fields of 18,000

ha, 7,900 ha or 44 % of the total upland fields are irrigated.

The present land use and prevailing cropping pattern in the basin are shown in Table D.13 and Figure D.11, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin in 2001 are estimated as follows:

Crops	Planted area (ha)	yield (ton/ha)	Production (ton)
Paddy	48,500		210,250
W-S (irrigated)	18,000	5.2	93,600
W-S (rainfed)	7,000	2.5	17,500
S-A (irrigated)	15,000	5.2	78,000
S-A (rainfed)	8,000	2.5	20,000
R (rainfed)	500	2.3	1,150
Maize	1,000		2,400
W-S (irrigated)	100	4.0	400
W-S (rainfed)	400	2.0	800
S-S (irrigated)	100	4.0	400
S-S (rainfed)	400	2.0	800
Cassava (rainfed)	4,000	7.0	28,000
Sweet potatoes	6,000	7.0	38,250
W-S (irrigated)	4,000	7.0	28,000
S-S (irrigated)	500	7.0	3,500
S-S (rainfed)	1,500	4.5	6,750
Groundnut	4,000		5,800
W-S (irrigated)	1,500	2.0	3,000
W-S (rainfed)	500	1.0	500
S-S (irrigated)	300	2.0	600
S-S (rainfed)	1,700	1.0	1,700
Sugarcane (rainfed)	3,000	35.0	105,000
Other	6,000		

2.6.2 Direction for Agriculture Development in the Huong River Basin

(1) National agricultural development plan for North Central Coast Zone

The Ma river basin is located in the North Central Coast Zone. The direction for agricultural development in the Zone indicated in the Strategy for Agricultural and Rural Development for 2001-2010 is to be referred to the Ma River Basin.

(2) Huong River basin agricultural development plan

1) Basin economic development goals and priority

Broadly the key targets of agricultural and rural development in the Huong River basin are: i) poverty alleviation and ensuring food security; ii) enhancing rural living standard and income by strengthening infrastructure, health services and a education for the rural people, encouraging urbanization in rural areas and reducing the disparity among regions; iii) increasing the export turnover of agricultural,

forestry and fishery products; and iv) raising tree cover ratio and protecting ecological environments.

In order to achieve the above targets, the priority projects will be to: construct reservoirs upstream and construct salinity prevention barrage downstream; upgrade and complete sea dyke systems, provide intake gates and spillways to serve for flood drainage in low lying delta regions and protect works.

2) Agricultural development direction of major crops for the year 2010

Production target of major crops in the Huong River basin is as follows:

- Food production: Food production is very important to ensure the people's food demand in the basin. Highly intensive paddy cultivation shall be promoted through spreading more high yielding varieties for paddy and maize and intensifying agricultural land use, in particular stable double cropping over the areas of about 20,000 ha. In addition to, expansion of planting areas of other food crops shall be promoted in the hilly areas of Phong Dien, Huong Thuy, Huong Tra, Nam Dong, and A Luoi districts. Such crops include maize, cassava, Sweet potatoes.
- Strategic major agricultural products selected for the development of the basin are: groundnut, rubber, and tobacco. To promote the production of these crops, special-production zones shall be formed for efficient production and export: Groundnut is mainly in Huong Tra, Phong Dien, Quang Dien, Phu Vang, and Phu Loc districts with a total area of 5,000 ha in 2010; Rubber is well planted in the hilly area of Nam Dong, Binh Dien, and Phong Son-Hao My districts with a total area of 5,000 ha; Tobacco is mostly planted in Phong Dien, Huong Tra, and A Luoi districts with a total area of 1,000 ha.
- Besides, the basin also concentrates on vegetables and fruits production such as orange, lemon, persimmon, banana, etc over the area of 5,000 ha.

2.6.3 Potential for Agricultural and Irrigation Development

The natural area in Thua Thien Hue province is estimated at 500,900 ha of which 11.2% is used for agricultural purposes; 38.2% for forestry. In the province, there is about 162,000 ha of bare land caused by war, slash-and burning land for cultivation, improper exploitation and fires. In which the cultivable land for 2010 is estimated at about 25-29 thousand ha. Since lowland plains have already been developed by double crop cultivation, extensive expansion of the agricultural lands are limited in mountainous and hilly areas, in particular bare lands.

In Huong river basin, existing irrigation structures serve to 18,000 ha of paddy field corresponded to 72% of demand. In details, about 36% are irrigated by reservoirs and weirs, and 65% by pumps. Despite existing structures, droughts still remain risk and cause serious damages. Drought usually happens end of the winter-spring and middle of the summer-autumn crop. Almost all paddy fields located in the plain will be able to

irrigate when water is available.

2.6.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.14 and Figure D.12, respectively.

2.7 Thu Bon River Basin

2.7.1 Agricultural Land Use, Production and Yield

The Thu Bon River basin stretches over Quang Nam province and Da Nang city. Agricultural land in the basin is estimated at a total of 111,800 ha which is consisted of the whole agricultural land in Quang Nam province and 50% of agricultural land in Da Nang city.

Eighty percent of the basin area lies in the highlands of which 80% is covered by forest, with narrow valleys and high mountain peaks. The remaining of 20% of the basin lies in lowlands located along the river valleys and estuaries.

Of the total agricultural land of 111,800 ha, 92,000 ha (82%) has been used currently as cultivated lands. About 85,000 ha or 93% of the cultivated lands is for annual cropland and remaining of 7,000 for perennial cropland. There are a few area left for agriculture development use in the future. The annual crop lands are consisted of 52,000 ha of paddy fields and 33,100 ha of annual crop fields. Of the paddy areas, 26,000 ha or 50% of the paddy fields have been irrigated and the remaining are cultivated under rainfed condition.

Paddy is usually grown three times per year: winter-spring paddy (Dec.-Mar./Apr.), summer-autumn paddy (May/June-Sept.) and rainy season paddy (Aug.-Dec.). While the winter-spring paddy and rainy season paddy are planted on the whole paddy field, the summer-autumn paddy is planted on the area of 4,000 ha (only about 8% of the total paddy area).

Of the annual and perennial upland fields, about 13% of the total upland fields or 5,000 ha has been irrigated, in particular sugarcane fields (about 25%). On the annual upland fields are usually planted subsidiary crops like maize, cassava, groundnut and vegetables, and sugarcane and tobacco also planted in a part of areas. Major perennial crops in the basin are tea, cinamon and fruit trees.

The present land use and prevailing cropping pattern in the basin are shown in Table D.15 and Figure D.13, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops		Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy		104,000		366,000
	W-S (irrigated)	26,000	5.0	130,000
	W-S (rainfed)	26,000	2.5	65,000
	S-A (irrigated)	2,000	5.0	10,000
	S-A (rainfed)	2,000	2.5	5,000
	Rainy (irrigated)	24,000	4.0	96,000
	Rainy (rainfed)	24,000	2.5	60,000
Maize		2,000		4,000
	W-S (irrigated)	1,000	3.5	3,500
	W-S (rainfed)	2,800	2.0	5,600
	Rainy (irrigated)	1,000	3.5	3,500
	Rainy (rainfed)	2,800	2.0	5,600
Cassava		12,000		64,000
	Irrigated	4,000	7.0	28,200
	Rainfed	8,000	4.5	36,000
Groundnut		7,000		14,600
	W-S (irrigated)	2,000	2.0	4,000
	W-S (rainfed)	3,300	1.0	3,300
	Rainy (irrigated)	2,000	2.0	4,000
	Rainy (rainfed)	3,300	1.0	3,300
Sugarcane		6,000		222,000
	Irrigated	1,400	60.0	84,000
	Rainfed	4,600	30.0	138,000
Fruit		2,500		
Tea		2,000		
Other annual crops		12,000		
Other perennial crops		2,400		

2.7.2 Direction for Agriculture Development in the Thu Bon River Basin

(1) National Agricultural Development Plan for South Central Coast Zone

The Thu Bon River basin is located in the South Central Coast Zone. The direction for agricultural development of the Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

By 2010, agriculture and rural development will still be important aspects in the area. The agricultural pattern shifting will be promoted satisfactorily with the demand of stable growth through the exploitation of potential for agricultural production and intensification, the development of commodity-based animal husbandry and aquaculture.

- Food production: continue to increase crop production intensity by means of various intensification measures in order to meet the basin demand for food. By 2010, areas for rice production will be 516,800 ha with productivity of 2.7 million tones; maize of 70,000 ha with 257,600 tones; totally the food productivity expected to achieve 3.26 million tones.
- Sugarcane production: Sugarcane is a major strategic crop in the Zone. All efforts shall be devoted to build a stable material-supply situation with reducing production cost and increasing competitiveness.

- Perennial industrial crops: Develop cashew areas by 2010 reaching at 90,000 ha with productivity of 80,000 tones and export of 80-90% of productivity. Rubber and fruit trees are also promising crops in the Zone to increase the areas by 31,500 ha for rubber plantation, and 74,300 ha for various fruit trees such as banana, mango, dragon and grape.
- Animal husbandry: This area has a big potential for development. For cow herd by 2010, it expects to be 1.5 million heads with weight meat of 76,300 tones. Raising goat and duck shall be recommended in semi-mountainous and coastal areas, respectively.
- Fishery: Develop aquaculture, shifting shrimp production from semi-intensification to intensification. Establish special areas for production of shrimps. Total area for aquaculture is planned to 29,800 ha with productivity of 56,800 tones. Shrimp production in this Zone will be accounted for about 50% of the national shrimp production.

(2) Thu Bon River Basin Agricultural Development Plan

1) Economic development goals and priority of the basin

While agricultural production constitutes 23% of total GDP at present, the share of agricultural is forecasted to decrease to 13% and 10% by 2010 and 2020, respectively. The government plans to develop the Quang Nam and Danang area to one of the three economic poles of the country with high growth rate of industry and service sectors. Despite the plan, the agricultural sector upon which about 60% of the total population depend is deemed to be still important in order to improve living standards of rural peoples. Thus, the basin economic development priority will be given to the followings:

- Increase in agricultural production through increasing productivity and cropping intensity;
- Increase in industrial activity;
- Increase in domestic water supply; and
- Construction of more reservoirs upstream for multiple purposes.

2) Agriculture development goals

In order to support the basin economic development, it is essential to attain sustainable agricultural development with the following targets:

- Food security: The total paddy area in the basin shall maintain at present level. However, the production of rice shall be increased more through increasing paddy yields under the intensive farming methods and the expansion/upgrade of irrigated area. Besides, other food crops such as maize, sweet potatoes and cassava shall be increased both in areas and yields.
- Perennial crops: In the highlands area, planting of perennial industrial crops

shall be promoted vigorously in order to supply raw materials for processing industries and to increase export products. Promising industrial perennial crops include cinnamon, tea, and mulberry.

- Other crops: In addition to the above, the planting of ground nut, tobacco and pineapple shall be encouraged to increase farmers' agricultural income.

2.7.3 Potential for Agriculture and Irrigation Development

In the basin area, there are little potential for expansion of cultivated lands; most low land areas have been cultivated, and in the upland areas, there seems to be limited potential for future for expansion into the rugged highlands. However, there is potential to increase crop intensity in paddy areas by implementing double and triple paddy cropping.

According to the World Bank Study*, there are about 46,000 ha of land under irrigation. This means that about 90% of paddy lands in the basin are under irrigation: these irrigated areas are consisted of the following schemes:

- A 5,500 ha scheme in the lowlands, consisting of three reservoirs (Vinh Thanh, Phu Loc and Trach Ban), four weirs and a distribution system for diversion;
- A 2,500 ha scheme in the upper catchment, which is serviced by three small reservoirs;
- A multipurpose storage schemes at Phu Ninh to irrigate 23,400 ha; and
- Numerous small irrigation systems of approximately 15,000 ha.

These schemes were built either during the colonial period before 1954 or after the end of war (1975). Most of these systems were damaged by war and frequent floods, and suffered from inadequate maintenance. Furthermore, some systems constructed after war are not fully operated with less their design capacities. Consequently, actual irrigated areas are about 26,000 ha or 57% of the design capacities.

In terms of potential for irrigation, the World Bank Study pointed out that the suitable portion of the lowland areas is already under irrigated crops. Given the rugged topography, small and scattered farm lands, and low river flows during the dry season in the upland areas, the future expansion for irrigation looks dim. Investment in these areas would be costly. Moreover, additional storage reservoirs would be required to further develop the limited irrigable land.

2.7.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.16 and Figure D.14, respectively.

* Vietnam: Water resources Sector Review: A joint report by WB, ADB, FAO UNDP and the NGO, 1996

2.8 Tra Khuc River Basin (Quang Ngai)

2.8.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

The topography of the Tra Khuc river basin changes from mountains in the west, which range from between 500 to 1,000 m above sea level and then changes to plains in the east with a height of between 15 to 20 m above sea level and between 2 to 3 m above sea level in the coastal areas.

The Tra Khuc basin extends into Quang Ngai province located in the South Central Coast Zone. Agricultural land of 82,000 ha in the basin is estimated at about 95 % of the agricultural land of Quang Ngai province.

The agricultural lands are classified into four: paddy areas of 38,000 ha, annual subsidiary crop areas of 20,300 ha, perennial crop areas of 10,700 ha, and potential cultivation lands of 13,000 ha.

Of the paddy areas, 27,000 ha or 70 % of the paddy areas have been irrigated and the rest are under rainfed condition. Paddy is generally cultivated three times in a year: winter-spring paddy (Dec. - March/April), summer-autumn paddy (April/May - July/Aug.) and rainy season paddy (Aug.- Nov.). After harvesting summer-autumn paddy, the irrigated paddy areas are cultivated for subsidiary crops such as sweet potatoes, groundnut, vegetables, etc.

On the annual subsidiary crop areas, sugarcane dominates about 60 % of the land, then maize and cassava. Major perennial crops are coconut, rubber, coffee, and fruits.

Of the total upland areas, 12,500 ha or 30 % of the areas are irrigated.

The present land use and prevailing cropping pattern in the basin are shown in Table D.17 and Figure D.15, respectively.

(2) Production and Yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yield in the basin in 2001 are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	85,000		315,000
W-S (irrigated)	27,000	4.5	108,000
W-S(rainfed)	11,000	2.5	27,500
S-A (irrigated)	18,000	4.5	81,000
Rainy (irrigated)	27,000	3.5	94,500
Rainy (rainfed)	2,000	2.0	4,000
Sweet Potatoes	4,000		19,000
S-A (irrigated)	2,000	5.5	11,000
S-A (rainfed)	2,000	4.0	8,000
Groundnut	9,200		7,140
S-A (irrigated)	3,500	1.7	5,950
S-A (rainfed)	1,700	0.7	1,190
Maize	6,000		16,500
W-S (irrigated)	1,500	3.5	5,250
W-S (rainfed)	1,500	2.0	3,000
Rainy (irrigated)	1,500	3.5	5,250
Rainy (rainfed)	1,500	2.0	3,000
Sugarcane	12,000		577,500
Irrigated	4,500	70.0	315,000
Rainfed	7,500	35.0	262,500
Rubber	1,000	0.5	500
Coconut	6,000	6.0	36,000
Coffee	1,000	1.0	6,000
Other	23,300		

2.8.2 Direction for Agricultural Development in the Tra Khuc River Basin

(1) National Agricultural Development Plan for south Central Coast Zone

The Tra Khuc River basin is located in the South Central Coast Zone. The direction for agricultural development of the Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

(Refer to the Thu Bon River Basin)

(2) Tra Khuc River Basin Agricultural Development Plan

1) Basin economic development goals and priority

The overall basin economic development goals and priorities are to: 1) improve the Thach Nham scheme to ensure irrigation of 42,590 ha, 2) supply water for the Dung Quat industrial zone in 2010 (300,000m3/day); for Van Tuong (31,500m3/day) and for Quang Ngai town (300,000m3/day).

2) Agriculture development goals

Agriculture is the core production of the economic structure for Quang Ngai province with turnover contribution of 43 % to the total provincial GDP value. While the agriculture contribution to the total provincial GDP will gradually decrease from 38 % in 2001 to 25% in 2010, annual agricultural GRDP growth rate will be expected to increase at around 5-6 % during the period.

In order to support the provincial economic development, it is essential to attain sustainable agricultural development with the following targets:

- Food security: Convert some paddy fields under rainfed conditions into other high value crops fields though keeping paddy cultivation area constantly at the level of 80,000 ha. Increase the average paddy yield from 3.8 tons/ha to 4.5 tons/ha in 2010 to attain the production of 360,000 ton. Annual food per capita will be at 300kg/head/year in 2010.
- Crops diversification and promotion of exportable products for domestic and abroad: Agricultural structure should be changed to increase a share of livestock breeding, aquaculture, and agricultural service sectors with reducing the share of cultivation sector. Regarding to the cultivation sector, development priority should be given to high value industrial crops (annual and perennial), and develop agricultural processing industry.
- *Sugarcane: sugarcane should be developed to achieve 15,000ha cultivation with average yield of 60 tons/ha in 2005, and 15,000ha cultivation with yield of 70tons/ha in 2010 to support sugar manufacturing of the province.*
- Sub-sectors proportion in agro-forestry structure is: cultivation: 45 %; breeding: 34 %; forestry 10%, aquaculture: 6% and services: 5%

2.8.3 Potential for Agriculture and Irrigation Development

In the basin area, there are about 13,000 ha of arable land, which has not been used for agriculture at present. The promotion of agro-processing industry is one of major thrust for economic development of Quang Ngai province. In order to develop agro-processing industries within the Dung Quat industrial zone, the arable land shall be used positively for promoting high value annual industrial crops, particularly sugarcane and groundnut. Some paddy fields with less productivity under rainfed conditions shall be converted into high value crop fields.

In the Tra Khuc river basin, there are many irrigation schemes, of which the biggest scheme is the Trach Nham irrigation scheme. Trach Nham weir was built on the mainstream of river with design irrigation areas of 50,000 ha. However, due to limited water resources and incomplete water infrastructure, irrigated areas cover only 26,000 ha i.e. 50% of potential. Furthermore, existing small hydraulic structures cannot perform their full capacity due to degradation and deterioration.

In upper Tra Khuc river basin there are 9 irrigation structure (mainly weirs) with a design capacity of 1,439 ha. Actual irrigated area is almost the same (1,389 ha)

At present there are hundreds of hydraulic works built to meet irrigation water requirements: inventory of total irrigation structure in Tra Khuc, Tra Bong and Ve river basins shows the existence of 24 reservoirs, 30 weirs and 13 pumping stations. However, the actual irrigated area is smaller. The main cause of this inefficiency is that the equipment in the majority of pumping stations is either inoperable or operating below

design capacity. Salinity intrusion in the lower reaches of the basin, which leads to high salt concentrations, limits the capacity to irrigate in these areas.

In order to support agriculture sector, upgrading and rehabilitate the existing irrigation facilities such as Thach Nham irrigation scheme and various minor irrigation works.

2.8.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.18 and Figure D.16, respectively.

2.9 Kone River Basin

2.9.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Kone River basin extends to Binh Dinh province. Agricultural land in the basin is estimated to be 82 % of the agricultural land of the province. The topography in the basin is steep from west to east and can be classified into 3 main types: mountain (elevation of 500-700 m), plain (2-3m in coastal area and 20-30m), and coastal areas.

There are about 82,000 ha of arable land in the basin of which 71,000 ha (91%) has been used for cultivated land, and remaining of 11,000 ha has not been developed yet. Of the 71,000 ha of cultivated lands, 58,000 ha (82%) are for annual crops lands and the rest are for perennial crops lands.

The annual crops lands of 58,000 ha are consisted of 44,000 ha of paddy fields and 14,000 ha of upland fields. Of the paddy areas, 24,000 ha or 55 % of the paddy areas are irrigated and the remaining are cultivated under rainfed condition.

Paddy is usually grown three times per year: winter-spring paddy (Dec.-March), spring-summer paddy (Apr.-July) and rainy season paddy (Aug.-Nov.). While the winter-spring paddy is planted on the whole paddy fields, the spring-summer paddy and rainy season paddy are planted on the areas of 33,000 ha (whole irrigated land and about 50 % of rainfed land). After harvesting spring-summer paddy, the paddy fields are used mainly for groundnut and other subsidiary crops.

The annual upland fields of 14,000 ha are usually planted subsidiary crops like maize, cassava, and sugarcane, etc. Major perennial crops in the basin are coconut and cashew.

Of the annual and perennial uplands, 1,000 ha or 4 % of the upland areas are irrigated.

The present land use and prevailing cropping pattern in the basin are shown in Table D.19 and Figure D.17, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural

production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	110,000		414,000
W-S (irrigated)	24,000	4.5	108,000
W-S (rainfed)	20,000	2.5	50,000
S-S (irrigated)	24,000	4.5	108,000
S-S (rainfed)	9,000	2.5	22,500
Rainy (irrigated)	24,000	4.5	108,000
Rainy (rainfed)	9,000	2.5	9,000
Maize	2,000		4,000
W-S (rainfed)	1,000	2.0	2,000
S-S (rainfed)	1,000	2.0	2,000
Cassava (rainfed)	8,000	8.3	66,400
Groundnut	7,000		10,000
S-A (irrigated)	6,000	1.5	9,000
S-A (rainfed)	1,000	1.0	1,000
Sugarcane	1,800		308,000
Irrigated	500	70.0	35,000
Rainfed	6,500	42.0	273,000
Cashew (rainfed)	6,000		
Other perennial crops (coconut, etc)	7,000		

2.9.2 Direction for Agriculture Development in the Kone River Basin

(1) National Agricultural Development Plan for South Central Coast Zone

The Kone River basin is located in the South Central Coast Zone. The direction for agricultural development of the Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

(Refer to the Thu Bon River Basin)

(2) Kone River Basin Agricultural Development Plan

1) Economic development goals and priority of Binh Dinh province

Presently agricultural production constitutes 38 % of total GDP. However, Binh Dinh province has plan to reduce this share to 25 and 19 % by 2010 and 2020, respectively, by increasing emphasis on industry, especially related to the processing of agricultural goods (industrial crops such as sugarcane, pineapple and cashews). Despite these plans, the agricultural sector upon which 75% of the total population depends is deemed to be very important in order to improve living standards. This is thought to come about through either increased irrigation, introduction of new crops or introduction of new and more efficient farming methods.

The first priority for economic development in the province has been given to hydropower development project, especially small hydropower in remote areas.

2) Agriculture development goals

In order to support the provincial economic development, it is essential to attain sustainable agricultural development with the following targets:

- Food security: Convert some paddy fields under rainfed conditions into other high value crops fields. However, total amount of paddy production shall be increased through increasing paddy yields with intensive farming methods and expansion of irrigated area up to 93% of total paddy fields. While maize shall be increased both area and yield to achieve 5,000 ha with average yield of 4.9 tons/ha in 2010, cassava shall be decrease both area and yield to convert the area into more high value crops such as groundnut, soybean and potatoes.
- Sugarcane: sugarcane should be developed to achieve 11,200 ha cultivation with average yield of 62 tons/ha in 2010 to support sugar manufacturing of the province.
- Perennial crops: Planting of perennial industrial crops shall be promoted vigorously in order to develop agro-processing industry and to increase exportable crops. Promising industrial perennial crops include cashew, cinnamon, pepper, cocoa, and rubber. In addition to the industrial crops, some tropical fruit trees shall be promoted.

2.9.3 Potential for Agriculture and Irrigation Development

In the basin area, there are about 11,000 ha of unused potential cultivation lands. The promotion of agro-processing industry is one of major thrust for economic development of Binh Dinh province. In order to develop agro-processing, this potential cultivation lands shall be used positively for promoting perennial industrial crops to supply raw material stably. Some paddy fields with less productivity under rainfed conditions shall be converted into high value crop fields. According to the crop diversification and export promotion project (FAO)[*], the plain of Binh Dinh province was identified as one of the most suitable area for mango production.

In the basin, there are two dry periods happening in April, and in July and August. The river flow of Kone river changes in a year considerably, important flows concentrate in the flood season but flows are very small in the dry season. Besides water taking structures on Kone river are mainly weirs so they are not able to ensure water supply in the two dry periods. Thus, water for crops is presently inadequate to meet demand. Droughts at the beginning of the summer-autumn and summer crops may result in crop yield reduction. The existing irrigation structure can only irrigate 25,000 ha of the annual crop lands of 58,000 ha. Targets for the share of irrigated areas to total agricultural areas have been set for 2010 at 93% in the Binh Dinh province. According to the previous studies[**] show that a considerable potential for irrigation development by constructing new reservoirs in the basin.

[*] Vietnam, Crop Diversification and Export Promotion Project, FAO, Draft Final Report,Dec. 1998
[**] includes WB, ADB, and the National Mekong Committee.

2.9.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.20 and Figure D.18, respectively.

2.10 Ba River Basin

2.10.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Ba River basin stretches over both Gia Lai and Phu Yen provinces. Agricultural land in the basin is estimated to be consisted of 95 % of the agricultural land of Gia Lai province and 65 % of Phu Yen province. Topography of the Ba River basin makes a narrow and long shape basin from upstream to downstream.

There are about 309,000 ha of agricultural lands in the basin of which 283,000 ha (92%) have been used for cultivated lands, and remaining of 26,000 ha have not been developed yet. These unused potential agricultural lands can be utilized for agriculture development in the future. Of the 283,000 ha of the cultivated lands, 166,500 ha (59%) are for annual crop lands and the rest (116,500) are for perennial crops lands.

The annual crop lands of 166,500 ha are consisted of 61,000 ha of paddy fields and 105,500 ha of upland fields. Of the paddy areas, 37,000 ha or 61 % of the paddy areas are irrigated and the remaining are cultivated under rainfed condition. Paddy is usually grown two times per year: winter-spring paddy (Dec.-March), and summer-autumn paddy (June/Aug.-Sep./Nov.) or rainy season paddy (Sep.-Dec.). After harvesting winter-spring paddy, the paddy fields are used mainly for subsidiary crops including vegetables.

The annual upland fields of 14,000 ha are usually planted subsidiary crops like maize, cassava, groundnut, sweet potato, etc, and sugarcane. Major perennial crops in the basin are coffee, cashew, coconut, fruits, etc.

Of the 222,000 ha of upland lands, 4,000 ha or only 2 % of the areas has been irrigated.

The present land use and prevailing cropping pattern in the basin are shown in Table D.21 and Figure D.19, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	90,000		323,700
W-S (irrigated)	26,000	5.3	137,800
W-S (rainfed)	3,000	2.5	7,500
S-A (irrigated)	14,000	5.3	74,200
S-A (rainfed)	2,000	2.5	5,000
Rainy (irrigated)	23,000	2.4	55,200
Rainy (rainfed)	22,000	2.0	44,000
Maize	22,000		34,125
W-S (irrigated)	500	3.5	1,750
W-S (rainfed)	10,500	2.0	21,000
S-S (irrigated)	250	3.5	
S-S (rainfed)	1,000	2.0	2,000
Sweet Potato	4,000		20,000
W-S (rainfed)	2,000	5.0	10,000
S-S (rainfed)	1,000	5.0	5,000
Rainy (rainfed)	1,000	5.0	5,000
Groundnut	27,000		143,000
W-S (rainfed)	2,500	1.2	3,000
S-S (rainfed)	1,250	1.2	1,500
Rainy (rainfed)	1,250	1.2	1,500
Cassava (rainfed)	18,000	6.5	117,000
Sugarcane	23,000		1,070,000
Irrigated	500	70.0	35,000
Rainfed	22,500	46.0	1,035,000
Coffee (rainfed)	43,000	1.4	60,200
Tea	1,000	3.2	3,200
Other annual crops(vegetables, etc)	116,000		
Other perennial crops (cashew, etc)	72,500		

2.10.2 Direction for Agriculture Development in the Ba River Basin

(1) National Agricultural Development Plan for South Central Coast Zone

The Ba River basin is located in the South Central Coast Zone (Phu Yen province) and Central Highlands Zone (Gia Lai provnce). The direction for agricultural development of the both Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is to be referred to the Thu Bon River Basin for the South Central Coast Zone and the Se San River Basin for the Central Highlands Zone: Refer to

(2) Ba River Basin Agricultural Development Plan

Presently agricultural production constitutes 52 % of total GDP. However, the socio-economic framework prepared by the Study team has projected to reduce this share to 39 % and 33 % by 2010 and 2020, respectively, by increasing emphasis on industry, especially related to the processing of agricultural products (industrial crops such as sugarcane, pineapple, coconut, cashew, etc). Despite these plans, the agricultural sector upon which 78 % of the total population depends is deemed to be very important in order to improve living standards.

Taking the above national agricultural development plan and both the soci0-economic development plans of Phy Yen and Gia Lai provinces into consideration, the basin agricultural development plan may be summarized as follows:

1) Major thrust for agriculture development

The major thrusts for agriculture development in the basin has been given to: a) increase of 30-40% in agricultural production over the period 2000-2010, b) increase industrial crops particularly coffee, rubber and sugarcane, and c) develop agro-processing industries.

2) Production target of major crops

- Food crops: Concentrate on intensive cultivation on food crops to meet the unceasingly high consumption demand in the basin and for export. Particularly, cropping intensity shall be pursued through promoting either triple cropping (2 paddy crops and 1 food crop) or double rice cropping (or 1 rice crop and 1 food crop). Other staple food crops of cassava, sweet potatoes and maize shall be increased in hilly and mountainous areas.
- Industrial crops: Major strategic industrial crops in the basin are sugarcane, coffee, rubber, and cashew.

  Sugarcane is the most important crop for supplying raw materials stabbly to the existing sugar factories in the basin. The production shall be strengthened through the expansion of planted areas and increase of irrigated fields.

  Coffee and rubber production shall be promoted in the hilly and mountainous areas located mainly in Gia Lai province.

  Cashew shall also be encouraged to increased its production.

  In order to develop agro-processing industries, it is essential for the basin to increase the production of food grains, industrial crops mentioned above.
- Breeding: The breeding technology in the basin has remained at traditional style and there are two major constraints for breeding: fodder and breed. The breeding shall be promoted gradually to modern breeding systems with increasing of herds and improving products quality under large-scale breeding.
- Aquaculture: Aquaculture in brackish water has a limitation for expanding its area, so the intensive cultivation shall be pursed to increase output. Aquaculture in fresh water including natural ponds, reservoirs, and lakes shall be promoted through expanding production areas.

2.10.3 Potential for Agriculture and Irrigation Development

While the cultivation of paddy is limited to the delta and coastal regions, there is little scope for expanding paddy fields. Double cropping is now dominated in the low lands, using the existing irrigation infrastructure. However, the existing paddy fields has been irrigated only 60 % due mainly to poor and deteriorated irrigation facilities. In the upland areas, rainfed agriculture have been dominated.

The basin's under-developed potential lies in the abundance of forestry land and the potential cultivation land. About 26,000 ha of potential agricultural land will be

developed for growing industrial crops because the basaltic nature of the basin's soil points to possibilities for planting perennial industrial crops, such as rubber, coffee, tea, cashew etc.

According to the World Bank study,* the coastal area has well established irrigation systems, although they are affected regularly by typhoons and floods. Severe inundation occurs in the lowlands. However, the valleys are not affected by typhoons, but often face drought conditions.

Among irrigation systems, the biggest existing irrigation scheme in the lower Ba basin is Dong Cam irrigation system having a design capacity of 19,000 ha. However, the actual irrigated area is about 17,000 ha due mainly to outdated system and deterioration. Ayun Ha reservoir having a design capacity of 13,500 ha is one of the water resources in the basin, and supply irrigation water to lower basin irrigation systems.

Due to limited potential in the lower basin, future development will take place mainly in upper parts of the basin. There may be some scope to bring more lands in the mid-uplands under irrigation. However, to do this will require costly investments.

2.10.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.22 and Figure D.20, respectively.

2.11 Sesan River Basin

2.11.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Se San River basin extends over Kon Tum province and a part of Gia Lai province. Thus, agricultural land in the Se San River basin is estimated at 165 % of the total agricultural land of Kom Tum province. The topography of the basin is rather complicated, characterized by mountains, plateaus and wider valleys with flood plain. The most populated areas lie some 1,000 m above sea level.

There are about 113,700 ha of agricultural land in the basin of which 105,000 ha (92%) has been used for cultivated land, and remaining of 8,700 ha has not been developed yet.

Of the 105,000 ha, 64,000 ha (61 %) is estimated to be used for annual crops land and the rest (41,000 ha) is for perennial crops land.

The annual cropland of 64,000 ha is consisted of 26,000 ha of paddy field and 38,000 ha of upland field. Of the paddy area, 13,000 ha or 50 % of the paddy area is irrigated and the remaining is cultivated under rainfed condition. While one cropping paddy in the rainy season is dominated, double cropping paddy, rainy season paddy (June-Sept.) and

* Vietnam water Resources assistance Program , World Bank

winter-spring paddy (Jan.-Apr.), is grown about 23 % of the total paddy field.

The annual upland field of 38,000 ha is usually planted subsidiary crops like maize, cassava, groundnut, sweet potato, etc, and sugarcane under rainfed conditions except a 500 ha of irrigated sugarcane fields.

Major perennial crops in the basin are rubber, coffee and fruits, of which about 50 % of the total coffee fields of 16,000 ha are irrigated.

The present land use and prevailing cropping pattern in the basin are shown in Table D.23 and Figure D.21, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	32,000		74,300
W-S (irrigated)	5,000	4.0	20,000
W-S (rainfed)	1,000	2.3	2,300
Rainy (irrigated)	13,000	2.2	28,600
Rainy (rainfed)	13,000	1.8	23,400
Maize (rainfed)	7,000	2.0	14,000
Cassava (rainfed)	12,000	9.5	114,000
Sweet Potato (rainfed)	500	7.0	3,500
Groundnut (rainfed)	700	1.0	700
Sugarcane	6,300		296,000
Irrigated	500	70.0	35,000
Rainfed	5,800	45.0	261,000
Rubber (rainfed)	20,000	1.4	28,000
Coffee	16,000		28,800
Irrigated	8,000	2.0	16,000
Rainfed	8,000	1.6	12,800
Other annual crops (vegetables, etc)	11,500		
Other perennial crops	5,000		

2.11.2 Direction for Agriculture Development in the Sesan River Basin

(1) National Agricultural Development Plan for Central Highlands Zone

The Se San River basin is located in the Central Highlands Zone. The direction for agricultural development of the Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

- Food production: In the years to come the task is to decrease importation of food from other areas through completely exploiting existed rainy season paddy areas and expand hybrid-corn areas. By 2010, areas for rice cultivation in this basin will be reached to 193,500 ha and maize of 150,000 ha.
- Coffee plantation: Coffee is one of high economic value crops in the Central Highlands Zone and the country as well, it has strong competitiveness in the world

market. To promote this advantage it is necessary to invest for intensification, expansion of area where irrigation water is available. By 2010, areas for coffee plantation expected to be 440,000 ha and productivity would be 862,000 tones.

- Rubber plantation: Tea plantation is concentrated in Lam Dong province and a part of Gia Lai. Intensification will be made for increasing tea productivity and quality. By 2010, total areas for tea plantation expected to reach 26,100 ha of which newly expansion of 4,000 ha.
- Cashew plantation: Replace low productivity and poor quality cashew varieties with high productivity and good quality in parallel with intensify cashew garden. There is a big potential land for cashew development, by 2010 its area expected to reach 52,000 ha.
- Pepper plantation: Areas for pepper plantation will be expanded only in areas where conditions are suitable. By 2010 it is planned to allocate 12,500 ha for pepper plantation and productivity of 22,000 tons.
- Sugarcane plantation: Strive to reach an area of 36,000 ha for sugarcane plantation by 2010, mainly in Gia Lai and Dak Lak provinces.
- Cotton production: It is planned to raise total area for cotton production up to 40,000 ha by 2010 with high productivity and hybrid varieties.
- Mulberry and silk: Mulberry will be mainly developed in Lam Dong province. By 2010, an area of 10,000 ha will be planted and it expected to obtain 4,600 tones of cocoon.
- Vegetable, flower and ornamental trees: Develop temperate vegetables, ornamental trees and flowers in Da Lat for export. It is estimated by 2010 there will be 25,000 ha of vegetables, 350-400 ha of all kind flowers in Da Lat.
- Animal husbandry: Strongly develop cow herd for meat and milk to meet with market demand. It is planned by 2010 products from animal husbandry will cover 25 % of total agricultural productivity value of the area.

(2) Se San River basin agricultural development plan

Taking the above national agricultural development plan and the socio-economic development plan of Kon Tum and Dak Lak provinces into consideration, the basin agricultural development direction may be summarized as follows:

- Food security: In order to ensure the basin food security, food production should be strengthened through: expanding irrigation areas and increasing productivity for paddy; and accelerating the use of hybrid variety for maize.
- Perennial and annual industrial crops:

To expand the industrial crops production, particularly coffee, rubber, and cashew through expanding planting areas and increasing productivity, replacing old trees of these crops into new ones. Sugarcane also expands in areas of high soil fertility.

To establish special production zones of these crops.

- Breeding: To encourage the development of cattle production for exporting outside the basin through intensive pasturing.
- Agro-processing industries: To promote the agro-processing industries, such as wood processing enterprises, coffee-processing factories, sugar factories, etc.
- Irrigation: To invest in irrigation work, particularly for developing additional water resources, constructing new irrigation systems and improving existing irrigation systems.

2.11.3 Potential for Agriculture and Irrigation Development

In general, the upper area of the basin is covered by forest with a considerable barren land in which reforestation has taken place. Much of the upper-mid basin area has been used for the production of industrial crops such as coffee, rubber and in areas of high soil fertility, sugarcane. Land use in the lower basin area is a mixture of slash-and-burn cultivation and paddy. It is estimated that more than 40% of the basin area is used for slash-and-burn cultivation.

Agricultural potential in the basin is substantial for the following reasons: (i) there are large amounts of potential cultivable land available, mostly undeveloped agricultural lands and a part of forest. (ii) The basin has a mild climate, with annual rainfall at 1,400-2,200 mm and ample surface water and groundwater. (iii) The basin has fertile soils, which have excellent conditions for cultivation of perennial industrial crops including rubber, coffee, tea, mangoes, avocados, citrus fruits, mulberry and a variety of other agricultural crops. (iv) Ho Chi Minh City and Dong Nai river basin provide a potential market for Srepok's output.

In recent years, agricultural development projects under direct government's financing or foreign cooperation program have been implemented to settle an additional population of 1.2 million in this region. Many export crop plantation areas have been created and their production largely contributes to the national economy. Of the total national production of coffee, 72% is produced in the area, 19% of the total production of rubber, 55% of the silk, and 22% of the tea.

According to the World Bank's Studys[*], over the past 15 years, emphasis has been given to the rapid development of irrigated agriculture. More than 600 hydraulic works and irrigation structures have been built. This high pace of development was at the expense of quality, and often based on insufficient data on river flows and topography at the design stage. As a result, the effective area irrigated is only half the design area. Many schemes are either incomplete due to luck of funds, or are in need of rehabilitation.

The existing formal irrigation schemes in the Se San River basin consists mostly of small gravity-fed fields below 50 ha. Very few are larger than 100 ha. Most of the irrigation

[*] Vietnam, Water Resources Assistance Program: Central Coast River Basin Development and Management. WB, 2000, and Water Resources Sector Review, A joint Report by WB, ADB, FAO, UNDP and the NGO,

schemes support paddy cultivation primarily during the dry season, but also in the rainy season. Irrigation is increasingly applied to coffee and tea, mainly irrigated by groundwater. In addition to the government operated irrigation schemes, there are many very small systems operated by farmers. These schemes have not been recorded by state agencies although they are of great importance for the agricultural production and livelihood of people.

The 15-year plan from 1995 to 2010 proposes many new gravity irrigation projects ranging from 20 to 80 ha.

It may be said that, in the basin, there is potential to increase paddy cultivation areas in valley bottom and industrial crop planting in hilly areas.

2.11.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.24 and Figure D.22, respectively.

2.12 Srepok River Basin

2.12.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

The Srepok River basin lies in the Dak Lak province. The agricultural land in the basin is estimated to 60 % of the agricultural land of Dak Lak province. In view of topographic feature, the basin is characterized by mountains, gently undulating plateaus and flat alluvial lowland lies in wider valleys.

There are about 235,000 ha of agricultural land in the basin of which 218,000 ha (93%) has been used for cultivated land, and remaining of 17,000 ha has not been developed yet. These unused potential agricultural lands can be utilized for agriculture development in the future.

Of the 218,000 ha, only about 73,000 ha (33 %) is estimated to be used for annual crops lands and the rest (145,000 ha) is for perennial crops lands.

The annual croplands of 73,000 ha are consisted of 27,000 ha of paddy fields and 50,000 ha of upland fields. Of the paddy areas,11,000 ha or 41 % of the paddy areas are irrigated and the remaining is cultivated under rainfed condition.

While one cropping paddy in the rainy season is dominated, double cropping paddy with rainy season paddy (May/June-Aug./Sept.) and winter-spring paddy (Dec./Jan.-March/ Apr.) is grown on about 30 % of the total paddy fields:.

The annual upland fields of 50,000 ha are usually planted subsidiary crops like maize, cassava, sweet potatoes and vegetables, and annual industrial crops such as sugarcane, groundnut, kenaf, etc,. Besides, there are several rubber, coffee and tea plantations as a

private commercial farming.

The present land use and prevailing cropping pattern in the Srepok River basin are shown in Table D.25 and Figure D.23, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	37,000		130,400
W-S (irrigated)	8,000	4.7	20,000
W-S (rainfed)	1,000	2.8	2,300
Rainy (irrigated)	11,000	4.0	44,000
Rainy (rainfed)	16,000	2.7	43,200
Maize	22,000		73,800
W-S (irrigated)	1,000	4.5	4,500
W-S (rainfed)	10,000	2.7	27,000
Rainy (irrigated)	1,000	4.3	4,300
Rainy(rainfed)	10,000	3.8	38,000
Cassava (rainfed)	2,000	10.0	20,000
Sweet Potato (rainfed)	2,000		14,000
W-S (rainfed)	1,000	7.0	7,000
Rainy (rainfed)	1,000	7.0	7,000
Groundnut (rainfed)	8,000		9,600
W-S (irrigated)	1,000	1.8	1,800
W-S (rainfed)	3,000	1.0	3,000
Rainy (irrigated)	1,000	1.8	1,800
Rainy(rainfed)	3,000	1.0	3,000
Sugarcane	4,000		235,000
Irrigated	1,000	70.0	70,000
Rainfed	3,000	55.0	165,000
Rubber (rainfed)	16,000	0.6	22,400
Coffee	105,000		163,000
Irrigated	40,000	1.8	72,000
Rainfed	65,000	1.4	91,000
Other annual crops (vegetables, etc)	50,000		
Other perennial crops	22,500		

2.12.2 Direction for Agriculture Development in the Srepok River Basin

(1) National Agricultural Development Plan for Central Highlands Zone

The Srepok River basin is located in the Central Highlands Zone. The direction for agricultural development of the Zone stated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

(Refer to the Se San River Basin)

(2) Srepok River basin agricultural development plan

Taking the above national agricultural development plan and the agricultural development plan of Dak Lak province into consideration, the Srepok River basin agricultural

development direction may be summarized as follows:

- Food security: In order to ensure the basin food security, food production shall be strengthened through: expanding irrigation areas and increasing productivity and cropping intensity for paddy; and accelerating the use of hybrid variety for maize. However, upland paddy areas should be minimized by converting upland paddy into high value crops such as coffee, cashew land.
- Perennial and annual industrial crops:

  To expand the industrial crops production, particularly coffee, rubber, and cashew through expanding planting area and increasing productivity by irrigation and replacing old trees of these crops into new ones: By 2010, coffee area should be expanded to 240,000 ha with output of 350,000 tones; 50000-70,000 ha with 23,000 tons of dry latex for rubber; and 15,000 ha with 7200 tones for cashew. Sugarcane also expands in areas of high soil fertility.

To establish specialized production zones of these crops

- Breeding: To encourage the development of cattle production for exporting outside the basin through intensive pasturing.
- Agro-processing industries: To promote the agro-processing industries, such as wood processing enterprises, coffee-processing factories, sugar factories, etc.
- Irrigation: To invest in irrigation work, particularly for developing additional water resources such as Easoup, Krongbuk, etc, constructing new irrigation systems and improving existing irrigation systems.

2.12.3 Potential for Agriculture and Irrigation Development

The Srepok River basin, with its vast undeveloped agricultural potential, can be expected to play a vital role in the development of agricultural economy. Consequently, the economy of the basin depends on exploitation of its vast natural resources - principally fertile land, rich forests and abundant water. Agricultural potential in the basin is substantial for the following reasons.

- There are large amounts of agricultural land available, mostly undeveloped. Of the agricultural land of 235,000 ha in the basin, about 218,000 ha (93%) has been used as cultivated land, and remaining of 17,000 ha has not been deployed yet. In addition to the undeveloped agricultural land, there are vast forestlands of about 729 thousand ha. Some part of the forest will also be used as the agricultural land in feature.
- The basin has a mild climate, with annual rainfall at 1,400-2,200 mm, water resources amount to 8.1 bcm annually.
- The basin has fertile soils, suitable for coffee, rubber and a variety of other agricultural crops. And

According to the World Bank's study*, Srepok is one of the few basins in Vietnam where irrigation depends heavily on groundwater, mainly for growing coffee. The basaltic nature of the geology in the basin endows with a good groundwater reserve, which is available both on the plateau and in most river valleys. On the plateau, the groundwater is used to irrigate high value food and cash crops, especially coffee. All coffee fields are now irrigated, half by surface water and the rest by groundwater from shallow wells.

The Action Plan proposed by the same Study revealed irrigation potential in the basin as follows:

- Reservoir development potential: the eleven potential sites for large schemes have been identified by the Study. These schemes are all multi-purpose schemes with hydropower, flood control and irrigation, etc. In addition, there are more than 25 sites for small hydropower schemes with some possibility of domestic supply and irrigation.
- Regarding the irrigation potential, the Action Plan gives higher priority to rehabilitation and the extension of existing schemes than to expansion of the network into new highland areas. Over the past 20 years, emphasis has been given to the rapid development of irrigated agriculture. More than 600 hydraulic works and irrigation structure have been built. This high pace of development was at the expense of quality, and often based on insufficient data on river flows and topography at the design stage. As a result, the effective area irrigated is only half the design area. Many schemes are either incomplete due to a lack of funds, or are in need of rehabilitation. It is estimated that rehabilitation will be needed roughly about 23,000 ha.

The numerous rivers in the basin provide ample water for rehabilitation and expansion of irrigated agriculture. Water simulation models in the Study shows that in almost all catchments, the rehabilitation of existing systems can take place without construction of additional large storage reservoirs.

2.12.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.26 and Figure D.24, respectively.

2.13 Dong Nai River Basin

2.13.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Dong Nai basin covers 8 provinces* and Ho Chi Minh City. Of which Dak Lak and Lam Dong provinces belong to the Central Highlands Zone, Long An province belongs to Cuu

* Vietnam: Water Resource Sector Review, A joint Report by WB, ADB, FAO, UNDP and the NGO, 1996
* includes Tay Ninh, Binh Thuan, Long An, Dak Lak, Lam Dong, Binh Phuoc, Binh Duong and Dong Nai.

Long Delta, and other provinces belong to South-East Zone.

In order to estimate the total agricultural land in the basin, the following percentage are used for calculating a coverage area of each province: 100 % for Ho Chi Minh City, Tay Ninh, Binh Phuoc and Binh Duong provinces; 92 % for Lam Dong; 87% for Dong Nai, 35 % for Long An, 25 % for Binh Thuan, and 10 % for Dak Lak, respectively.

There are about 1,476,000 ha of agricultural land in the basin of which 1,398,000 ha (95 %) has been used as cultivated land, and remaining of 79,000 ha has not been deployed yet. These unused arable lands can be utilized for agriculture development in the future.

Of the 1,398,000 ha of cultivated land, 690,000 ha (49 %) is used for annual crops lands and the rest (708,000 ha) is for perennial crops lands.

The annual crops lands of 690,000 ha are consisted of 381,000 ha of paddy fields and 308,000 ha of upland fields. Of the paddy areas, 95,000 ha or 25 % of the paddy areas are irrigated and the remaining are cultivated under rainfed condition. There are considerable variation for the paddy cropping season in the basin, paddy is basically grown two times per year: winter-spring paddy (Nov./Dec.-Feb./March), and summer-autumn paddy Mar./May.-July/Sep.) or rainy season paddy (July/Oct-Oct./Jan.). Winter-spring paddy has generally been restricted by shortage of water resources in the dry season.

The annual upland fields of 308,000 ha are usually planted subsidiary crops like maize, cassava, potatoes, beans, vegetables, etc, and industrial annual crops such as sugarcane, groundnut, soybean and tobacco. Major perennial crops in the basin are rubber, fruits, cashew, coconut, etc.

The study team estimated that about35,000 ha or 2 % of the total upland fields have been irrigated at present.

The present land use and prevailing cropping pattern in the basin are shown in Table D.27 and Figure D.25, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	498,000		1,490,900
W-S (irrigated)	95,000	4.6	437,000
W-S (rainfed)	23,000	2.3	52,900
S-A (irrigated)	80,000	4.6	368,000
S-A (rainfed)	40,000	2.3	92,000
Rainy (irrigated)	15,000	2.4	51,000
Rainy (rainfed)	245,000	2.0	490,000
Maize	10,000		30,000
W-S (rainfed)	5,000	3.0	15,000
Rainy (rainfed)	5,000	2.0	15,000
Soybean	28,000		25,200
W-S (rainfed)	14,000	0.9	12,600
Rainy (rainfed)	14,000	0.9	12,600
Sweet Potato	40,000		228,000
W-S (irrigated)	5,000	7.0	35,000
W-S (rainfed)	15,000	5.3	79,500
Rainy (irrigated)	5,000	6.8	34,000
Rainy (rainfed)	15,000	5.3	79,500
Groundnut	80,000		107,500
W-S (irrigated)	5,000	2.0	10,000
W-S (rainfed)	35,000	1.3	45,500
Rainy (irrigated)	5,000	2.0	10,000
Rainy (rainfed)	35,000	1.2	42,000
Cassava (rainfed)	34,000	10.0	340,000
Sugarcane	65,000		3,110,000
Irrigated	5,000	70.0	350,000
Rainfed	46,000	46.0	2,760,000
Rubber	495,000	1.2	594,000
Cashew	84,000	0.7	58,800
Fruits	43,000		
Other annual crops	442,000		
Other perennial crops (cashew, etc)	10,000		

2.13.2 Direction for Agricultural Development in the Dong Nai River Basin

The Dong Nai River Basin is located in the South East Zone. The direction for agricultural development in the zones is stipulated in the Strategy for Agricultural and Rural Development for 2001-2010. The basic development direction in the Zone is as follows:

Direction for agricultural development in the basin is to produce commodity agro-products with high competitiveness and value, special attentions are given to development of industrial crops, fruit trees, ornamental trees, animal husbandry, and processing industry in conjunction with concentrated commodity-based production area.

- Food production: By 2010, areas for rice cultivation in the basin will be 300,000 ha with productivity of 1.3 million tones. Maize production will also be developed for providing feed for animal husbandry and materials of processing industry: areas of maize plantation will be reached at 150, 000 ha by 2010 with productivity of 601,500 tones.

- Rubber plantation: While rubber plantation expects to be kept present situation in terms of areas and productivity, the investment to rubber plantations will be accelerated for intensifying land use of the plantations.
- Coffee plantation: Continue to intensify in existed rubber plantation areas. By 2010, the area and productivity expected to be 65,000 ha and 120,000 tones.
- Cashew plantation: Area is going to be enlarged to reach at 220,000 ha with a productivity of 220,000 tones of which 87,000 ha is newly planted with high productivity varieties.
- Pepper plantation: By 2010, the total area for pepper plantation will be 30,000 of which 24,000 ha for harvest with productivity of 72,000 tones.
- Fruit tree plantation: Fruit trees will be developed, raising its area up to 100,000 ha by 2010 (by improving garden, applying hybrid techniques, transplanting tissue, establishing communities, setting up processing system, all to serve for domestic consumption and export).
- Vegetable, flower and ornamental trees: It is planned to allocate 66,000 ha for vegetable cultivation by 2010. Specialized vegetable-cultivation areas will be located in Ho Chi Minh city and industrialized areas as well as along some city towns. Flower and ornamental trees will also be developed with an area of 1,260 ha, bringing an export value of USD 50 million.
- Sugarcane production, By 2010, sugarcane productivity expected to reach 75 tones/ha, area of 40,000 and annual output of 280,000 tones.
- Oil trees plantation: By 2010 area for groundnut production will be 70,000 ha, producing 210,000 tones of raw groundnut. Soybean's area and productivity will be 20,000 ha and 40,000 tones, respectively.
- Cotton Production: It is planned to allocate 40,000 ha for cotton production, providing productivity of 2 tones/ha. Supportive tax and subsidization are needed to assist farmers at the beginning stage.
- Tobacco production: The area would be 20,000 ha by 2010. It will be needed to sustain and restore traditional tobacco-growing areas.
- Animal husbandry: Develop milk cow, meat cow, buffalo, pig and poultry for providing foodstuff for local market. Export of USD 15 million/year will be expected.
- Take advantage of surface water for aquaculture with high economic value species, such as turtle crocodile, shrimp, malacological species, etc., giving a productivity of around 40,000 tones.

2.13.3 Potential for Agriculture and Irrigation Development

The basin is divided into three economic zones. (a) the industrial and service activity zone- chiefly HCMC and Bien Hoa, (b) the industrial crop and forestry zone- most of the basin area, except Long An, and (c) the rice cultivation zone- the Long An alluvial plain,

which is similar to that of Cuu Long Delta, and was developed recently

The basin is endowed with several natural advantages. Unlike some other basins, typhoons are rare. Thus, flooding is not as sever as in other basins, except some inundation that occurs near the coastal zones during the rainy season due to inadequate drainage capacity. The temperature, humidity and sunlight conditions are favorable to agriculture.

The amount of cultivated land is estimated at 1.4 million ha. Furthermore, there are about 79,000 ha of unused potential agriculture land. Most agricultural activities are concentrated in the narrow valleys. Tree crops occupy the rugged topography in the highland areas.

The development of this basin has been shown in recent years and food production could satisfy only 50% of demand. The food deficits are made up with food supplied from the Cuu Long delta region. Besides the possibility to increase crop intensity in rice cultivation areas (at present about 130 %), there is potential to expand areas for industrial crop planting especially for rubber, coffee, bananas, fruit trees, and tobacco. Most of the land in the basin consists of basaltic and gray soils, which can support the cultivation of several important commercial crops, such as rubber, pepper, coffee, tobacco and cotton.

The problems for agriculture stem from water shortages. Dong Nai receives less rain during the year than the basins located in the northern part of the country. The climate is of bi-seasonal and monsoon characteristic, which is typical in southern Vietnam. The basin is subject to a long dry period of five months each year, during which monthly rainfall is as little as 10-50 mm (compared to 400-450mm in wet month). The lower rainfall levels make irrigation indispensable for the cultivation of many crops during the dry season, and during dry spells of the rainy season. Despite recent efforts to build big irrigation systems, the lack of fresh water during January to May and salinity problems constraint agricultural potential.

The irrigation potential in the basin was studied by JICA Master Plan Study on Dong Nai River Basin in 1996*. According to the results of the study, the designed irrigation areas in the basin are estimated approximately at 196,000 ha under about 350 irrigation schemes, occupying about 8 % of the annual cropping areas. However, the actual irrigated area is estimated at 115,000 ha or 60 % of the designed irrigation area due mainly to: a) water shortage, b) inadequate or defective design of irrigation systems, c) damage and deterioration of irrigation systems, d) insufficient development in on-farm irrigation system, and e) poor operation and maintenance.

The Master Plan Study identified a lot of irrigation development projects as the master plan projects with a total irrigation development area of more than 200,000 ha in the basin.

* The Master Plan Study on Dong Nai River and Surrounding Basins Water Resources Development, JICA, 1996.

2.13.4 Agricultural Land Use Plans for 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.28 and Figure D.26, respectively.

2.14 Cuu Long Delta Basin

2.14.1 Agricultural Land Use, Production and Yield

(1) Agricultural land use

Cuu Long Delta basin covers 12 provinces* of which about 35 % of the total area of Long An province belong to Dong Nai River basin.

The Cuu Long Delta basin in the Southern parts of Vietnam covers about 4 million ha of land, which equals 12 % of the total area of the nation. The Delta has a tropical climate and is characterized by lowland, fertile soils and dense network of rivers and canals.

The total land area of 12 provinces, with the exclusion of 35 % of the areas in Long An province, amounts to just over 3.81 million ha. Of this area, 2.60 million ha is currently used for agriculture purposes.

There is about 2,596,000 ha of agricultural lands in the Delta of which 2,439,000 ha (94 %) have been used for cultivated lands. Of the cultivated lands, 2,088,000 ha (86 %) are estimated to be for annual crop lands and the rest (351,000 ha) are for perennial crop lands.

The annual crop lands are consisted of 1,970,000 ha of paddy fields and 308,000 ha of upland fields. Of the paddy fields, 1,478,000 ha or 75 % of the paddy fields are irrigated and the remaining are cultivated without irrigation. Furthermore, about 2% (9,000 ha) of the upland crop areas are irrigated.

While there are considerable varieties of paddy cropping system in the Delta, double paddy cropping is the predominant cropping system: winter-spring paddy (Nov./Dec.-Feb./March) and summer-autumn paddy (Apr./May/ -July/Aug.). Paddy cropping systems are depended mainly on climatic and water control conditions. In the central part of the Delta where the natural water control conditions are favorable, there is already a considerable area under the three paddy cropping systems. On the other hand, in the deep flooded or long saline intruded parts of the Delta, single paddy cropping is done. Deep water rice planting ((July -Dec.) Floating rice (May-Dec).

The annual upland fields of 308,000 ha are usually planted upland crops such as maize, soybean, mungbean, groundnut, sesame, sugarcane, kenaf, and vegetables, etc.

Major perennial crops in the basin are coconut and fruit trees including banana, pineapple,

*Long An, Dong Thap, An Giang, Vinh Long, Kien Giang, Soc Trang, Bac Lieu, Ca Mau, Tien Giang, Ben Tre, Can Tho, and Tra Vinh provinces.

longan, mango, dragon fruit, milk fruit etc.

The present land use and prevailing cropping pattern in the basin are shown in Table D.29 and Figure D.27, respectively.

(2) Production and yield

Based on the existing statistical data and other relevant documents, agricultural production and crop yields in the basin are estimated as follows:

Crops	Planted Area (ha)	Yield (ton/ha)	Production (ton)
Paddy	3,382,000		14,323,400
W-S (irrigated)	1,412,,000	5.2	7,342,400
S-A (irrigated)	1,378,000	4.0	5,512,000
S-A (rainfed)	290,000	2.5	725,000
Rainy (irrigated)	100,000	3.4	340,000
Rainy (rainfed)	202,000	2.0	404,000
Maize	6,000		19,200
W-S (irrigated)	500	4.2	2,100
W-S (rainfed)	2,500	3.0	7,500
S-A (irrigated)	500	4.2	2,100
S-A (rainfed)	2,500	3.0	7,500
Cassava (rainfed)	10,000	9.0	90,000
Beans	6,000		16,800
W-S (irrigated)	1,000	2.4	2,400
W-S (rainfed)	5,000	1.2	6,000
S-A (irrigated)	1,000	2.4	2,400
S-A (rainfed)	5,000	1.2	6,000
Sugarcane	65,000		3,585,000
Irrigated	500	75.0	37,500
Rainfed	64,500	55.0	2,760,000
Fruit	188,000		
Coconut	71,000	5.0	355,000
Other annual crops	66,000		
Other perennial crops (cashew, etc)	92,000		

2.14.2 Direction for Agricultural Development Plan for Cuu Long Delta Basin

The basic development direction in the Cuu Long Delta stipulated in the Strategy for Agricultural and Rural Development for 2001-2010 is as follows:

Direction for agricultural development in the basin is to focus on promoting an integrated agriculture, diversifying production and pushing up local advantages, such as food production, foodstuff, animal husbandry, fruit tree, aquaculture and catching.

- Food production: Food production will be developed at certain level with an area of 3,898,800 ha. Rice cultivation by 2010 will be allocated with 1,930,000 ha and annual rice export of 4 million tones. Besides, maize will also be developed by 2010 with an area of 100,000 ha and productivity of 549,000 tones.
- Sugarcane: Keep area for sugarcane plantation stabilized for providing materials for 8 sugar plants in the basin. By 2010, there 80,000 ha of sugarcane will be intensified for

meeting with productivity of 5.6 million tones of sugar.

- Fruit tree plantation: improve mixed garden, intensify and expand area for obtaining 279,200 ha of tropical fruits such as banana, pineapple, longan, mango, dragon fruit, milk fruit, etc. for meeting with domestic and export requirement. Pineapple (40,000 ha), banana (40,000 ha), mango (60,000 ha) longan and litch (25,000 ha) etc. will be allocated along Tien and Hau rivers, Ca Mau, west Hau river, North Tien Giang.
- Animal husbandry: Focus in developing 2 livestock of pig and poultry. By 2010, cow herd expected to reach 3.7 million by intensifying, to meet with local consumption and export. Chicken herd consists of 29.3 million, meat productivity and egg are 52.7 million tones and 770 million, respectively. Dug herd is 24.1 million, 54,200 tones of meet and 825 million eggs, besides its salted egg and feather are to be exported.
- Fishery: By 2010, total fishery product in there will be 1.9 million tones, of which aquaculture and catching occupy 912,000 tones and 1 million tones, respectively. In the regard of area for aquaculture it would be 544,000 ha, of which 250,000 ha, 32,000 ha and 220,000 ha of tiger prawn, blue legged prawn and caged fish, respectively.

2.14.3 Potential for Agriculture and Irrigation Development

The Cuu Long Delta is the largest rice production area of the country and will play an important role in agricultural development, food stabilization, and export earnings. The Delta contributes to the export of rice for approximately 85%. Almost 50% of the total paddy production of Vietnam come from this region. The Delta has the potential to keep its role as surplus producer of rice and at the same time to diversify into higher value non-rice crops.

Currently, there are 2.4 million ha of lands used for agricultural activities. Nearly all planted annual crop areas in the Delta grow paddy. The potential for expansion of agricultural land is limited to about 0.2 million ha at present. However, the Delta has abundant land resources for further expansion of agricultural land on condition of providing proper water control systems. Generally, the soils of the Delta pose no major constraints to agriculture, except acid sulfate soils mainly extended over the Plain of Reeds.

The availability of water resources in the Delta alternates every six months, from surplus to shortage. During July-December, heavy rainfall and runoff occur over the 6 months, causing long periods of inundation over 25% of the delta. The northern delta is inundated as a result of overtopped banks of the river system; and the southern delta is inundated as a result of poor drainage, low lying lands and depression in the area. Cropping patterns in the delta have been adapted to these situations over the years. Therefore, it would be said that the Delta's agricultural potential could only be exploited fully if water control measures are taken to deal with the alternating vagaries of water surpluses and shortages. The most important water control measures in that respect are irrigation during the dry season and flood control and drainage during the rainy season.

Many water control measures have already been implemented in the Delta. There is an extensive system of primary and secondary canals and of flood protection embankments. According to the Cuu Long Delta Master Plan*, actual water control is exercised in the water control units: flood control at the secondary unit level, irrigation and drainage at the tertiary/farm unit level. Irrigation is mostly by low lift pumping from the canal system. The water control infrastructure is more complete in the central part of the Delta than in the outer areas.

In order to increase of the cropped area and cropping intensity in the Delta, it is absolutely necessary for strengthening water control measures under a long-term water control program.

The main thrust of water control measures, particularly related to irrigation would be: (a) on-farm development; and (b) canal improvement (enlargement of existing and construction of new, primary and secondary canals and water control structures, such as salinity control sluice gates) to bring more irrigation water to the already irrigated areas, as well as to improve drainage conditions and promote flushing of acid water. Water control would also include embankment improvement to prevent flooding till the end of August in the deep-flood areas and full, year-round protection in the already more developed shallow-flood areas.

2.14.4 Agricultural Land Use for 2010 and 2020

Taking the above basin agricultural development plan and the national agricultural development plan for Northern Mountainous and Midland Zone into consideration, the Study team prepared the following agricultural land use plan and cropping pattern, as shown in Table D.30 and Figure D.28, respectively.

* Mekong Delta Master Plan (VIE/87/031): World Bank/Mekong Secretariat/UNDP, 1993

Table D.1 Area of Msain Soil Groups by Region in Vietnam

Soil Units	Whole Country	Rate (%)	North-west	Viet Bac Hoang Lien Son	North-east	Red River Delta	North Central Coast	South Central Coast	Central Highlands	Southeast	Mekong River Delta
1. Sand dunes and sandy marine soils	538.6	1.6		0.5	5.9	10.2	187.8	262.3		28.6	43.3
2. Saline Soils	975.4	3.0			50.3	82.7	46.2	49.1		2.6	744.5
3. Acid sulphate soils	1,866.5	5.7			4.9	34.6	42.1	7.5		177.1	1,600.3
4. Alluvial soils	3,612.9	11.0	27.1	149.6	205.7	795.8	545.9	368.7	245.4	86.2	1,188.5
5. Swamp and pesat soils	50.6	0.2		1.7		5.2	1.4	5.0	4.8	8.5	24.0
6. Grey degtrded soils	1,807.7	5.5		39.2	58.6	26.2	45.5	294.4	510.4	783.6	49.8
7. Reddish and brownish grey soils in the semi-arid regi	39.7	0.1						39.7			
8. Black soils	318.9	1.0	5.9	1.4	5.6	1.5		22.3	136.5	145.7	
9. Yrllowish redish soils	17,881.4	54.3	2,132.8	2,121.3	2,546.5	109.5	3,288.6	2,897.6	3,743.2	954.6	87.3
10.Redish and yellowish humus soils in the mountsains	3,228.4	9.8	1,168.3	655.0	122.1	0.3	352.6	266.0	664.1		
11.Humus soil in the mountains	185.0	0.6	78.7	89.4			4.7		12.2		
12.Colluvial soils	318.3	1.0	3.5	23.1	19.0	7.1	98.1	45.7	74.3	47.5	
13.Eroded skelital soils	3,286.8	0.9		1.9	4.9	1.6	137.5	46.9	73.1	12.1	8.8
Total of soils area	31,110.3	94.5	3,416.3	3,083.1	3,023.5	1,074.7	4,750.4	4,305.2	5,464.0	2,246.5	3,746.5
14.Stream and lake	824.8	2.5	41.0	84.7	60.7	115.8	107.7	62.5	51.8	86.1	214.5
15.Rock	992.2	3.0	138.0	164.6	258.8	71.8	259.3	64.9	16.0	17.6	1.2
Total of area	32,927.2	100.0	3,595.3	3,332.4	3,343.0	1,262.3	5,117.4	4,432.6	5,531.8	2350.2	3,962.2

Source: Nsational Institute for Agricultural Planing and Projection

Table D.2 List of Institutes, Universities, Agricultural Science research Centers (in 2000)

Management Level	No.	Name
Institute and Research Centers under MARD	1	Forest Science Institute of Vietnam
	2	Vietnam Institute for Water Resources Research
	3	Southern Institute of Water Resources Research
	4	Vietnam Aagricultural Science Institute
	5	Southern Institute of Agricultural Science
	6	Western Hifhlands Agro-forestry and Technology Institute
	7	Food Crops Research Institute
	8	Cuu Long Delta Rice Research Institute
	9	Agricultural Genetic Institute
	10	Research Institute for Fruits and Vegetables
	11	SouthernFruit Research Institute
	12	National Maize Research Institute
	13	National Institute of Animal Husbandry
	14	National Institute of Veterinary Research
	15	Post-harvest Technology Institute
	16	National Institute for Soils and Fertilizer
	17	National Institute for Plant Protection
	18	Vietnam Institute of Agricultural Engineering
	19	Institute of Agricultural Economic
	20	Central Sericulture Research Center
	21	Information Center of Agriculture and Rural Development
Institutes/Centers under Enterprises	22	Rubber Research Institute of Vietnam
	23	Tea Research Institute of Vietnam
	24	Institute of Sugarcane Research
	25	Bavi Coffee Research Center
	26	Bee Research and Development Center
	27	Veterinary Research Center
Institutes of Planning	28	National Institute for Agricultural Planning and Projection
	29	Forest Inventory and Planning Institute
	30	Institute of Water Resources Planning
University under MARD	31	University of Water Resources
	32	University of Forestry
Agricultural Universities under Ministry of Training and Education	33	Hanoi Agricultural University No.1
	34	Thai Nguyen Agro-Forest University
	35	Hue Agro-Forest University
	36	Thu Duc Agro-Forest University
Universities with Agricultural faculty under Ministry of Training and Education	37	Can Tho University
	38	Tay Nguyen University
	39	Hong Duc University
	40	An Giang University
National Center of Natural science & Technology	41	Bio-Technology University
Ministry of Industry	42	Oil-tree Research Institute
	43	Industrial Chemistry Institute
	44	Nha Ho Cotton Research Center
	45	Cigarette Research Institute

Source: MARD, Deptment of Science, Technology and Product Quality

Table D.3 Present Agricultural Land Use in 2001, Bang Giang & Ky Cung Rivers Basins

*: Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a: Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b: Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c: Agriculture in Vietnam - 61 Provinces, 2001
d: The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Cao Bang Province, Cultivated Land	100%	100%	47%			53%		
Ratio of Cultivated Land in River Basin	70%	62,000 a	29,000 a			33,000		
Lang Song Province, Cultivated Land	100%	100%	62%			38%		
Ratio of Cultivated Land in River Basin	40%	61,000 a	38,000 a			23,000		
Cao Bang Province, Cultivated Land	55%							
Ban Giang & Ky Cung River Basin		**68,000**	**36,000** c	**70%** *	**25,000**	**32,000**	**2%** *	**500**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	5,000	5,000 c		5,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	36,000	36,000 c		25,000			
2	Maize (Winter - Spring)	0	c			c		0
	Maize (Spring - Summer)	17,500	10,000 c		10,000	7,500 c		0
	Maize (Rainy Season)	7,500				7,500		0
3	Cassava	10,000	0 b		0	10,000 b		0
4	Sweet Potato (Winter - Spring)	0	0 b			0		0
	Sweet Potato (Spring - Summer)	2,000	2,000 b		2,000	0		0
5	Groundnut (Winter - Spring)	0	0 c			0		0
	Groundnut (Spring Summer)	1,000	1,000 c		1,000	0		0
6	Sugar Cane	1,800				1,800 c		500
7	Other Annual (Potato, etc.) (Winter - Spring)	0	0 b			0		0
	Other Annual (Potetos, etc.) (Spring - Summer)	19,500	12,000 b		7,000	7,500		0
	Other Annual (Tomato, etc.) (Rainy Season)	7,500				7,500		0
8	Fruits	4,500				4,500 c		0
9	Tea	600				600 c		0
10	Coffee	100				100 c		0
11	Other Perenial Crops	0				0 c		0
	Total Planted Area (ha)	**113,000**	**66,000**		**50,000**	**47,000** b		**500**
	Winter - Spring	5,000	5,000		5,000	0		0
	Spring - Summer	40,000	25,000		20,000	15,000		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	51,000	36,000		25,000	15,000		0
	Year Round	17,000	0		0	17,000		500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		68,000	**36,000**		**25,000**	**32,000**		**500**
								c

Table D.4 Target Agricultural Land Use Plan for 2020, Bang Giang & Ky Cung Rivers Basins

*: Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a: Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b: Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c: Agriculture in Vietnam - 61 Provinces, 2001
d: The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Cao Bang Province, Cultivated Land	100%	100%	47%			53%		
Ratio of Cultivated Land in River Basin	70%	80,000 a	29,000 a			51,000		
Lang Song Province, Cultivated Land	100%	100%	62%			38%		
Ratio of Cultivated Land in River Basin	40%	79,000 a	38,000 a			41,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	55%							
Ban Giang & Ky Cung River Basin		**88,000**	**36,000** c	**100%** *	**36,000**	**52,000**	**61%** *	**31,500**
No.	Crop	Planted Area(ha)	Planted Area(ha)		Planted Area(ha)	Planted Area(ha)		Planted Area(ha)
1	Paddy (Winter - Spring)	7,000	7,000 c		7,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	36,000	36,000 c		36,000			
2	Maize (Rainy Season)	0	c			c		
	Maize (Spring - Summer)	23,500	12,000 c		12,000	11,500 c		10,000
	Maize (Rainy Season)	11,500				11,500		10,000
3	Cassava	15,000	0 b		0	15,000 b		0
4	Sweet Potato (Winter - Spring)	0	0 b			0		0
	Sweet Potato (Spring - Summer)	3,000	3,000 b		3,000	0		0
5	Groundnut (Winter - Spring)	0	0 c			0		0
	Groundnut (Spring Summer)	2,000	2,000 c		2,000	0		0
6	Sugar Cane	2,500				2,500 c		2,500
7	Other Annual (Potato, etc.) (Winter - Spring)	0	0 b			0		0
	Other Annual (Poteto, etc.) (Spring - Summer)	23,500	12,000 b		12,000	11,500		10,000
	Other Annual (Tomato, etc.) (Rainy Season)	11,500				11,500		10,000
8	Fruits	9,500				9,500 c		7,000
9	Tea	800				800 c		800
10	Coffee	1,200				1,200 c		1,200
11	Other Perenial Crops	0				0 c		0
	Total Planted Area (ha)	**147,000**	**72,000**		**72,000**	**75,000** b		**51,500**
	Winter - Spring	7,000	7,000		7,000	0		0
	Spring - Summer	52,000	29,000		29,000	23,000		20,000
	Summer -Autumn	0	0		0	0		0
	Rainy Season	59,000	36,000		36,000	23,000		20,000
	Year Round	29,000	0		0	29,000		11,500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		88,000	**36,000**		**36,000**	**52,000**		**31,500**
		61,500	36,000		36,000	38,000		20,000

Table D.5 Present Agricultural Land Use in 2001, Red River Basin

*: Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a: Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b: Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c: Agriculture in Vietnam - 61 Provinces, 2001
d: The Sector Review Study for the Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Delta, Cultivated Land	100%	100%	91%			9%		
Ratio of Cultivated Land in River Basin	100%	731,000 a	667,000 a			64,000		
Hilly Provinces, Cultivated Land	100%	100%	45%			55%		
Ratio of Cultivated Land in River Basin	90%	838,000 a	377,000 a			461,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	95%							
Ban Giang & Ky Cung River Basin		**1,485,000**	**1,006,000 c**	**75% ***	**755,000**	**479,000**	**53% ***	**253,000**
No.	Crop	Planted Area(ha)	Planted Area(ha)		Planted Area(ha)	Planted Area(ha)		Planted Area(ha)
1	Paddy (Winter - Spring)	1,006,000	1,006,000 c		755,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	878,000	878,000 c		640,000			
2	Maize (Winter - Spring)	85,000				85,000 c		50,000
	Maize (Rainy Season)	85,000	38,000		38,000	47,000 c		27,000
3	Soybean (Winter - Spring)	0						
	Soybean (Rainy Season)	39,000				39,000 c		23,000
4	Sweet Potato (Winter - Spring)	0						0
	Sweet Potato (Rainy Season)	76,000				76,000 b		46,000
5	Groundnut (Winter - Spring)	17,000				17,000 c		10,000
	Groundnut (Rainy Season)	17,000				17,000 c		10,000
6	Sugar Cane	16,000				16,000 b		10,000
7	Other Annual (Potato, etc.) (Winter - Spring)	183,000				183,000 c		110,000
	Other Annual (Tomato, etc.) (Rainy Season)	183,000	77,000		77,000	106,000 c		64,000
8	Fruits	40,000				40,000 c		24,000
9	Tea	82,000				82,000 c		15,000
10	Coffee	25,000				25,000 c		15,000
11	Other Perenial Crops	31,000				31,000 c		19,000
	Total Planted Area (ha)	**2,763,000**	**1,999,000**		**1,510,000**	**764,000 b**		**423,000**
	Winter - Spring	1,291,000	1,006,000		755,000	285,000		170,000
	Spring - Summer	0	0		0	0		0
	Autumn - Winter	0				0		0
	Rainy Season	1,278,000	993,000		755,000	285,000		170,000
	Year Round	194,000	0		0	194,000		83,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		1,485,000	**1,006,000**		**755,000**	**479,000**		**253,000**
		1,472,000	993,000		755,000	479,000		170,000

Table D.6 Target Agricultural Land Use Plan for 2020, Red River Basin,

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Delta, Cultivated Land	100%	100%	89%			11%		
Ratio of Cultivated Land in River Basin	100%	731,000 a	650,000 c			81,000		
Hilly Provinces, Cultivated Land	100%	100%	45%			55%		
Ratio of Cultivated Land in River Basin	90%	838,000 a	377,000 c			461,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	95%							
Ban Giang & Ky Cung River Basin		**1,485,000**	**989,000 c**	**95% ***	**940,000**	**496,000**	**71% ***	**351,000**
No.	Crop	Planted Area(ha)	Planted Area(ha)		Planted Area(ha)	Planted Area(ha)		Planted Area(ha)
1	Paddy (Winter - Spring)	989,000	989,000 c		940,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	869,000	869,000 c		820,000			
2	Maize (Winter - Spring)	90,000				90,000 c		71,000
	Maize (Rainy Season)	90,000	40,000		40,000	50,000 c		39,000
3	Soybean (Winter - Spring)	0						
	Soybean (Rainy Season)	74,000				74,000 c		59,000
4	Sweet Potato (Winter - Spring)	0						0
	Sweet Potato (Rainy Season)	46,000				46,000 b		37,000
5	Groundnut (Winter - Spring)	22,000				22,000 c		18,000
	Groundnut (Rainy Season)	22,000				22,000 c		18,000
6	Sugar Cane	16,000				16,000		13,000
7	Other Annual (Potato, etc.) (Winter - Spring)	175,000				175,000 c		140,000
	Other Annual (Tomato, etc.) (Rainy Season)	175,000	80,000		80,000	95,000 c		76,000
8	Fruits	45,000				45,000 c		36,000
9	Tea	87,000				87,000 c		24,000
10	Coffee	30,000				30,000 c		24,000
11	Other Perenial Crops	31,000				31,000 c		25,000
	Total Planted Area (ha)	**2,761,000**	**1,978,000**		**1,880,000**	**783,000 b**		**580,000**
	Winter - Spring	1,276,000	989,000		940,000	287,000		229,000
	Spring - Summer	0	0		0	0		0
	Autumn - Winter	0				0		0
	Rainy Season	1,276,000	989,000		940,000	287,000		229,000
	Year Round	209,000	0		0	209,000		122,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		1,485,000	**989,000**		**940,000**	**496,000**		**351,000**
		1,485,000	989,000		940,000	496,000		229,000

Table D.7 Present Agricultural Land Use in 2001, Ma River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Ma River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Thanh Hoa Province		100%	56.3%			43.7%		
		241,400 c	136,000 c			105,400		
Ratio of Cultivated Land (Ref. Land Use Map)** 105%								
Ma River Basin		**253,500**	**143,000 c**	**74.0% d**	**106000**	**110,500**	**5.4% d**	**6,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	123,000	123,000 c		91,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	143,000	143,000 c		106,000			
2	Maize (Winter - Spring)	21,000				21,000 c		0
	Maize (Rainy Season)	21,000				21,000 c		0
3	Cassava	13,000				13,000 c		0
4	Sweet Potato (Winter - Spring)	14,000				14,000 c		0
	Sweet Potato (Rainy Season)	14,000				14,000 c		0
5	Groundnut (Winter - Spring)	8,000				8,000 c		0
	Groundnut (Rainy Season)	8,000				8,000 c		0
6	Sugar Cane	18,000				18,000 c		6,000
7	Other Annual (Potato, etc.) (Winter - Spring)	7,500				7,500 b		0
	Other Annual (Tomato, etc.) (Rainy Season)	7,500				7,500 b		0
8	Rubber	7,000				7,000 c		0
9	Tea	2,000				2,000 c		0
10	Coffee	1,000				1,000 c		0
11	Other Perenial Crops (Fruits)	19,000				19,000 c		0
	Total Planted Area (ha)	**427,000**	**266,000**		**197,000**	**161,000 b**		**6,000**
	Winter - Spring	173,500	123,000		91,000	50,500		0
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	193,500	143,000		106,000	50,500		0
	Year Round	60,000	0		0	60,000		6,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		253,500	**143,000**		**106,000**	**110,500**		**6,000**

Table D.8 Target Agricultural Land Use Plan for 2020, Ma River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Ma River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Thanh Hoa Province		100%	47.4%			52.6%		
		289,000	137,000 c			152,000		
Ratio of Cultivated Land (Ref. Land Use Map)** 105%								
Ma River Basin		**303,500**	**144,000 c**	**100.0%**	**144000**	**159,500**	**34.8%**	**55,500**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	144,000	144,000 c		144,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	144,000	144,000 c		144,000			
2	Maize (Winter - Spring)	34,000				34,000 c		10,000
	Maize (Rainy Season)	34,000				34,000 c		10,000
3	Cassava	13,000				13,000 c		0
4	Sweet Potato (Winter - Spring)	10,000				10,000 c		2,000
	Sweet Potato (Rainy Season)	10,000				10,000 c		2,000
5	Groundnut (Winter - Spring)	10,000				10,000 c		0
	Groundnut (Rainy Season)	10,000				10,000 c		0
6	Sugar Cane	34,000				34,000 c		30,000
7	Other Annual (Potato, etc.) (Winter - Spring)	8,000				8,000 b		8,000
	Other Annual (Tomato, etc.) (Rainy Season)	8,000				8,000 b		8,000
8	Rubber	11,000				11,000 c		0
9	Tea	9,000				9,000 c		1,000
10	Coffee	7,500				7,500 c		3,500
11	Other Perenial Crops (Fruits)	23,000				23,000 c		1,000
	Total Planted Area (ha)	**509,500**	**288,000**		**288,000**	**221,500 b**		**75,500**
	Winter - Spring	206,000	144,000		144,000	62,000		20,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	206,000	144,000		144,000	62,000		20,000
	Year Round	97,500	0		0	97,500		35,500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		303,500	**144,000**		**144,000**	**159,500**		**55,500**

Table D.9 Present Agricultural Land Use in 2001, Ca River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Nghe An Province, Cultivated Land	100%	100%	70%			30%		
Ratio of Cultivated Land in River Basin	85%	141,000 a	99,000 a			42,000		
Ha Tinh Province, Cultivated Land	100%	100%	85%			15%		
Ratio of Cultivated Land in River Basin	95%	78,000 a	66,000 a			12,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	89%							
Ca River Basin		**194,000**	**147,000** c	**60%** *	**88,000**	**47,000**	**10%** *	**5,000**
No.	Crop	Planted Area(ha)	Planted Area(ha)		Planted Area(ha)	Planted Area(ha)		Planted Area(ha)
1	Paddy (Winter - Spring)	114,000	114,000 c		67,000			
	Paddy (Summer - Autumn)	79,000	79,000 c		47,000			
	Paddy (Rainy Season)	68,000	68,000 c		41,000			
2	Maize (Winter - Spring)	11,000				11,000 c		1,000
	Maize (Rainy Season)	11,000				11,000 c		1,000
3	Soybean (Winter - Spring)	1,000	1,000 c		0			
	Soybean (Rainy Season)	0						
4	Sweet Potato (Winter - Spring)	22,000	16,000 b		0	6,000 b		1,000
	Sweet Potato (Rainy Season)	6,000				6,000 b		1,000
5	Groundnut (Winter - Spring)	20,000	16,000 c		0	4,000 c		500
	Groundnut (Rainy Season)	4,000				4,000 c		500
6	Sugar Cane	8,000				8,000 b		1,000
7	Other Annual (Potato, etc.) (Winter - Spring)	12,000				12,000 c		1,500
	Other Annual (Tomato, etc.) (Rainy Season)	12,000				12,000 c		1,500
8	Rubber	3,000				3,000 c		0
9	Tea	2,000				2,000 c		0
10	Coffee	1,000				1,000 c		0
11	Other Perenial Crops	0				0 c		0
	Total Planted Area (ha)	**374,000**	**294,000**		**155,000**	**80,000 b**		**9,000**
						58,000		
	Winter - Spring	180,000	147,000		67,000	33,000		4,000
	Summer -Autumn	79,000	79,000		47,000	0		0
	Rainy Season	101,000	68,000		41,000	33,000		4,000
	Year Round	14,000	0		0	14,000		1,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		194,000	**147,000**		**88,000**	**47,000**		**5,000**
		194,000	147,000		67,000	47,000		5,000

Table D.10 Target Agricultural Land Use Plan for 2020, Ca River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Nghe An Province, Cultivated Land	100%	100%	52%			48%		
Ratio of Cultivated Land in River Basin	85%	190,000 a	99,000 a			91,000		
Ha Tinh Province, Cultivated Land	100%	100%	67%			33%		
Ratio of Cultivated Land in River Basin	95%	99,000 a	66,000 a			33,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	89%							
Ca River Basin		**256,000**	**147,000** c	**90%** *	**132,000**	**109,000**	**65%** *	**71,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	114,000	114,000 c		103,000			
	Paddy (Summer - Autumn)	79,000	79,000 c		71,000			
	Paddy (Rainy Season)	68,000	68,000 c		61,000			
2	Maize (Winter - Spring)	13,000				13,000 c		9,000
	Maize (Rainy Season)	13,000				13,000 c		9,000
3	Soybean (Winter - Spring)	1,000	1,000 c		1,000			
	Soybean (Rainy Season)	0						
4	Sweet Potato (Winter - Spring)	22,000	16,000 b		14,000	6,000 b		4,000
	Sweet Potato (Rainy Season)	6,000				6,000 b		4,000
5	Groundnut (Winter - Spring)	30,000	16,000 c		14,000	14,000 c		9,000
	Groundnut (Rainy Season)	14,000				14,000 c		9,000
6	Sugar Cane	17,000				17,000 b		11,000
7	Other Annual (Potato, etc.) (Winter - Spring)	12,000				12,000 c		8,000
	Other Annual (Tomato, etc.) (Rainy Season)	12,000				12,000 c		8,000
8	Rubber	15,000				15,000 c		8,000
9	Tea	10,000				10,000 c		7,000
10	Coffee	12,000				12,000 c		8,000
11	Other Perenial Crops (Fruits, etc.)	10,000				10,000 c		7,000
	Total Planted Area (ha)	**448,000**	**294,000**		**264,000**	**154,000 b**		**101,000**
						128,000		
	Winter - Spring	192,000	147,000		132,000	45,000		30,000
	Summer -Autumn	79,000	79,000		71,000	0		0
	Rainy Season	113,000	68,000		61,000	45,000		30,000
	Year Round	64,000	0		0	64,000		41,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		256,000	**147,000**		**132,000**	**109,000**		**71,000**
		256,000	147,000		132,000	109,000		71,000

Table D.11 Present Agricultural Land Use in 2001, Thach Han River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Thach Han River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Quang Tri Province		100%	44%			56%		
		54,400 a	23,900 a			30,500 a		
Ratio of Cultivated Land (Ref. Land Use Map)** 40%								
Thach Han River Basin		**31,800**	**0 c**	**40% d**	**0**	**31,800**	**10% d**	**3,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	10,000	10,000 c		4,000			
	Paddy (Summer - Autumn)	7,000	7,000 c		3,000			
	Paddy (Rainy Season)	2,000	2,000 c		1,000			
2	Maize (Winter - Spring)	500				500 c		0
	Maize (Rainy Season)	500				500 c		0
3	Cassava	1,600				1,600 b		0
4	Sweet Potato (Winter - Spring)	1,000				1,000 b		300
	Sweet Potato (Rainy Season)	1,000				1,000 b		300
5	Groundnut (Winter - Spring)	800				800 c		300
	Groundnut (Rainy Season)	800				800 c		300
6	Sugar Cane	500				500 c		0
7	Other Annual (Tomato, etc.) (Winter - Spring)	800				800 b		300
	Other Annual (Tomato, etc.) (Rainy Season)	800				800 b		300
8	Rubber	4,400				4,400 c		0
9	Tea	0				0 c		0
10	Coffee	1,200				1,200 c		100
11	Other Perenial Crops (Fruits)	1,000				1,000 c		0
	Total Planted Area (ha)	**33,900**	**19,000**		**8,000**	**14,900**		**1,900**
						12,300		
	Winter - Spring	13,100	10,000		4,000	3,100		900
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	7,000	7,000		3,000	0		0
	Rainy Season	5,100	2,000		1,000	3,100		900
	Year Round	8,700	0		0	8,700		100
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		21,800	**10,000**		**4,000**	**11,800**		**1,000**

Table D.12 Target Agricultural Land Use Plan for 2020, Thach Han River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Thach Han River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Quang Tri Province		100%	38%			62%		
		63,200 a	23,900 a			39,300 a		
Ratio of Cultivated Land (Ref. Land Use Map)** 40%								
Thach Han River Basin		**25,300**	**10,000 c**	**90% d**	**9,000**	**15,300**	**42% d**	**6,400**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	10,000	10,000 c		9,000			
	Paddy (Summer - Autumn)	7,000	7,000 c		6,000			
	Paddy (Rainy Season)	2,000	2,000 c		2,000			
2	Maize (Winter - Spring)	1,400				1,400 c		1,400
	Maize (Rainy Season)	1,400				1,400 c		1,400
3	Cassava	600				600 b		0
4	Sweet Potato (Winter - Spring)	400				400 b		400
	Sweet Potato (Rainy Season)	400				400 b		400
5	Groundnut (Winter - Spring)	1,100				1,100 c		1,100
	Groundnut (Rainy Season)	1,100				1,100 c		1,100
6	Sugar Cane	400				400 c		400
7	Other Annual (Tomato, etc.) (Winter - Spring)	300				300 b		300
	Other Annual (Tomato, etc.) (Rainy Season)	300				300 b		300
8	Rubber	6,900				6,900 c		
9	Tea	0				0 c		0
10	Coffee	3,000				3,000 c		2,000
11	Other Perenial Crops (Fruits)	1,200				1,200 c		800
	Total Planted Area (ha)	**37,500**	**19,000**		**17,000**	**18,500**		**9,600**
						15,100		
	Winter - Spring	13,200	10,000		9,000	3,200		3,200
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	7,000	7,000		6,000	0		0
	Rainy Season	5,200	2,000		2,000	3,200		3,200
	Year Round	12,100	0		0	12,100		3,200
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		25,300	**10,000**		**9,000**	**15,300**		**6,400**

Table D.13 Present Agricultural Land Use in 2001, Huong River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Huong River Basin, October 2000
* Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
** Agriculture in Vietnam - 61 Provinces, 2001
*** Feasibility Report TA TRACH PROJECT, May 2000, HEC 1

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Thua Thien Hue Province		100%	55%			45%		
		47,000 **	26,000 **			21,000		
Ratio of Cultivated Land (Ref. Land Use Map)** 95%								
Huong River Basin		**45,000 ****	**25,000 ****	**72%**	**18,000 *****	**20,000**	**40%**	**7,900 *****
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	25,000	25,000 **		18,000 ***			
	Paddy (Summer - Autumn)	23,000	23,000 **		15,000 ***			
	Paddy (Rainy Season)	500	500		0			
2	Maize (Winter - Spring)	500				500 *		100 ***
	Maize (Spring - Summer)	500				500 *		100 ***
3	Cassava	4,000				4,000 *		0 ***
4	Sweet Potato (Winter - Spring)	4,000				4,000 *		4,000 ***
	Sweet Potato (Spring - Summer)	2,000				2,000 *		500 ***
5	Groundnut (Winter - Spring)	2,000				2,000 **		1,500 ***
	Groundnut (Spring - Summer)	2,000				2,000 **		300 ***
6	Sugar Cane	3,000				3,000 *		0 ***
7	Other Annual (Potato, etc.) (Winter - Spring)	3,000				3,000 *		2,300 ***
	Other Annual (Tomato, etc.) (Spring - Summer)	3,000				3,000 *		2,300 ***
8	Perenial Crops	3,500				3,500 *		0 ***
	Total Planted Area (ha)	**76,000**	**48,500**		**33,000**	**27,500**		**11,100**
						22,500		
	Winter - Spring	34,500	25,000		18,000	9,500		11,900 ***
	Spring - Summer	7,500	0		0	7,500		3,200 ***
	Summer -Autumn	23,000	23,000		15,000	0		0
	Rainy Season	500	500		0	0		0
	Year Round	10,500	0		0	10,500		0
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		45,000	**25,000**		**18,000**	**20,000**		**7,900**
								3,200

Table D.14 Target Agricultural Land Use Plan for 2020, Huong River Basin

World Bank - Vietnam Water Resources Assistance Program Profile for Huong River Basin, October 2000
* Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
** Agriculture in Vietnam - 61 Provinces, 2001
*** Feasibility Report TA TRACH PROJECT, May 2000, HEC 1

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Thua Thien Hue Province		100%	50%			50%		
		52,000 **	26,000 **			26,000		
Ratio of Cultivated Land (Ref. Land Use Map)** 95%								
Huong River Basin		**49,000 ****	**25,000 ****	**80%**	**19,900 *****	**24,000**	**25%**	**6,000 *****
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	25,000	25,000 **		19,900 ***			
	Paddy (Summer - Autumn)	23,000	23,000 **		19,900 ***			
	Paddy (Rainy Season)	500	500 **		0			
2	Maize (Winter - Spring)	1,000				1,000		500 ***
	Maize (Spring - Summer)	1,000				1,000		500 ***
3	Cassava	4,000				4,000		0 ***
4	Sweet Potato (Winter - Spring)	3,000				3,000		2,000 ***
	Sweet Potato (Spring - Summer)	3,000				3,000		2,000 ***
5	Groundnut (Winter - Spring)	2,500				2,500 **		1,500 ***
	Groundnut (Spring - Summer)	2,500				2,500 **		1,500 ***
6	Sugar Cane	3,000				3,000		0 ***
7	Other Annual (Potato, etc.) (Winter - Spring)	3,500				3,500 **		2,000 ***
	Other Annual (Tomato, etc.) (Spring - Summer)	3,500				3,500 **		2,000 ***
8	Perenial Crops	7,000				7,000 **		0 ***
	Total Planted Area (ha)	**82,500**	**48,500**		**39,800**	**34,000**		**12,000**
						28,000		
	Winter - Spring	35,000	25,000		19,900	10,000		6,000 ***
	Spring - Summer	10,000	0		0	10,000		6,000 ***
	Summer -Autumn	23,000	23,000		19,900	0		0
	Rainy Season	500	500		0	0		0
	Year Round	14,000	0		0	14,000		0
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		49,000	**25,000**		**19,900**	**24,000**		**6,000**
								6,000

Table D.15 Present Agricultural Land Use in 2001, Vu Gia - Thu Bon River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Da Nang City, Cultivated Land	100%	100%	46%			54%		
Ratio of Cultivated Land in River Basin	50%	13,300 a	6,100 a			7,200		
Quang Nam Province, Cultivated Land	100%	100%	54%			46%		
Ratio of Cultivated Land in River Basin	100%	91,400 a	49,200 a			42,200		
Ratio of Cultivated Land (Ref. Land Use Map)**	94%							
Ban Giang & Ky Cung River Basin		**98,000**	**52,000 c**	**50% ***	**26,000**	**46,000**	**11% ***	**4,900**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	52,000	52,000 c		26,000			
	Paddy (Summer - Autumn)	4,000	4,000 c		2,000			
	Paddy (Rainy Season)	48,000	48,000 c		24,000			
2	Maize (Winter - Spring)	3,800	c			3,800 c		500
	Maize (Rainy Season)	3,800	0 c		0	3,800 c		500
3	Cassava	12,000	b			12,000 b		
4	Sweet Potato (Winter - Spring)	6,000	0 b			6,000		300
	Sweet Potato (Rainy Season)	6,000	0 b		0	6,000		300
5	Groundnut (Rainy Season)	5,300	0 c			5,300		300
	Groundnut (Rainy Season)	5,300	0 c		0	5,300		300
6	Sugar Cane	6,000				6,000 c		1,400
7	Other Annual (Potato, etc.) (Winter - Spring)	6,000	0 b			6,000		2,000
	Other Annual (Tomato, etc.) (Rainy Season)	6,000	0 b		0	6,000		2,000
8	Fruits	2,500				2,500 c		
9	Tea	2,000				2,000 c		200
10	Coffee	400				400 c		100
11	Other Perenial Crops	2,000				2,000 c		100
	Total Planted Area (ha)	**171,100**	**104,000**		**52,000**	**67,100 b**		**8,000**
	Winter - Spring	73,100	52,000		26,000	21,100		3,100
	Spring - Summer	0				0		0
	Summer -Autumn	4,000	4,000		2,000	0		0
	Rainy Season	69,100	48,000		24,000	21,100		3,100
	Year Round	24,900	0		0	24,900		1,800
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		98,000	**52,000**		**26,000**	**46,000**		**4,900**
		82,200	52,000		26,000	21,100		3,100

Table D.16 Target Agricultural Land Use Plan for 2020, Vu Gia - Thu Bon River Basin,

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Da Nang City, Cultivated Land	100%	100%	54%			46%		
Ratio of Cultivated Land in River Basin	50%	11,300 a	6,100 a			5,200		
Quang Nam Province, Cultivated Land	100%	100%	55%			45%		
Ratio of Cultivated Land in River Basin	100%	89,400 a	49,200 a			40,200		
Ratio of Cultivated Land (Ref. Land Use Map)**	94%							
Ban Giang & Ky Cung River Basin		**95,000**	**52,000 c**	**95% ***	**49,000**	**43,000**	**65% ***	**28,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	52,000	52,000 c		49,000			
	Paddy (Summer - Autumn)	3,000	3,000 c		3,000			
	Paddy (Rainy Season)	49,000	49,000 c		46,000			
2	Maize (Winter - Spring)	5,000	c			5,000 c		4,000
	Maize (Rainy Season)	5,000	0 c		0	5,000 c		4,000
3	Cassava	6,000	b			6,000 b		
4	Sweet Potato (Winter - Spring)	6,500	0 b			6,500		5,000
	Sweet Potato (Rainy Season)	6,500	0 b		0	6,500		5,000
5	Groundnut (Rainy Season)	6,500	0 c			6,500		5,000
	Groundnut (Rainy Season)	6,500	0 c		0	6,500		5,000
6	Sugar Cane	7,500				7,500 c		5,500
7	Other Annual (Potato, etc.) (Winter - Spring)	4,500	0 b			4,500		3,200
	Other Annual (Tomato, etc.) (Rainy Season)	4,500	0 b		0	4,500		3,200
8	Fruits	2,500				2,500 c		2,000
9	Tea	2,000				2,000 c		1,500
10	Coffee	500				500 c		300
11	Other Perenial Crops	2,000				2,000 c		1,500
	Total Planted Area (ha)	**169,500**	**104,000**		**98,000**	**65,500 b**		**45,200**
	Winter - Spring	74,500	52,000		49,000	22,500		17,200
	Spring - Summer	0				0		0
	Summer -Autumn	3,000	3,000		3,000	0		0
	Rainy Season	71,500	49,000		46,000	22,500		17,200
	Year Round	20,500	0		0	20,500		10,800
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		95,000	**52,000**		**49,000**	**43,000**		**28,000**
		84,000	52,000		49,000	22,500		17,200

Table D.17 Present Agricultural Land Use in 2001, Tra Khuc River Basin

* World Bank - Vietnam Water Resources Assistance Program Profile for Tra Khuc River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Quang Ngai Province		100%	52%			48%		
		78,200 a	40,400 a			37,800 a		
Ratio of Cultivated Land (Ref. Land Use Map)** 95%								
Tra Khuc River Basin		**74,300**	**38,000 c**	**70% ***	**27,000**	**36,300**	**17% ***	**6,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	38,000	38,000 c		27,000 b			
	Paddy (Summer - Autumn)	18,000	18,000 c		18,000 b			
	Paddy (Rainy Season)	29,000	29,000 c		27,000 b			
2	Maize (Winter - Spring)	3,000				3,000 c		500
	Maize (Rainy Season)	3,000				3,000 c		500
3	Cassava	10,600				10,600 b		
4	Sweet Potato (Winter - Spring)	0				0		0
	Sweet Potato (Summer - Autumn)	4,000	4,000 c		2,000	0		0
	Sweet Potato (Rainy Season)	0				0		0
5	Groundnut (Winter - Spring)	0				0		0
	Groundnut (Summer - Autumn)	5,200	5,200 c		3,500	0		0
	Groundnut (Rainy Season)	0				0		0
6	Sugar Cane	12,000				12,000		4,500
7	Other Annual (Potato, etc.) (Winter - Spring)	0				0		0
	Other Annual (Tomato, etc.) (Summer - Autumn)	5,000	5,000 c		3,500	0		0
	Other Annual (Tomato, etc.) (Rainy Season)	5,000	5,000 c			0		0
8	Rubber	1,000				1,000 c		0
9	Coconut	6,000				6,000 c		0
10	Coffee	1,000				1,000 c		200
11	Other Perenial Crops (Fruits, etc.)	2,700				2,700 c		800
	Total Planted Area (ha)	**143,500**	**104,200**		**81,000**	**39,300**		**6,500**
	Winter - Spring	41,000	38,000		27,000	3,000		500
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	32,200	32,200		27,000	0		0
	Rainy Season	37,000	34,000		27,000	3,000		500
	Year Round	33,300	0		0	33,300		5,500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		74,300	**38,000**		**27,000**	**36,300**		**6,000**

Table D.18 Target Agricultural Land Use Plan for 2020, Tra Khuc River Basin

* World Bank - Vietnam Water Resources Assistance Program Profile for Tra Khuc River Basin, October 2000
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Quang Ngai Province		100%	40%			60%		
		91,900 a	37,000 a			54,900 a		
Ratio of Cultivated Land (Ref. Land Use Map)** 95%								
Tra Khuc River Basin		**87,300**	**35,000 c**	**95% ***	**33,000**	**52,300**	**40% ***	**21,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	35,000	35,000 c		33,000 b			
	Paddy (Summer - Autumn)	20,000	20,000 c		20,000 b			
	Paddy (Rainy Season)	26,000	26,000 c		26,000 b			
2	Maize (Winter - Spring)	3,300				3,300 c		3,000
	Maize (Rainy Season)	3,300				3,300 c		3,000
3	Cassava	10,600				10,600 b		
4	Sweet Potato (Winter - Spring)	0				0		0
	Sweet Potato (Summer - Autumn)	1,900	1,900 c		1,500	0		0
	Sweet Potato (Rainy Season)	0				0		0
5	Groundnut (Winter - Spring)	0				0		0
	Groundnut (Summer - Autumn)	6,700	6,700 c		6,000	0		0
	Groundnut (Rainy Season)	0				0		0
6	Sugar Cane	14,000				14,000		12,000
7	Other Annual (Potato, etc.) (Winter - Spring)	0				0		0
	Other Annual (Tomato, etc.) (Summer - Autumn)	6,400	6,400 c		5,500	0		0
	Other Annual (Tomato, etc.) (Rainy Season)	9,000	9,000 c		7,000	0		0
8	Rubber	2,000				2,000 c		
9	Coconut	6,000				6,000 c		0
10	Coffee	1,000				1,000 c		500
11	Other Perenial Crops (Fruits, etc.)	15,400				15,400 c		5,500
	Total Planted Area (ha)	**160,600**	**105,000**		**99,000**	**55,600**		**24,000**
	Winter - Spring	38,300	35,000		33,000	3,300		3,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	35,000	35,000		33,000	0		0
	Rainy Season	38,300	35,000		33,000	3,300		3,000
	Year Round	49,000	0		0	49,000		18,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		87,300	**35,000**		**33,000**	**52,300**		**21,000**

Table D.19 Present Agricultural Land Use in 2001, Kone River Basin

* World Bank - Vietnam Water Resources Assistance Program Profile for Kone - Ha Thanh - La Thinh River Basin, October 2000

** Agriculture in Vietnam - 61 Provinces, 2001
*** Answer to Questionnaire, December 2001

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Binh Dinh Province		100%	58%			42%		
		91,400	53,300			38,100		
Ratio of Cultivated Land (Ref. Land Use Map)** 82%								
Kone - Ha Thanh River Basin		**75,000**	**44,000**	**55%**	**24,000 *****	**31,000**	**3%**	**1,000 *****
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	44,000	44,000		24,000			
	Paddy (Summer - Autumn)	33,000	33,000		24,000			
	Paddy (Rainy Season)	33,000	33,000		24,000			
2	Cassava	8,000				8,000		0
3	Maize (Winter - Spring)	1,000				1,000		0
	Maize (Summer - Autumn)	1,000				1,000		0
4	Sugar Cane	7,000				7,000		500
5	Other Annual (Tomato, etc.) (Winter - Spring)	2,000				2,000		500
	Other Annual (Tomato, etc.) (Summer - Autumn)	12,000	10,000			2,000		500
6	Cashew	10,000				10,000		0
7	Other Perenial	3,000				3,000		0
	Total Planted Area (ha)	**154,000**	**120,000**		**72,000**	**34,000**		**1,500**
						34,000		
	Winter - Spring	47,000	44,000		24,000	3,000		500
	Spring - Summer	0						
	Summer -Autumn	46,000	43,000		24,000	3,000		500
	Rainy Season	33,000	33,000		24,000			
	Year Round	20,000				28,000		500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		75,000	**44,000**		**24,000**	**31,000**		**1,000**

Table D.20 Target Agricultural Land Use Plan for 2020, Kone River Basin

* World Bank - Vietnam Water Resources Assistance Program Profile for Kone - Ha Thanh - La Thinh River Basin, October 2000

** Agriculture in Vietnam - 61 Provinces, 2001
*** Answer to Questionnaire, December 2001

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Binh Dinh Province		100%	54%			46%		
		90,400	49,000			41,400		
Ratio of Cultivated Land (Ref. Land Use Map)** 82%								
Kone - Ha Thanh River Basin		**74,000**	**40,000**	**100%**	**40,000 *****	**34,000**	**26%**	**9,000 *****
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	40,000	40,000		40,000			
	Paddy (Summer - Autumn)	28,000	28,000		28,000			
	Paddy (Rainy Season)	40,000	40,000		40,000			
2	Cassava (Winter - Spring)	6,000				6,000		0
3	Maize (Winter - Spring)	2,000				2,000		2,000
	Maize (Summer - Autumn)	2,000				2,000		2,000
4	Sugar Cane	9,000				9,000		6,000
5	Other Annual (Tomato, etc.) (Winter - Spring)	1,000				1,000		1,000
	Other Annual (Tomato, etc.) (Summer - Autumn)	13,000	12,000		12,000	1,000		1,000
6	Cashew	15,000				15,000		0
7	Other Perenial	1,000				1,000		0
	Total Planted Area (ha)	**157,000**	**120,000**		**120,000**	**37,000**		**12,000**
						37,000		
	Winter - Spring	43,000	40,000		40,000	3,000		3,000
	Spring - Summer	0						
	Summer -Autumn	43,000	40,000		56,000	3,000		3,000
	Rainy Season	40,000	40,000		40,000			
	Year Round	25,000				31,000		6,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		74,000	**40,000**		**40,000**	**34,000**		**9,000**

Table D.21 Present Agricultural Land Use in 2001, Ba River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Phu Yen Province, Cultivated Land	100%	100%	51%			49%		
Ratio of Cultivated Land in River Basin	65%	64,300 a	32,500 a			31,800		
Gia Lai Province, Cultivated Land	100%	100%	16%			84%		
Ratio of Cultivated Land in River Basin	95%	253,900 a	41,700 a			212,200		
Ratio of Cultivated Land (Ref. Land Use Map)**	89%							
Ban Giang & Ky Cung River Basin		**283,000**	**61,000 c**	**60%**	**37,000 ***	**222,000**	**2%**	**4,000 ***
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	29,000	29,000 c		26,000			
	Paddy (Summer - Autumn)	16,000	16,000 c		14,000			
	Paddy (Rainy Season)	45,000	45,000 c		23,000			
2	Maize (Winter - Spring)	11,000				11,000		500
	Maize (Spring - Summer)	5,500				5,500		250
	Maize (Rainy Season)	5,500				5,500		250
3	Cassava	9,000				9,000		
4	Sweet Potato (Winter - Spring)	2,000				2,000		
	Sweet Potato (Spring - Summer)					1,000		
	Sweet Potato (Rainy Season)	1,000				1,000		
5	Groundnut (Winter - Spring)	2,500				2,500		
	Groundnut (Spring - Summer)					1,250		
	Groundnut (Rainy Season)	1,250				1,250		
6	Sugar Cane	23,000				23,000		500
7	Other Annual (Tomato, etc.) (Winter - Spring)	69,000	11,000		11,000	58,000		3,000
	Other Annual (Tomato, etc.) (Spring - Summer)	29,000				29,000		1,500
	Other Annual (Tomato, etc.) (Rainy Season)	29,000				29,000		1,500
8	Fruits	2,500				2,500		
9	Tea	1,000				1,000		
10	Coffee	43,000				43,000		
11	Other Perenial Crops	70,000				70,000		
	Total Planted Area (ha)	**396,500**	**101,000**		**74,000**	**295,500**		**7,500**
	Winter - Spring	113,500	40,000		37,000	73,500		3,500
	Spring - Summer	36,750	0		0	36,750		1,750
	Summer -Autumn	16,000	16,000		14,000	0		0
	Rainy Season	81,750	45,000		23,000	36,750		1,750
	Year Round	148,500	0		0	148,500		500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		283,000	**61,000**		**37,000**	**222,000**		**4,000**

Table D.22 Target Agricultural Land Use plan for 2020, Ba River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Phu Yen Province, Cultivated Land	100%	100%	51%			49%		
Ratio of Cultivated Land in River Basin	65%	64,300 a	32,500 a			31,800		
Gia Lai Province, Cultivated Land	100%	100%	25%			75%		
Ratio of Cultivated Land in River Basin	95%	277,000 a	64,300 a			212,700		
Ratio of Cultivated Land (Ref. Land Use Map)**	89%							
Ban Giang & Ky Cung River Basin		**305,000**	**82,000 c**	**90%**	**74,000 ***	**223,000**	**50%**	**112,000 ***
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	39,000	39,000 c		39,000			
	Paddy (Summer - Autumn)	16,500	16,500 c		16,500			
	Paddy (Rainy Season)	65,500	65,500 c		57,500			
2	Maize (Winter - Spring)	15,000				15,000		10,000
	Maize (Spring - Summer)	7,500				7,500		5,000
	Maize (Rainy Season)	7,500				7,500		5,000
3	Cassava	9,000				9,000		
4	Sweet Potato (Winter - Spring)	2,000				2,000		1,800
	Sweet Potato (Spring - Summer)					1,000		900
	Sweet Potato (Rainy Season)	1,000				1,000		900
5	Groundnut (Winter - Spring)	7,000				7,000		5,000
	Groundnut (Spring - Summer)					3,500		2,500
	Groundnut (Rainy Season)	3,500				3,500		2,500
6	Sugar Cane	30,000				30,000		20,000
7	Other Annual (Tomato, etc.) (Winter - Spring)	55,000	35,000		35,000	20,000		18,000
	Other Annual (Tomato, etc.) (Spring - Summer)	10,000				10,000		9,000
	Other Annual (Tomato, etc.) (Rainy Season)	10,000				10,000		9,000
8	Fruits	3,600				3,600		2,200
9	Tea	1,000				1,000		
10	Coffee	59,000				59,000		35,000
11	Other Perenial Crops	76,400				76,400		20,000
	Total Planted Area (ha)	**423,000**	**156,000**		**148,000**	**267,000**		**146,800**
	Winter - Spring	118,000	74,000		74,000	44,000		34,800
	Spring - Summer	22,000	0		0	22,000		17,400
	Summer -Autumn	16,500	16,500		16,500	0		0
	Rainy Season	87,500	65,500		57,500	22,000		17,400
	Year Round	179,000	0		0	179,000		77,200
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		305,000	**82,000**		**74,000**	**223,000**		**112,000**

Table D.23 Present Agricultural Land Use in 2001, Sesan River Basin

a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001 s
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Kon Tum Province		100%	25%			75%		
		63,800 c	16,000 c			47,800		
Ratio of Cultivated Land (Ref. Land Use Map)** 165%								
Sesan River Basin		**105,000**	**26,000 c**	**50% d**	**13,000**	**79,000**	**12% d**	**9,500**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	6,000	6,000 c		5,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	26,000	26,000 c		13,000			
2	Maize (Winter - Spring)	0				c		0
	Maize (Rainy Season)	7,000				7,000 c		0
3	Cassava	12,000				12,000 c		0
4	Sweet Potato (Winter - Spring)	0				c		0
	Sweet Potato (Rainy Season)	500				500 c		0
5	Groundnut (Winter - Spring)	0				c		0
	Groundnut (Rainy Season)	700				700 c		0
6	Sugar Cane	6,300				6,300 c		500
7	Other Annual (Tomato, etc.) (Winter - Spring)	0				b		0
	Other Annual (Tomato, etc.) (Rainy Season)	11,500				11,500 b		1,000
8	Rubber	20,000				20,000 c		0
9	Tea	0				c		0
10	Coffee	16,000				16,000 c		8,000
11	Other Perenial Crops (Fruits)	5,000				5,000 c		0
	Total Planted Area (ha)	**111,000**	**32,000**		**18,000**	**79,000 b**		**9,500**
						60,000		
	Winter - Spring	18,000	6,000		5,000	12,000		0
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	45,700	26,000		13,000	19,700		1,000
	Year Round	59,300	0		0	59,300		8,500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		105,000	**26,000**		**13,000**	**79,000**		**9,500**

Table D.24 Target Agricultural Land Use Plan for 2020, Sesan River Basin

a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Kon Tum Province		100%	16%			84%		
		63,800 c	10,000 c			53,800		
Ratio of Cultivated Land (Ref. Land Use Map)** 165%								
Sesan River Basin		**105,000**	**17,000 c**	**90% d**	**15,000**	**88,000**	**40% d**	**35,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	12,000	12,000 c		12,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	17,000	17,000 c		15,000			
2	Maize (Winter - Spring)	3,000				3,000 c		3,000
	Maize (Rainy Season)	5,000				5,000 c		3,000
3	Cassava	12,000				12,000 c		0
4	Sweet Potato (Winter - Spring)	300				300 c		300
	Sweet Potato (Rainy Season)	500				500 c		300
5	Groundnut (Winter - Spring)	500				500 c		500
	Groundnut (Rainy Season)	700				700 c		500
6	Sugar Cane	8,500				8,500 c		6,000
7	Other Annual (Tomato, etc.) (Winter - Spring)	6,000				6,000 b		6,000
	Other Annual (Tomato, etc.) (Rainy Season)	6,500				6,500 b		6,000
8	Rubber	27,000				27,000 c		0
9	Tea	0				c		0
10	Coffee	25,000				25,000 c		18,700
11	Other Perenial Crops (Fruits)	2,800				2,800 c		500
	Total Planted Area (ha)	**126,800**	**29,000**		**27,000**	**97,800 b**		**44,800**
						77,800		
	Winter - Spring	33,800	12,000		12,000	21,800		9,800
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	29,700	17,000		15,000	12,700		9,800
	Year Round	75,300	0		0	75,300		25,200
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		105,000	**17,000**		**15,000**	**88,000**		**35,000**

Table D.25 Present Agricultural Land Use in 2001, Srepok River Basi

a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Dak Lak Province		100%	12%			88%		
		364,900 c	44,300 c			320,600		
Ratio of Cultivated Land (Ref. Land Use Map)** 60%								
Sesan River Basin		**219,000**	**27,000 c**	**40% d**	**11,000**	**192,000**	**24% d**	**47,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	10,000	10,000 c		8,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	27,000	27,000 c		11,000			
2	Maize (Winter - Spring)	11,000				11,000 c		1,000
	Maize (Rainy Season)	11,000				11,000 c		1,000
3	Cassava	2,000				2,000 c		0
4	Sweet Potato (Winter - Spring)	1,000				1,000 c		0
	Sweet Potato (Rainy Season)	1,000				1,000 c		0
5	Groundnut (Winter - Spring)	4,000				4,000 c		1,000
	Groundnut (Rainy Season)	4,000				4,000 c		1,000
6	Sugar Cane	4,000				4,000 c		1,000
7	Other Annual (Tomato, etc.) (Winter - Spring)	25,000				25,000 b		1,000
	Other Annual (Tomato, etc.) (Rainy Season)	25,000				25,000 b		1,000
8	Rubber	16,000				16,000 c		0
9	Pepper	1,500				1,500 c		0
10	Coffee	105,000				105,000 c		40,000
11	Other Perenial Crops (Fruits, etc.)	22,500				22,500 c		3,000
	Total Planted Area (ha)	**270,000**	**37,000**		**19,000**	**233,000 b**		**50,000**
						209,000		
	Winter - Spring	51,000	10,000		8,000	41,000		3,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	68,000	27,000		11,000	41,000		3,000
	Year Round	151,000	0		0	151,000		44,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		219,000	**27,000**		**11,000**	**192,000**		**47,000**

Table D.26 Target Agricultural Land Use Plan for 2020, Srepok River Basin

a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Dak Lak Province		100%	12%			88%		
		364,900 c	44,300 c			320,600		
Ratio of Cultivated Land (Ref. Land Use Map)** 60%								
Sesan River Basin		**219,000**	**27,000 c**	**90% d**	**24,000**	**192,000**	**65% d**	**125,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	10,000	10,000 c		10,000			
	Paddy (Summer - Autumn)	0	0 c		0			
	Paddy (Rainy Season)	27,000	27,000 c		24,000			
2	Maize (Winter - Spring)	11,000				11,000 c		8,000
	Maize (Rainy Season)	11,000				11,000 c		8,000
3	Cassava	2,000				2,000 c		0
4	Sweet Potato (Winter - Spring)	1,000				1,000 c		700
	Sweet Potato (Rainy Season)	1,000				1,000 c		700
5	Groundnut (Winter - Spring)	4,000				4,000 c		3,300
	Groundnut (Rainy Season)	4,000				4,000 c		3,300
6	Sugar Cane	4,000				4,000 c		3,000
7	Other Annual (Tomato, etc.) (Winter - Spring)	25,000	15,000		14,000	25,000 b		20,000
	Other Annual (Tomato, etc.) (Rainy Season)	25,000				25,000 b		20,000
8	Rubber	16,000				16,000 c		0
9	Pepper	1,500				1,500 c		0
10	Coffee	105,000				105,000 c		77,500
11	Other Perenial Crops (Fruits, etc.)	22,500				22,500 c		12,500
	Total Planted Area (ha)	**285,000**	**52,000**		**48,000**	**233,000 b**		**157,000**
						209,000		
	Winter - Spring	66,000	25,000		24,000	41,000		32,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	0	0		0	0		0
	Rainy Season	68,000	27,000		24,000	41,000		32,000
	Year Round	151,000	0		0	151,000		93,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		219,000	**27,000**		**24,000**	**192,000**		**125,000**

Table D.27 Present Agricultural Land Use in 2001, Dong Nai River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Annual Crops Area, Cultivated Land	100%	100%	57%			43%		
Ratio of Cultivated Land in River Basin	100%	488,000 a	278,000 a			210,000		
Provinces in Perennial Crops Area, Cultivated Land	100%	100%	11%			89%		
Ratio of Cultivated Land in River Basin	98%	942,000 a	103,000 a			839,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	99%							
Dong Nai River Basin		**1,411,000**	**380,000 c**	**25% ***	**95,000**	**1,031,000**	**2% ***	**20,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	118,000	118,000 c		95,000			
	Paddy (Summer - Autumn)	120,000	120,000 c		80,000			
	Paddy (Rainy Season)	260,000	260,000 c		15,000			
2	Maize (Winter - Spring)	5,000				5,000 c		0
	Maize (Rainy Season)	5,000				5,000 c		0
3	Soybean (Winter - Spring)	14,000				14,000 c		0
	Soybean (Rainy Season)	14,000				14,000 c		0
4	Sweet Potato (Winter - Spring)	20,000				20,000 c		5,000
	Sweet Potato (Rainy Season)	20,000				20,000 c		5,000
5	Cassava	34,000				34,000 c		0
6	Groundnut (Winter - Spring)	40,000				40,000 c		5,000
	Groundnut (Rainy Season)	40,000				40,000 c		5,000
7	Sugar Cane	65,000				65,000 c		5,000
8	Other Annual (Tomato, etc.) (Winter - Spring)	221,000				221,000 c		5,000
	Other Annual (Tomato, etc.) (Rainy Season)	221,000				221,000 c		5,000
9	Fruits	43,000				43,000 c		0
10	Cashew	84,000				84,000 c		0
11	Rubber	495,000				495,000 c		0
12	Other Perenial Crops	10,000				10,000 c		0
	Total Planted Area (ha)	**1,829,000**	**498,000**		**190,000**	**1,331,000 b**		**35,000**
	Winter - Spring	418,000	118,000		95,000	300,000		15,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	120,000	120,000		80,000	0		0
	Rainy Season	560,000	260,000		15,000	300,000		15,000
	Year Round	731,000	0		0	731,000		5,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		1,411,000	**380,000**		**95,000**	**1,031,000**		**20,000**
		1,257,000	260,000		15,000	997,000		15,000

Table D.28 Target Agricultural Land Use Plan for 2020, Dong Nai River Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Annual Crops Area, Cultivated Land	100%	100%	45%			55%		
Ratio of Cultivated Land in River Basin	100%	486,000 a	222,000 a			264,000		
Provinces in Perennial Crops Area, Cultivated Land	100%	100%	9%			91%		
Ratio of Cultivated Land in River Basin	98%	1,033,300 a	82,000 a			951,300		
Ratio of Cultivated Land (Ref. Land Use Map)**	99%							
Dong Nai River Basin		**1,499,000**	**300,000 c**	**90% ***	**270,000**	**1,199,000**	**10% ***	**123,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	98,000	98,000 c		98,000			
	Paddy (Summer - Autumn)	100,000	100,000 c		100,000			
	Paddy (Rainy Season)	200,000	200,000 c		170,000			
2	Maize (Winter - Spring)	10,000				10,000 c		3,000
	Maize (Rainy Season)	10,000				10,000 c		3,000
3	Soybean (Winter - Spring)	24,000				24,000 c		8,000
	Soybean (Rainy Season)	24,000				24,000 c		8,000
4	Sweet Potato (Winter - Spring)	5,000				5,000 c		2,000
	Sweet Potato (Rainy Season)	5,000				5,000 c		2,000
5	Cassava	26,000				26,000 c		0
6	Groundnut (Winter - Spring)	53,000				53,000 c		17,000
	Groundnut (Rainy Season)	53,000				53,000 c		17,000
7	Sugar Cane	85,000				85,000 c		25,000
8	Other Annual (Tomato, etc.) (Winter - Spring)	160,000				160,000 c		64,000
	Other Annual (Tomato, etc.) (Rainy Season)	160,000				160,000 c		64,000
9	Fruits	122,000				122,000 c		0
10	Cashew	77,000				77,000 c		0
11	Rubber	625,000				625,000 c		0
12	Other Perenial Crops	12,000				12,000 c		4,000
	Total Planted Area (ha)	**1,849,000**	**398,000**		**368,000**	**1,451,000 b**		**217,000**
	Winter - Spring	350,000	98,000		98,000	252,000		94,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	100,000	100,000		100,000	0		0
	Rainy Season	452,000	200,000		170,000	252,000		94,000
	Year Round	947,000	0		0	947,000		29,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		1,499,000	**300,000**		**270,000**	**1,199,000**		**123,000**
		1,373,000	200,000		170,000	1,173,000		94,000

Table D.29 Present Agricultural Land Use in 2001, Cuu Long Delta Basin

*: Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a: Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b: Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c: Agriculture in Vietnam - 61 Provinces, 2001
d: The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

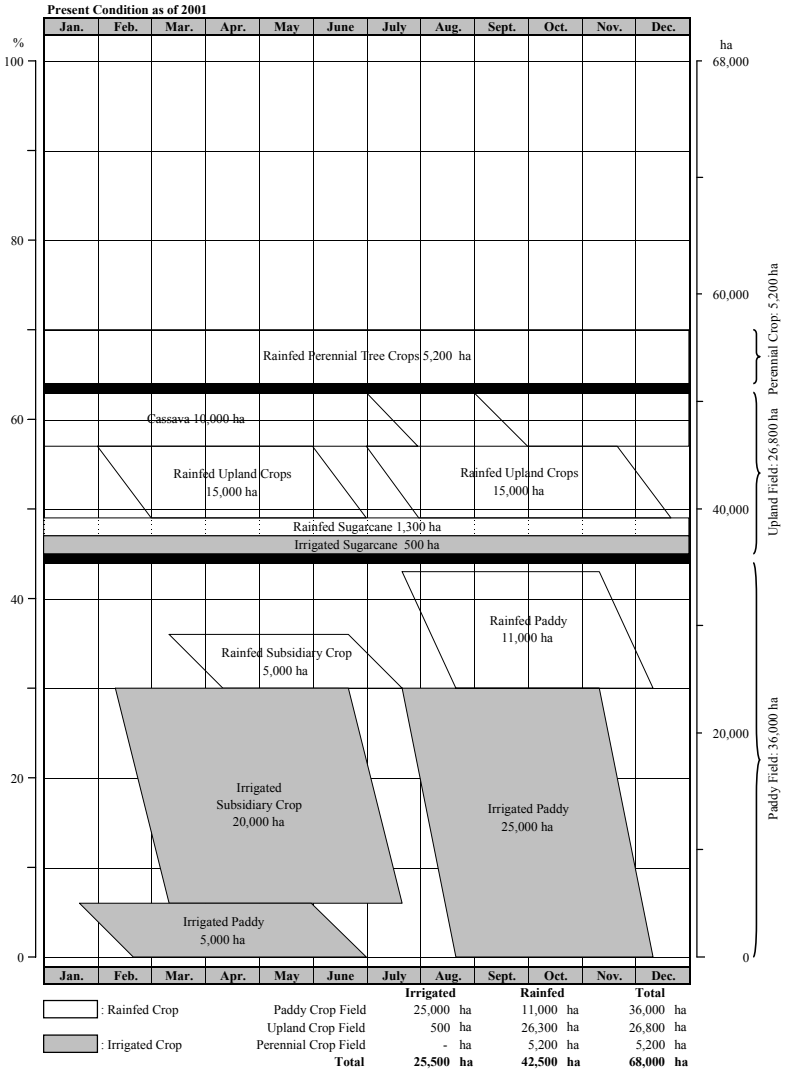
Year 2001		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Annual Crops Area, Cultivated Land	100%	100%	87%			13%		
Ratio of Cultivated Land in River Basin	94%	1,830,000 a	1,600,000 a			230,000		
Provinces in Perennial Crops Area, Cultivated Land	100%	100%	0.6439499			0.3560501		
Ratio of Cultivated Land in River Basin	100%	719,000 a	463,000 a			256,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	96%							
Dong Nai River Basin		**2,439,000**	**1,970,000 c**	**75% ***	**1,478,000**	**469,000**	**2% ***	**9,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	1,412,000	1,412,000 c		1,412,000			
	Paddy (Summer - Autumn)	1,668,000	1,668,000 c		1,378,000			
	Paddy (Rainy Season)	302,000	302,000 c		100,000			
2	Maize (Winter - Spring)	3,000				3,000 c		500
	Maize (Summer - Autumn)	3,000				3,000 c		500
3	Beans (Winter - Spring)	3,000				3,000 c		500
	Beans (Summer - Autumn)	3,000				3,000 c		500
4	Sweet Potato (Winter - Spring)	4,000				4,000 b		500
	Sweet Potato (Summer - Autumn)	4,000				4,000 b		500
5	(Winter - Spring)	0				0 c		0
	(Rainy Season)	0				0 c		0
6	(Winter - Spring)	0				0 c		0
	(Rainy Season)	0				0 c		0
5	Cassava	10,000				10,000 b		0
6	Sugar Cane	65,000				65,000 c		500
7	Other Annual (Tomato, etc.) (Winter - Spring)	33,000				33,000 c		7,000
	Other Annual (Tomato, etc.) (Summer - Autumn)	33,000				33,000 c		7,000
8	Fruits	188,000				188,000 c		0
9	Cashew	8,000				8,000 c		0
10	Coconut	71,000				71,000 c		0
11	Other Perenial Crops (Pineapple, etc.)	84,000				84,000 c		0
	Total Planted Area (ha)	**3,894,000**	**3,382,000**		**2,890,000**	**512,000 b**		**17,500**
	Winter - Spring	1,455,000	1,412,000		1,412,000	43,000		8,500
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	1,668,000	1,668,000		1,378,000	0		0
	Rainy Season	345,000	302,000		100,000	43,000		8,500
	Year Round	426,000	0		0	426,000		500
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		2,439,000	**1,970,000**		**1,478,000**	**469,000**		**9,000**

Table D.30 Target Agricultural Land Use Plan for 2020, Cuu Long Delta Basin

* Vietnam Water Resources Sector Review, Main Report, May 1996, IWRP WB, ADB, FAO, UNDP, NGOs
a Statistical Data of Vietnam - Agriculture, Forestry and Fishery, 1975 - 2000
b Socio-economic Statisical Data of 61 Provinces and Cities in Vietnam, 2001, GSO
c Agriculture in Vietnam - 61 Provinces, 2001
d The Sector Review Study for The Water Resources Development, August 1992, Nippon Koei

Year 2020		Cultivated Land	Paddy Field (ha)			Other Crops Field (ha)		
		(ha)	Area	Irrigated Ratio	Irrigated Area	Area	Irrigated Ratio	Irrigated Area
Provinces in Annual Crops Area, Cultivated Land	100%	100%	81%			19%		
Ratio of Cultivated Land in River Basin	94%	1,968,000 a	1,600,000 a			368,000		
Provinces in Perennial Crops Area, Cultivated Land	100%	100%	463000			-462999		
Ratio of Cultivated Land in River Basin	100%	736,000 a	463,000 a			273,000		
Ratio of Cultivated Land (Ref. Land Use Map)**	96%							
Dong Nai River Basin		**2,586,000**	**1,970,000 c**	**95% ***	**1,872,000**	**616,000**	**60% ***	**370,000**
No.	**Crop**	**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**	**Planted Area(ha)**		**Planted Area(ha)**
1	Paddy (Winter - Spring)	1,865,000	1,865,000 c		1,865,000			
	Paddy (Summer - Autumn)	1,896,000	1,896,000 c		1,798,000			
	Paddy (Rainy Season)	74,000	74,000 c		74,000			
2	Maize (Winter - Spring)	30,000				30,000 c		24,000
	Maize (Summer - Autumn)	30,000				30,000 c		24,000
3	Beans (Winter - Spring)	16,000				16,000 c		13,000
	Beans (Summer - Autumn)	16,000				16,000 c		13,000
4	Sweet Potato (Winter - Spring)	4,000				4,000 b		3,000
	Sweet Potato (Summer - Autumn)	4,000				4,000 b		3,000
5	(Winter - Spring)	0				0 c		0
	(Rainy Season)	0				0 c		0
6	(Winter - Spring)	0				0 c		0
	(Rainy Season)	0				0 c		0
5	Cassava	10,000				10,000 b		0
6	Sugar Cane	80,000				80,000 c		65,000
7	Other Annual (Tomato, etc.) (Winter - Spring)	44,000				44,000 c		40,000
	Other Annual (Tomato, etc.) (Summer - Autumn)	44,000				44,000 c		40,000
8	Fruits	219,000				219,000 c		153,000
9	Cashew	24,000				24,000 c		0
10	Coconut	79,000				79,000 c		0
11	Other Perenial Crops (Pineapple, etc.)	110,000				110,000 c		72,000
	Total Planted Area (ha)	**4,545,000**	**3,835,000**		**3,737,000**	**710,000 b**		**450,000**
	Winter - Spring	1,959,000	1,865,000		1,865,000	94,000		80,000
	Spring - Summer	0	0		0	0		0
	Summer -Autumn	1,896,000	1,896,000		1,798,000	0		0
	Rainy Season	168,000	74,000		74,000	94,000		80,000
	Year Round	522,000	0		0	522,000		290,000
		Field Area (ha)	**Field Area (ha)**		**Field Area (ha)**	**Field Area (ha)**		**Field Area (ha)**
		2,586,000	**1,970,000**		**1,872,000**	**616,000**		**370,000**

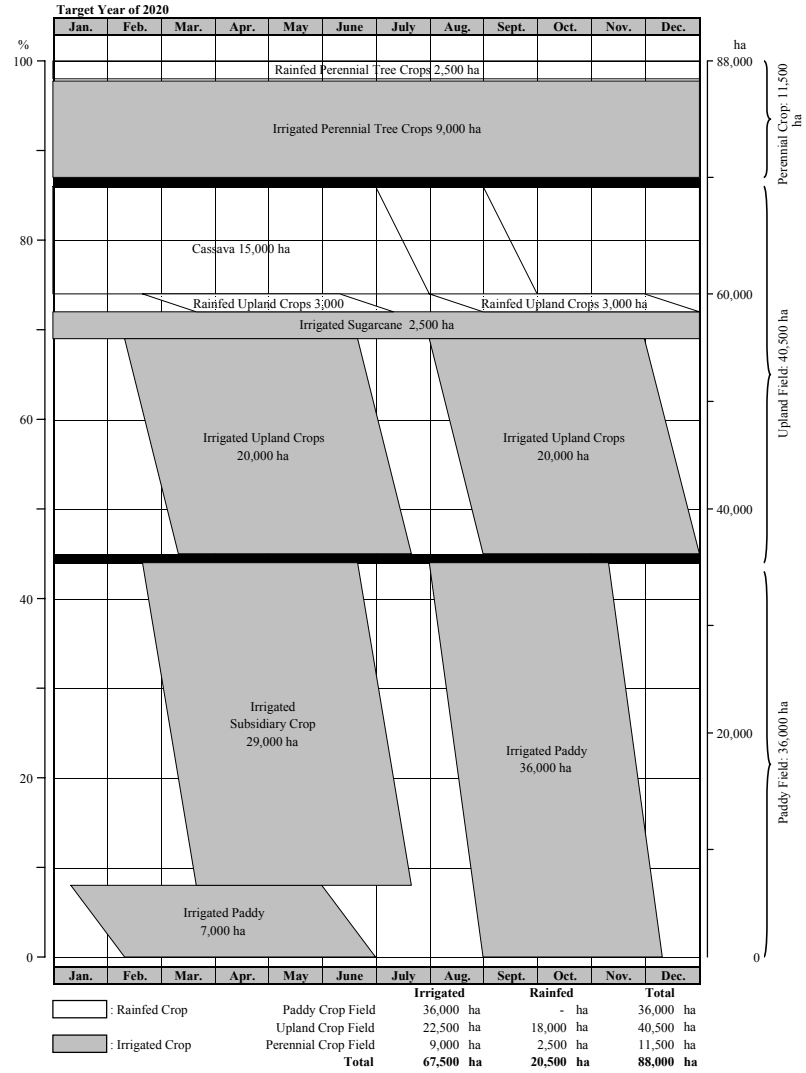
Figure D.1 Present Cropping Pattern of Bang Giang and Ky Cung Rivers Basins



: Rainfed Crop
: Irrigated Crop

	Irrigated	Rainfed	Total
Paddy Crop Field	25,000 ha	11,000 ha	36,000 ha
Upland Crop Field	500 ha	26,300 ha	26,800 ha
Perennial Crop Field	- ha	5,200 ha	5,200 ha
Total	**25,500 ha**	**42,500 ha**	**68,000 ha**

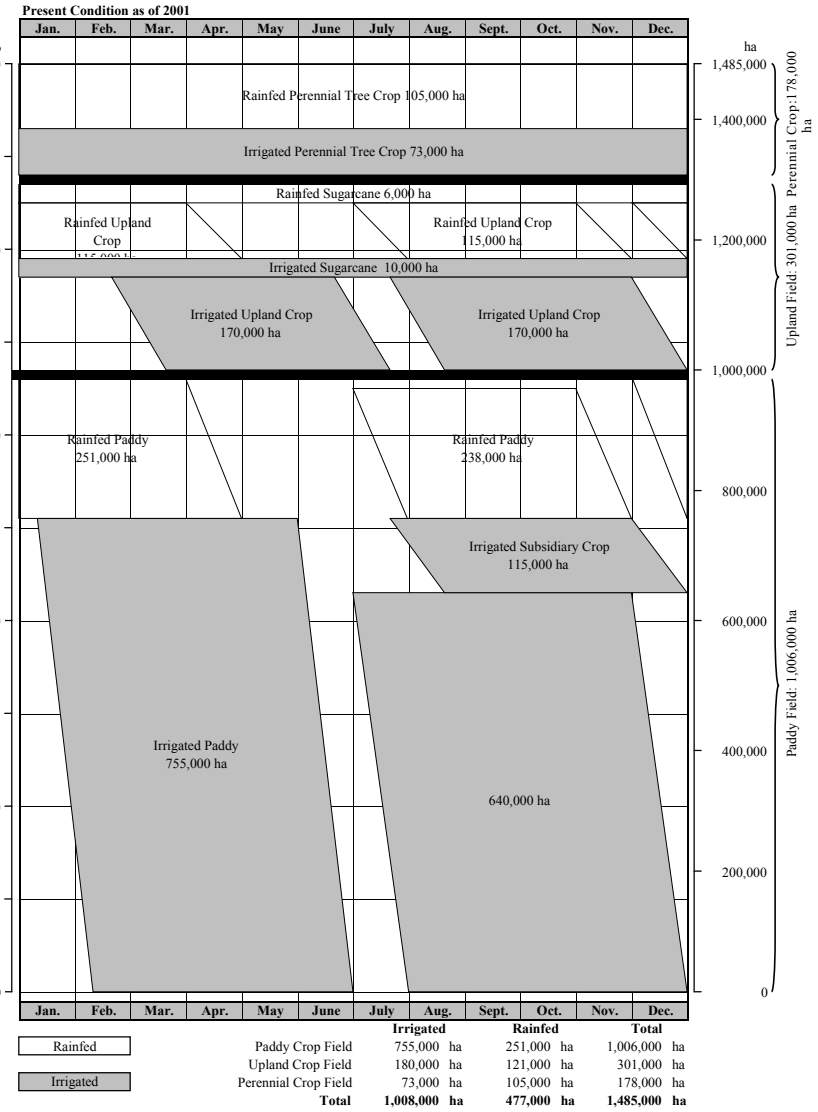
Figure D.2 Target Cropping Pattern of Bang Giang and Ky Cung Rivers Basins



: Rainfed Crop
: Irrigated Crop

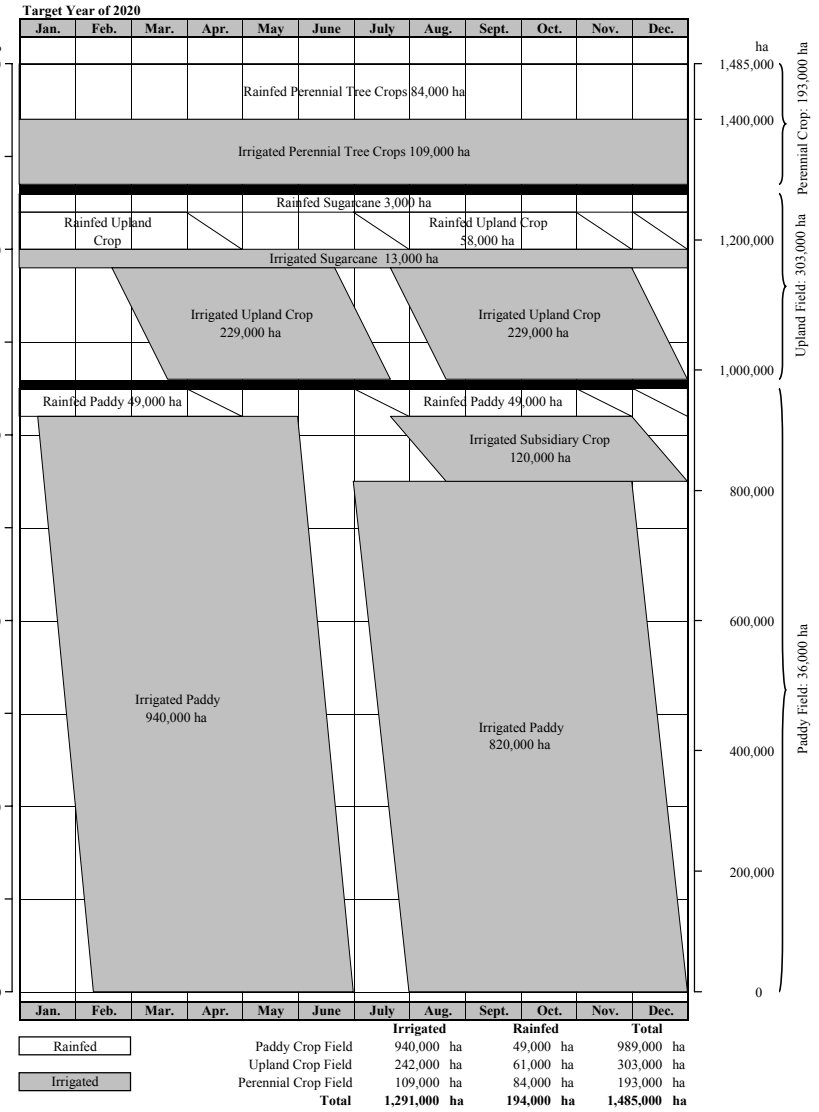
	Irrigated	Rainfed	Total
Paddy Crop Field	36,000 ha	- ha	36,000 ha
Upland Crop Field	22,500 ha	18,000 ha	40,500 ha
Perennial Crop Field	9,000 ha	2,500 ha	11,500 ha
Total	**67,500 ha**	**20,500 ha**	**88,000 ha**

Figure D.3 Present Cropping Pattern of Red River Basin



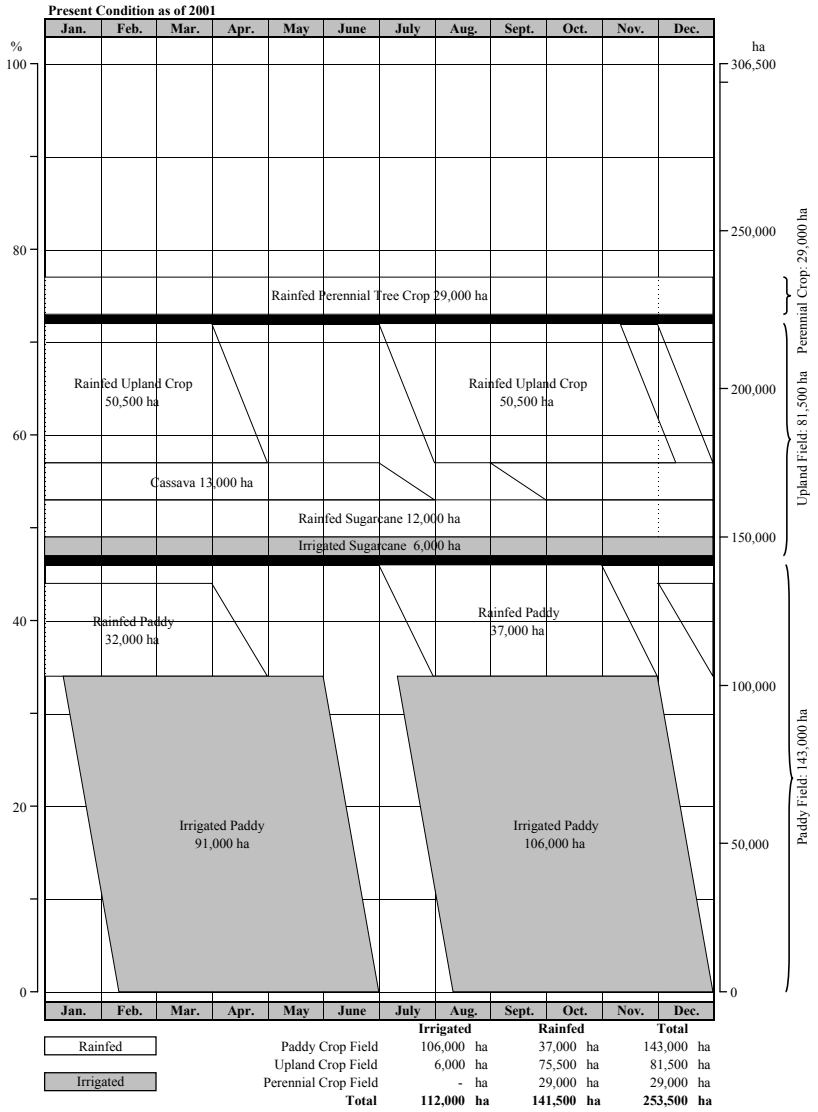
		Irrigated		Rainfed		Total	
	Paddy Crop Field	755,000	ha	251,000	ha	1,006,000	ha
	Upland Crop Field	180,000	ha	121,000	ha	301,000	ha
	Perennial Crop Field	73,000	ha	105,000	ha	178,000	ha
	Total	**1,008,000**	**ha**	**477,000**	**ha**	**1,485,000**	**ha**

Figure D.4 Target Cropping Pattern of Red River Basin



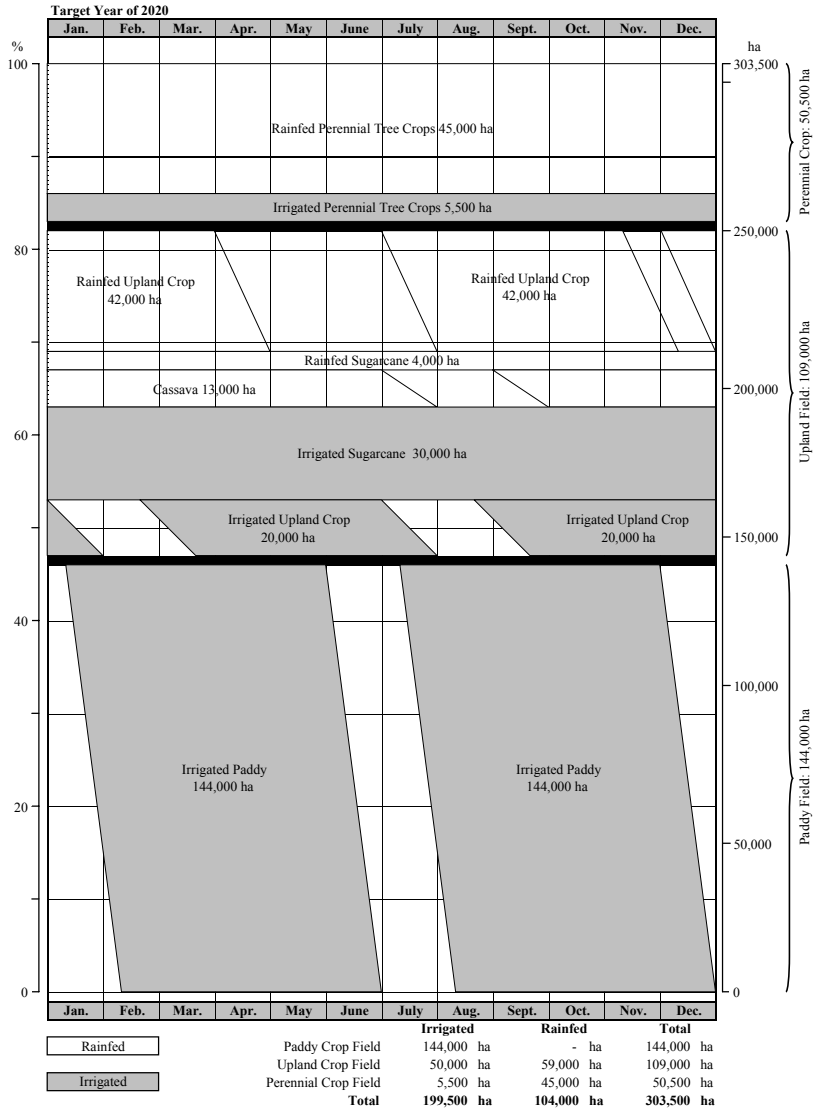
		Irrigated		Rainfed		Total	
	Paddy Crop Field	940,000	ha	49,000	ha	989,000	ha
	Upland Crop Field	242,000	ha	61,000	ha	303,000	ha
	Perennial Crop Field	109,000	ha	84,000	ha	193,000	ha
	Total	**1,291,000**	**ha**	**194,000**	**ha**	**1,485,000**	**ha**

Figure D.5 Present Cropping Pattern of Ma River Basin



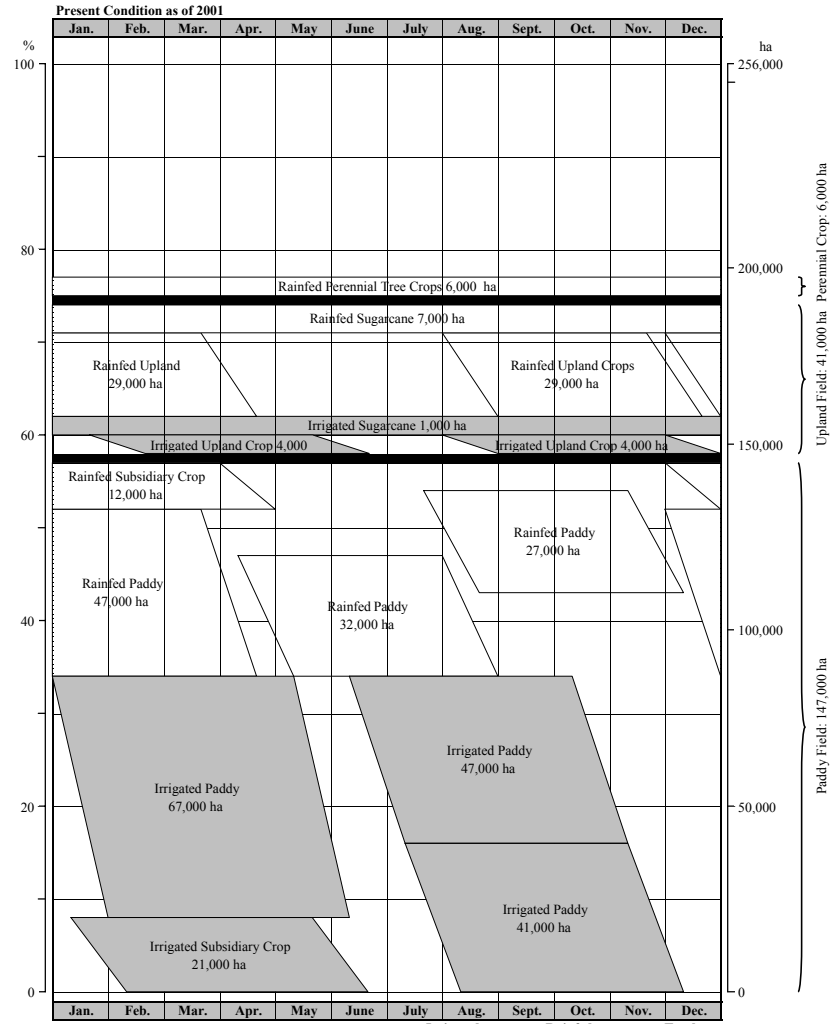
		Irrigated	Rainfed	Total
Rainfed	Paddy Crop Field	106,000 ha	37,000 ha	143,000 ha
	Upland Crop Field	6,000 ha	75,500 ha	81,500 ha
Irrigated	Perennial Crop Field	- ha	29,000 ha	29,000 ha
	Total	**112,000 ha**	**141,500 ha**	**253,500 ha**

Figure D.6 Target Cropping Pattern of Ma River Basin



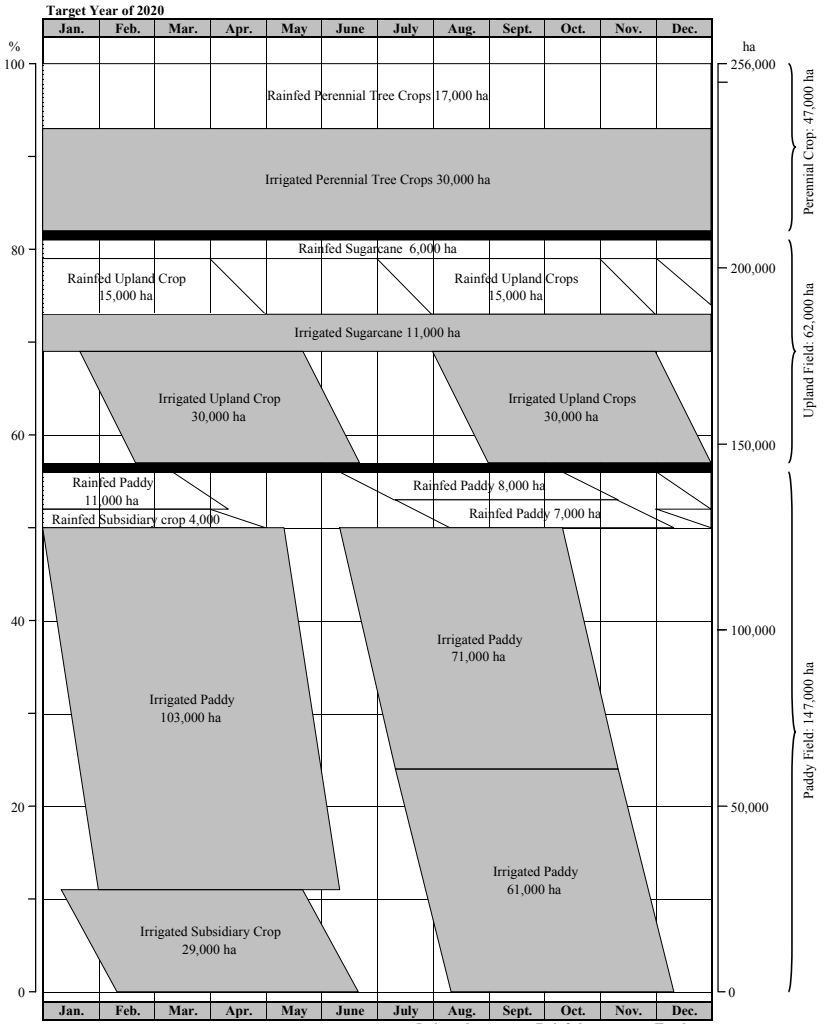
		Irrigated	Rainfed	Total
Rainfed	Paddy Crop Field	144,000 ha	- ha	144,000 ha
	Upland Crop Field	50,000 ha	59,000 ha	109,000 ha
Irrigated	Perennial Crop Field	5,500 ha	45,000 ha	50,500 ha
	Total	**199,500 ha**	**104,000 ha**	**303,500 ha**

Figure D.7 Present Cropping Pattern of Ca River Basins



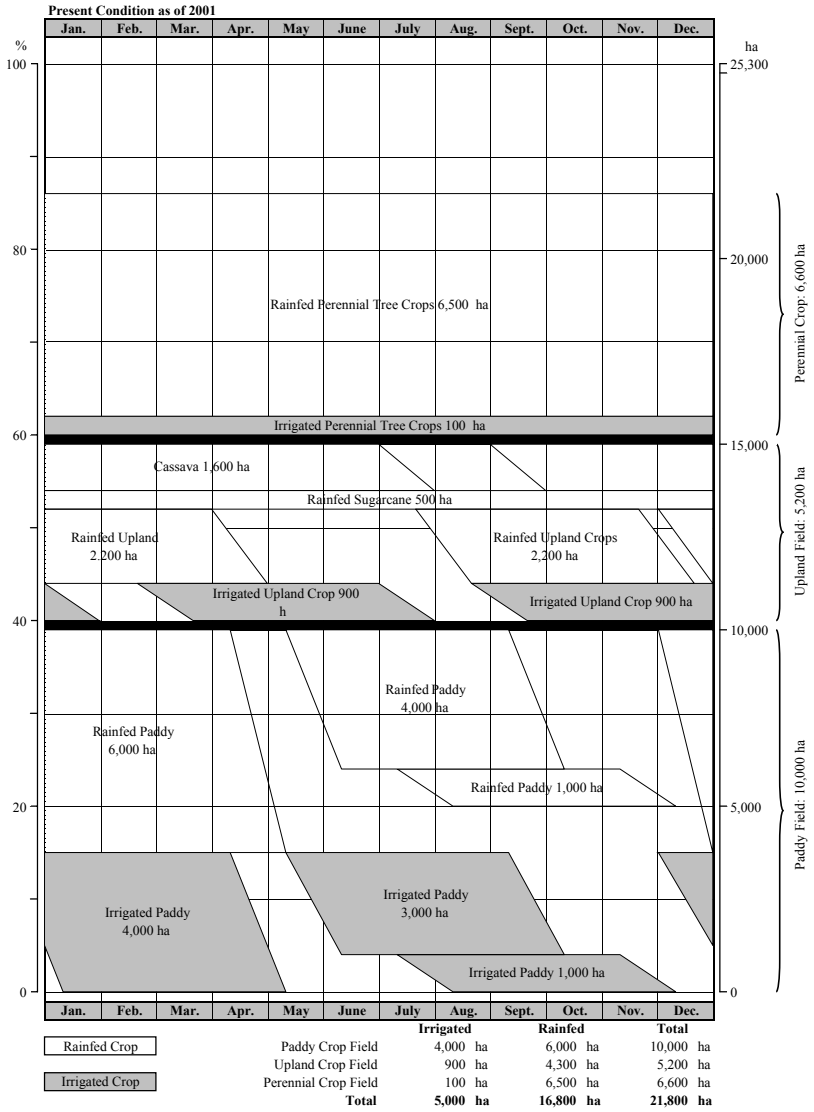
		Irrigated	Rainfed	Total
Paddy Crop Field		88,000 ha	59,000 ha	147,000 ha
Upland Crop Field		5,000 ha	36,000 ha	41,000 ha
Perennial Crop Field		- ha	6,000 ha	6,000 ha
Total		**93,000 ha**	**101,000 ha**	**194,000 ha**

Figure D.8 Target Cropping Pattern of Ca River Basins



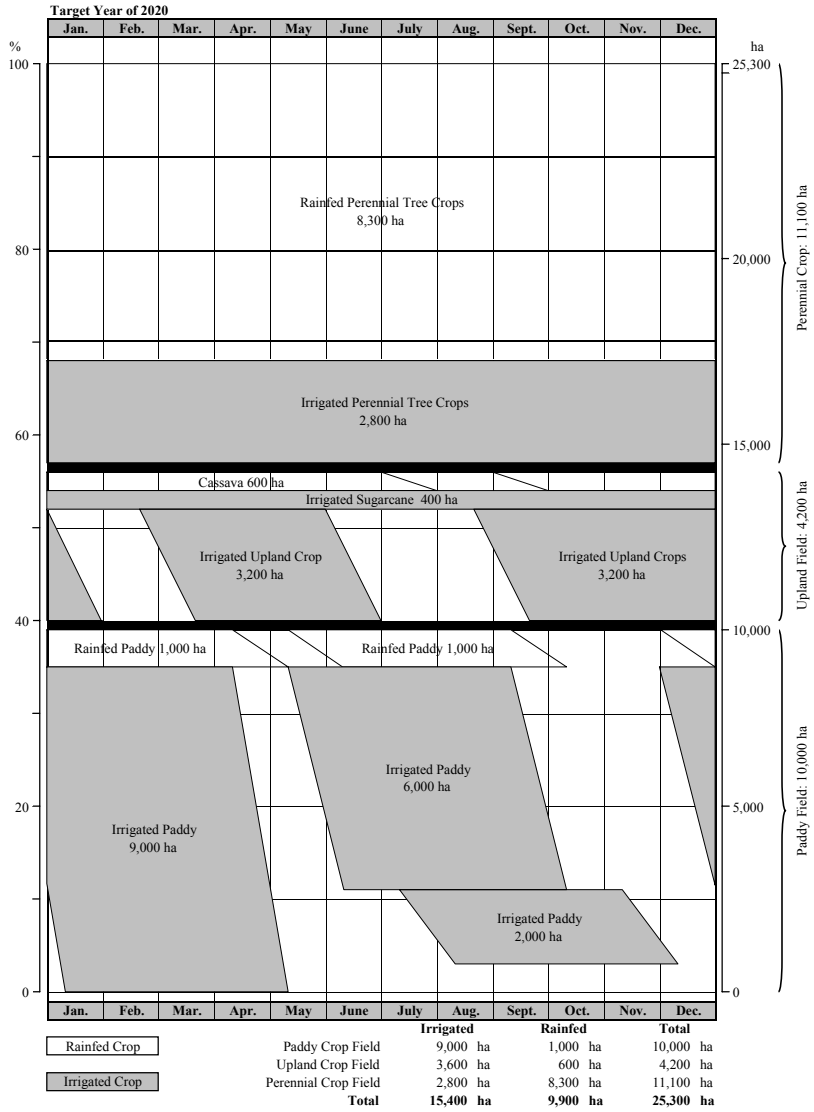
		Irrigated	Rainfed	Total
Paddy Crop Field		132,000 ha	15,000 ha	147,000 ha
Upland Crop Field		41,000 ha	20,000 ha	61,000 ha
Perennial Crop Field		30,000 ha	17,000 ha	47,000 ha
Total		**203,000 ha**	**52,000 ha**	**255,000 ha**

Figure D.9 Present Cropping Pattern of Thach Han River Basins



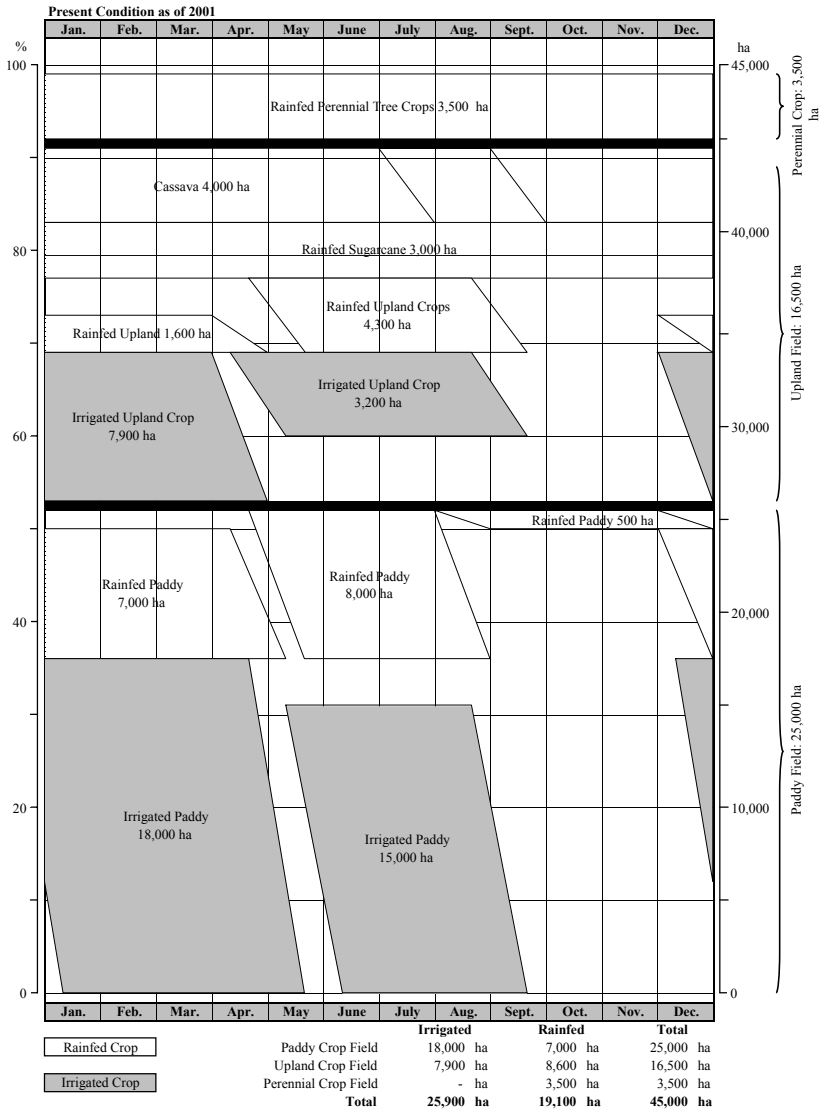
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	4,000 ha	6,000 ha	10,000 ha
	Upland Crop Field	900 ha	4,300 ha	5,200 ha
Irrigated Crop	Perennial Crop Field	100 ha	6,500 ha	6,600 ha
	Total	**5,000 ha**	**16,800 ha**	**21,800 ha**

Figure D.10 Target Cropping Pattern of Thach Han River Basins



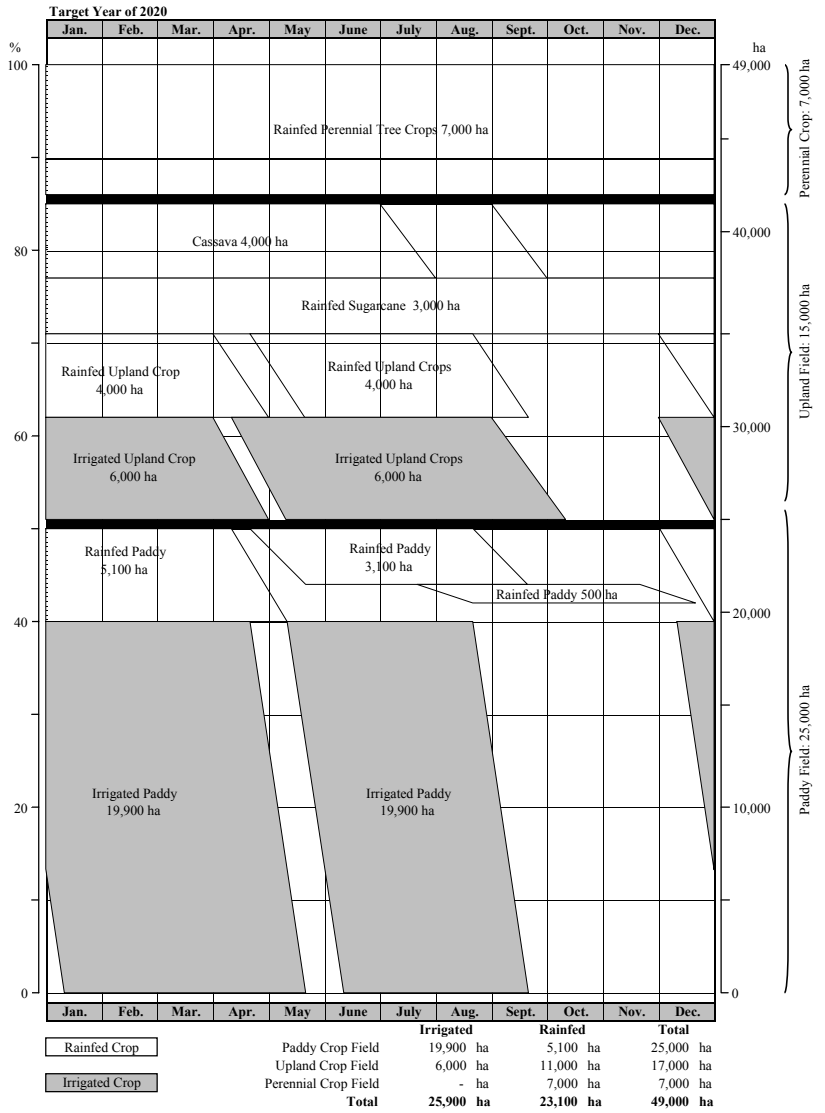
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	9,000 ha	1,000 ha	10,000 ha
	Upland Crop Field	3,600 ha	600 ha	4,200 ha
Irrigated Crop	Perennial Crop Field	2,800 ha	8,300 ha	11,100 ha
	Total	**15,400 ha**	**9,900 ha**	**25,300 ha**

Figure D.11 Present Cropping Pattern of Huong River Basins



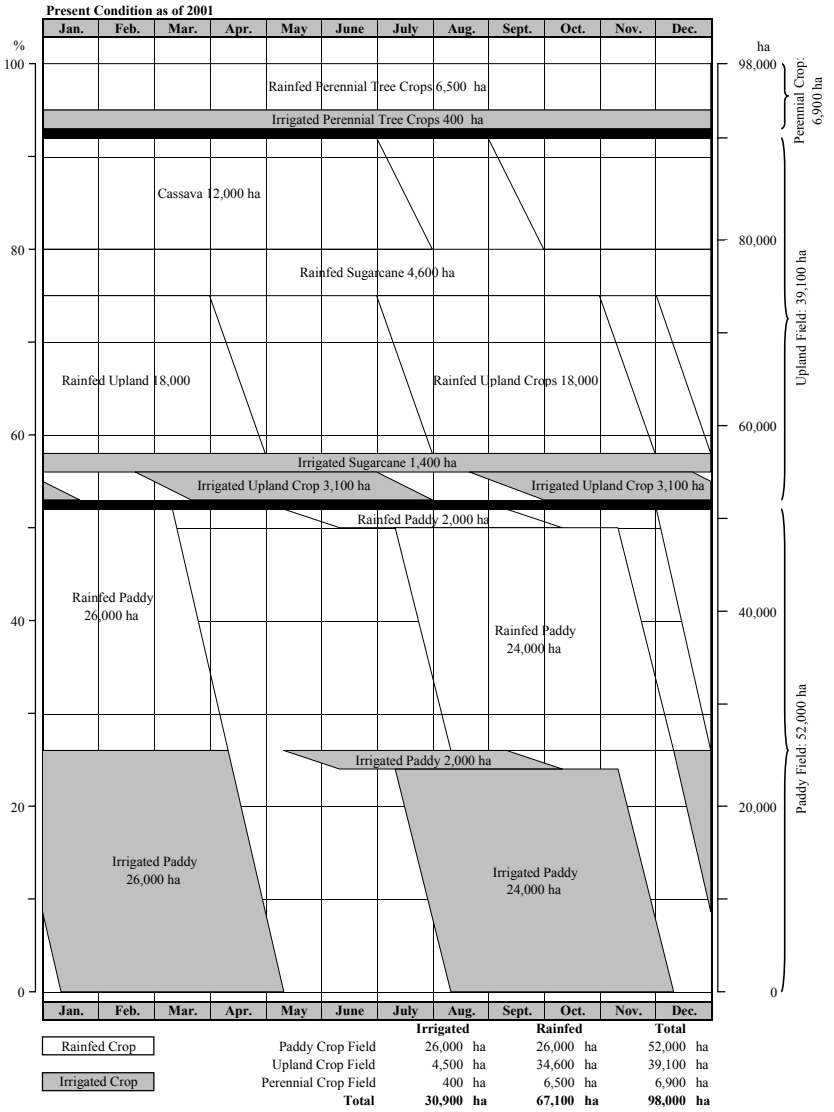
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	18,000 ha	7,000 ha	25,000 ha
Irrigated Crop	Upland Crop Field	7,900 ha	8,600 ha	16,500 ha
	Perennial Crop Field	- ha	3,500 ha	3,500 ha
	Total	**25,900 ha**	**19,100 ha**	**45,000 ha**

Figure D.12 Target Cropping Pattern of Huong River Basins



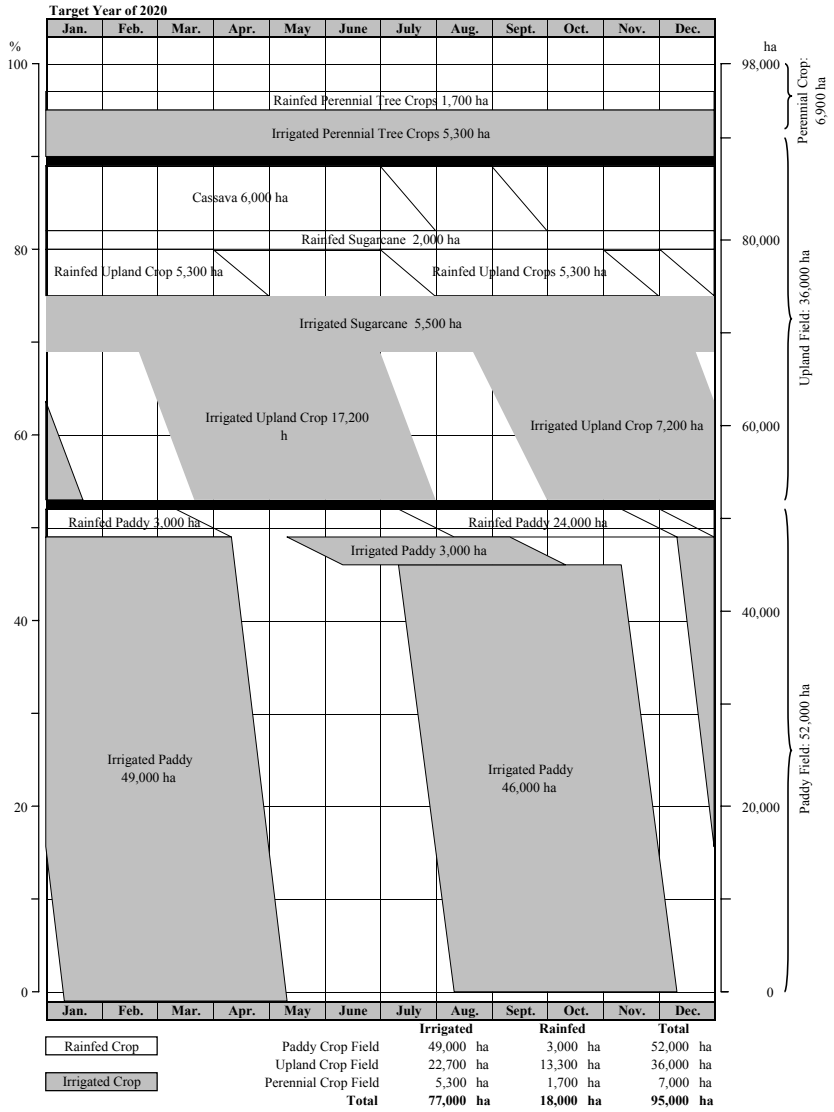
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	19,900 ha	5,100 ha	25,000 ha
Irrigated Crop	Upland Crop Field	6,000 ha	11,000 ha	17,000 ha
	Perennial Crop Field	- ha	7,000 ha	7,000 ha
	Total	**25,900 ha**	**23,100 ha**	**49,000 ha**

Figure D.13 Present Cropping Pattern of Vu Gia Thu Bon River Basins



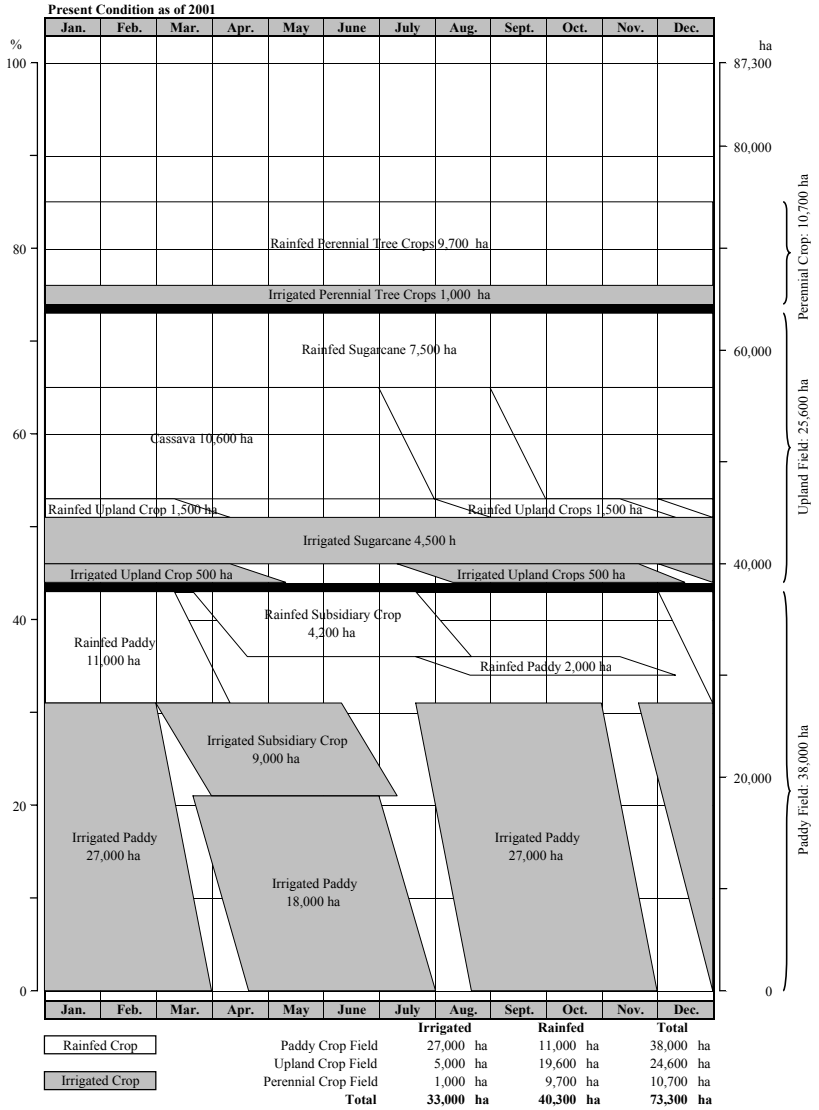
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	26,000 ha	26,000 ha	52,000 ha
	Upland Crop Field	4,500 ha	34,600 ha	39,100 ha
Irrigated Crop	Perennial Crop Field	400 ha	6,500 ha	6,900 ha
	Total	**30,900 ha**	**67,100 ha**	**98,000 ha**

Figure D.14 Target Cropping Pattern of Vu Gia Thu Bon River Basins



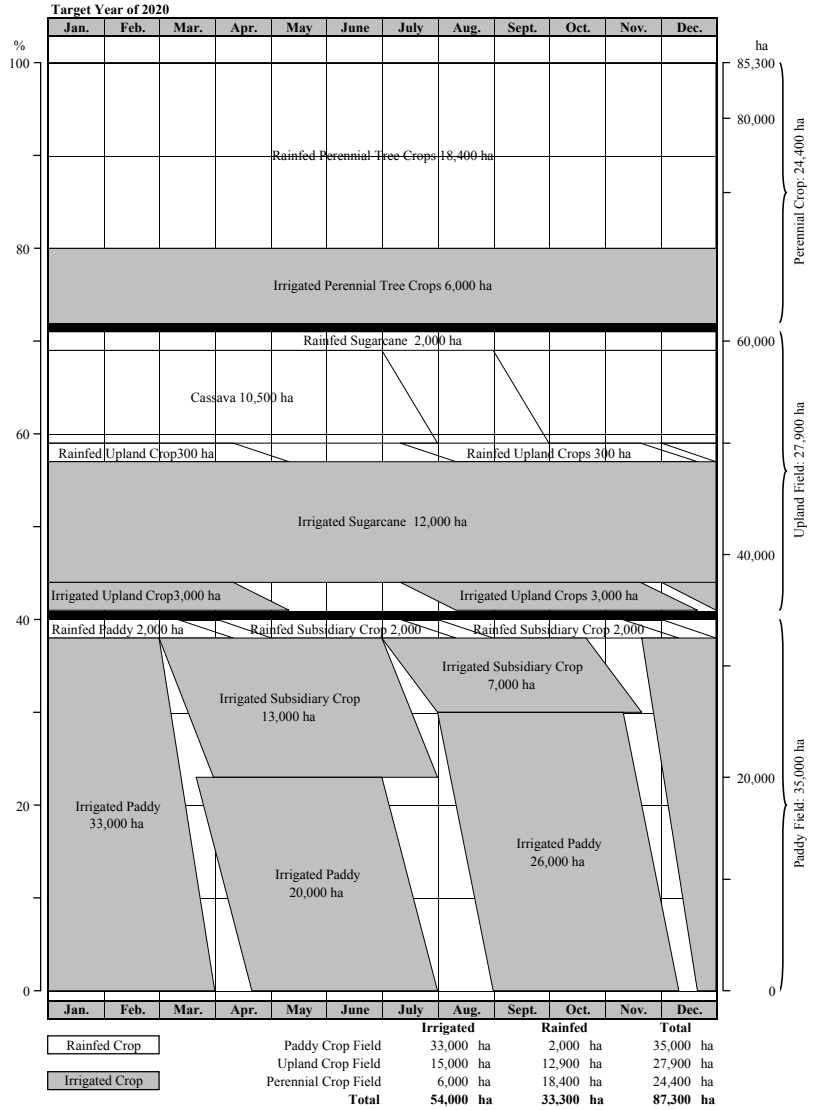
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	49,000 ha	3,000 ha	52,000 ha
	Upland Crop Field	22,700 ha	13,300 ha	36,000 ha
Irrigated Crop	Perennial Crop Field	5,300 ha	1,700 ha	7,000 ha
	Total	**77,000 ha**	**18,000 ha**	**95,000 ha**

Figure D.15 Present Cropping Pattern of Tra Khuc River Basin



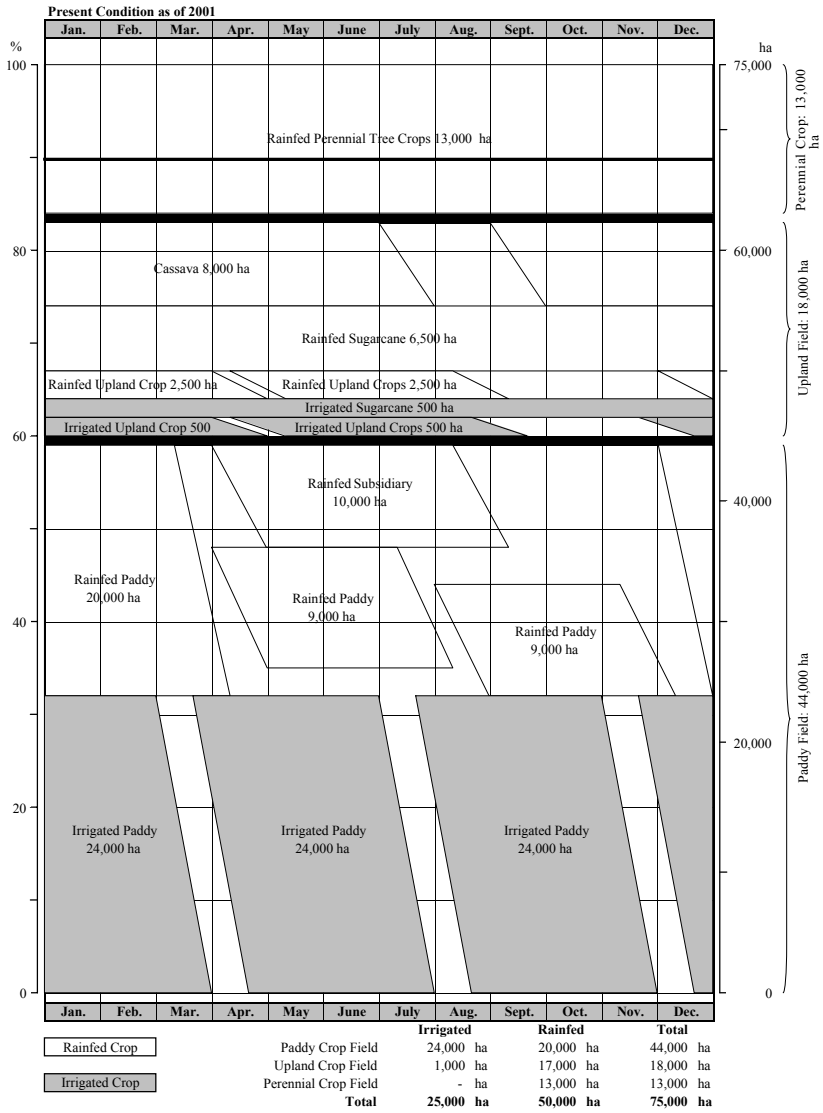
		Irrigated	Rainfed	Total
Paddy Crop Field	27,000 ha	11,000 ha	38,000 ha
Upland Crop Field	5,000 ha	19,600 ha	24,600 ha
Perennial Crop Field	1,000 ha	9,700 ha	10,700 ha
Total	**33,000 ha**	**40,300 ha**	**73,300 ha**

Figure D.16 Target Cropping Pattern of Tra Khuc River Basin



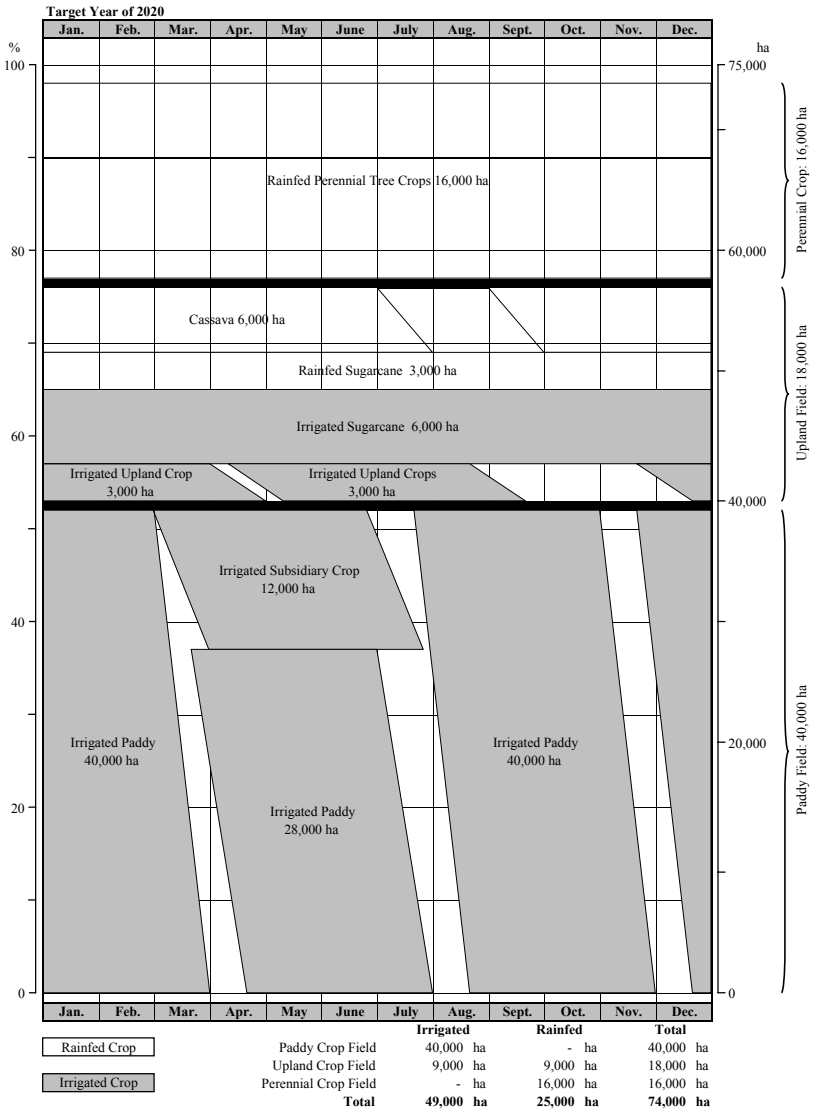
		Irrigated	Rainfed	Total
Paddy Crop Field	33,000 ha	2,000 ha	35,000 ha
Upland Crop Field	15,000 ha	12,900 ha	27,900 ha
Perennial Crop Field	6,000 ha	18,400 ha	24,400 ha
Total	**54,000 ha**	**33,300 ha**	**87,300 ha**

Figure D.17 Present Cropping Pattern of Kone River Basin



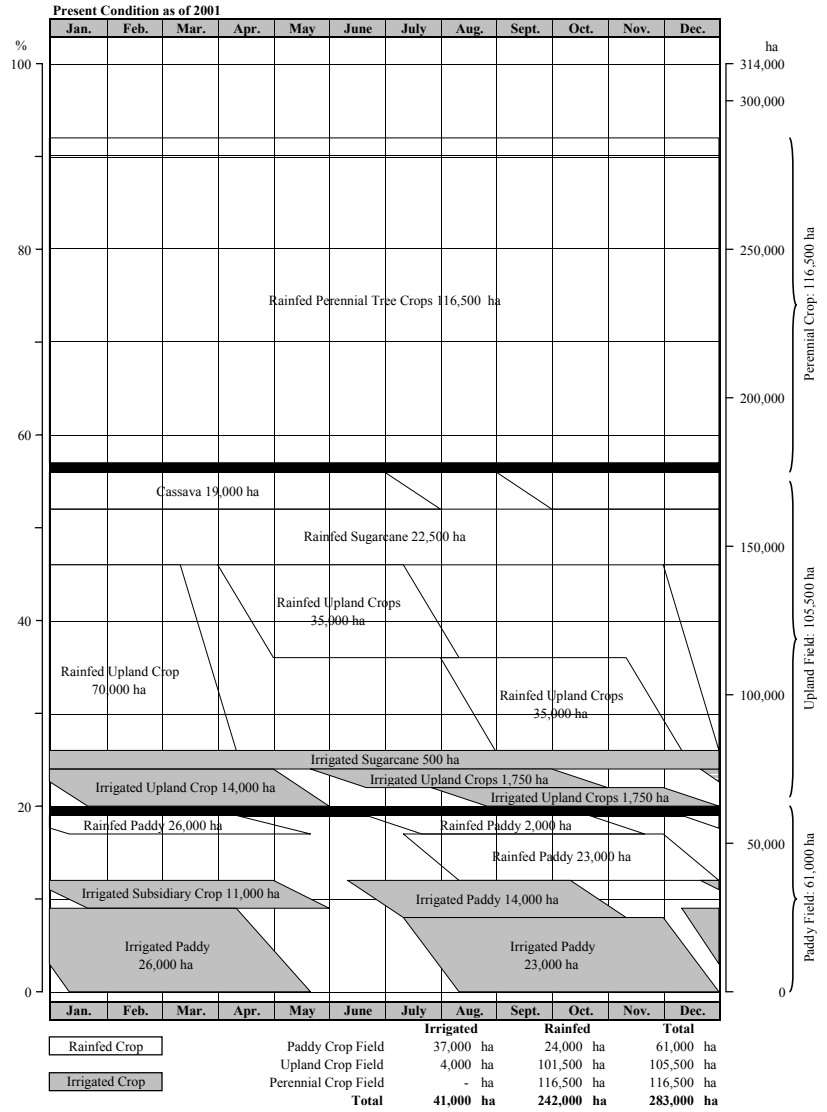
		Irrigated	Rainfed	Total
Paddy Crop Field		24,000 ha	20,000 ha	44,000 ha
Upland Crop Field		1,000 ha	17,000 ha	18,000 ha
Perennial Crop Field		- ha	13,000 ha	13,000 ha
Total		**25,000 ha**	**50,000 ha**	**75,000 ha**

Figure D.18 Target Cropping Pattern of Kone River Basin



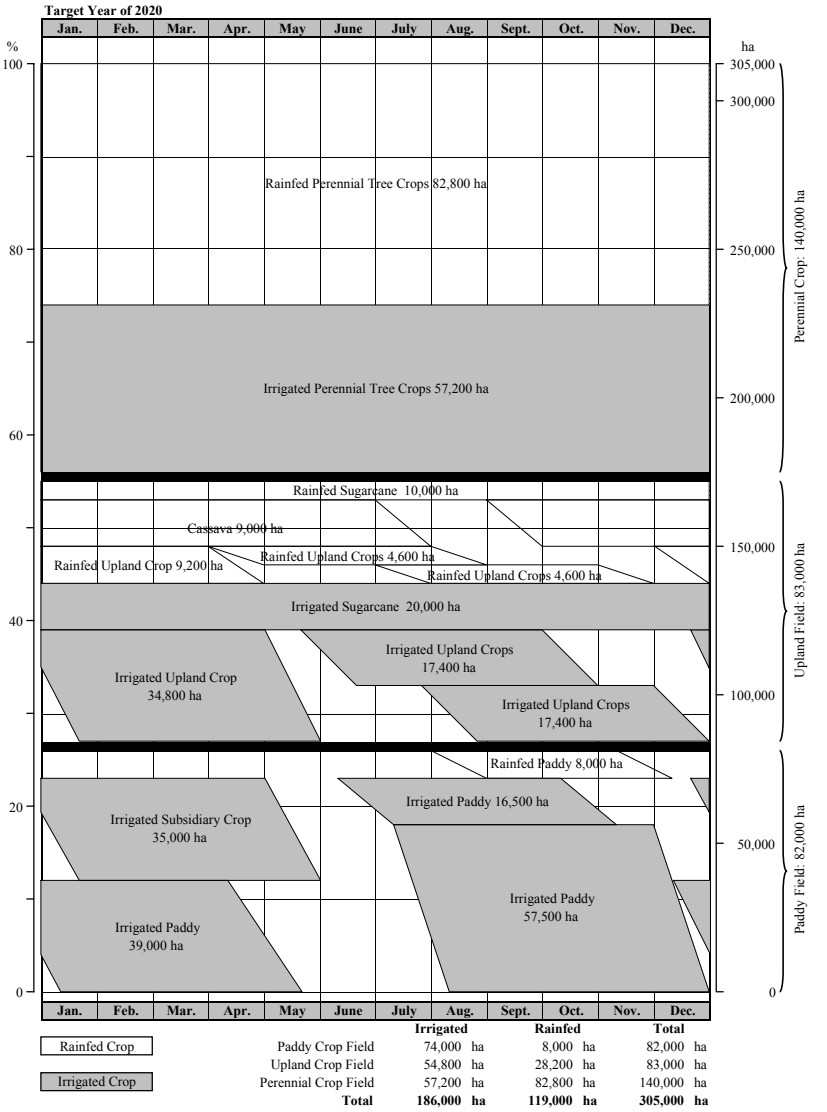
		Irrigated	Rainfed	Total
Paddy Crop Field		40,000 ha	- ha	40,000 ha
Upland Crop Field		9,000 ha	9,000 ha	18,000 ha
Perennial Crop Field		- ha	16,000 ha	16,000 ha
Total		**49,000 ha**	**25,000 ha**	**74,000 ha**

Figure D.19 Present Cropping Pattern of Ba River Basin



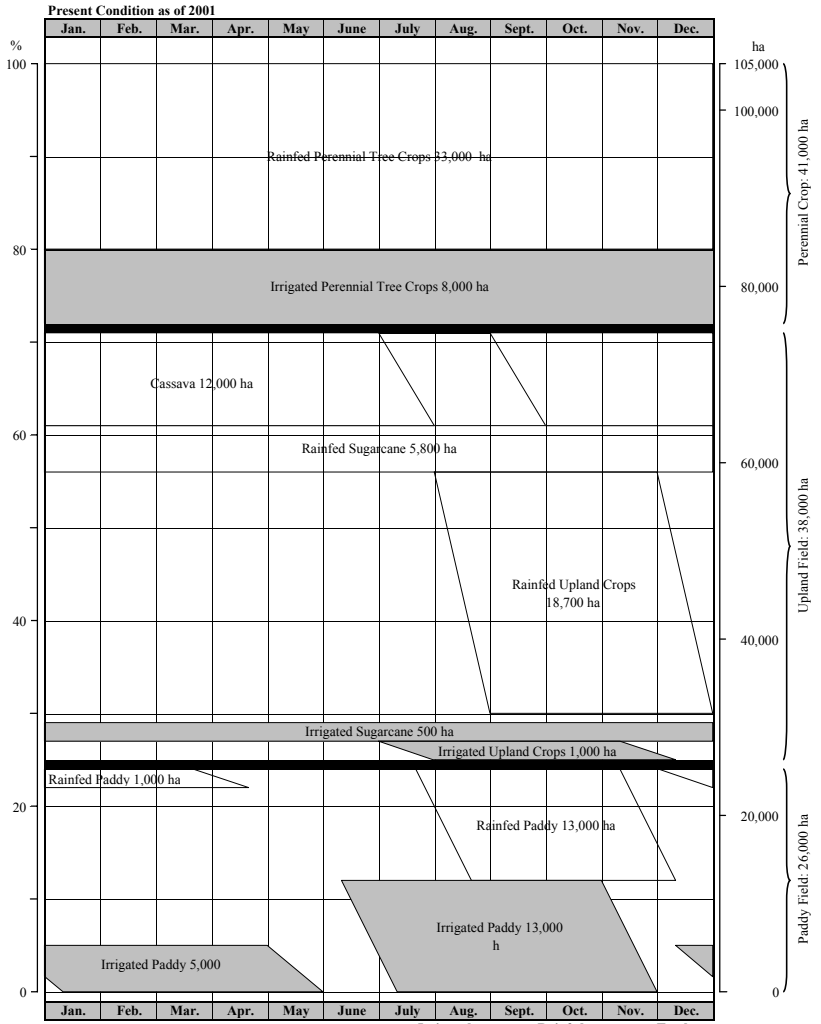
		Irrigated	Rainfed	Total
Paddy Crop Field		37,000 ha	24,000 ha	61,000 ha
Upland Crop Field		4,000 ha	101,500 ha	105,500 ha
Perennial Crop Field		- ha	116,500 ha	116,500 ha
	Total	**41,000 ha**	**242,000 ha**	**283,000 ha**

Figure D.20 Future Cropping Pattern of Ba River Basin



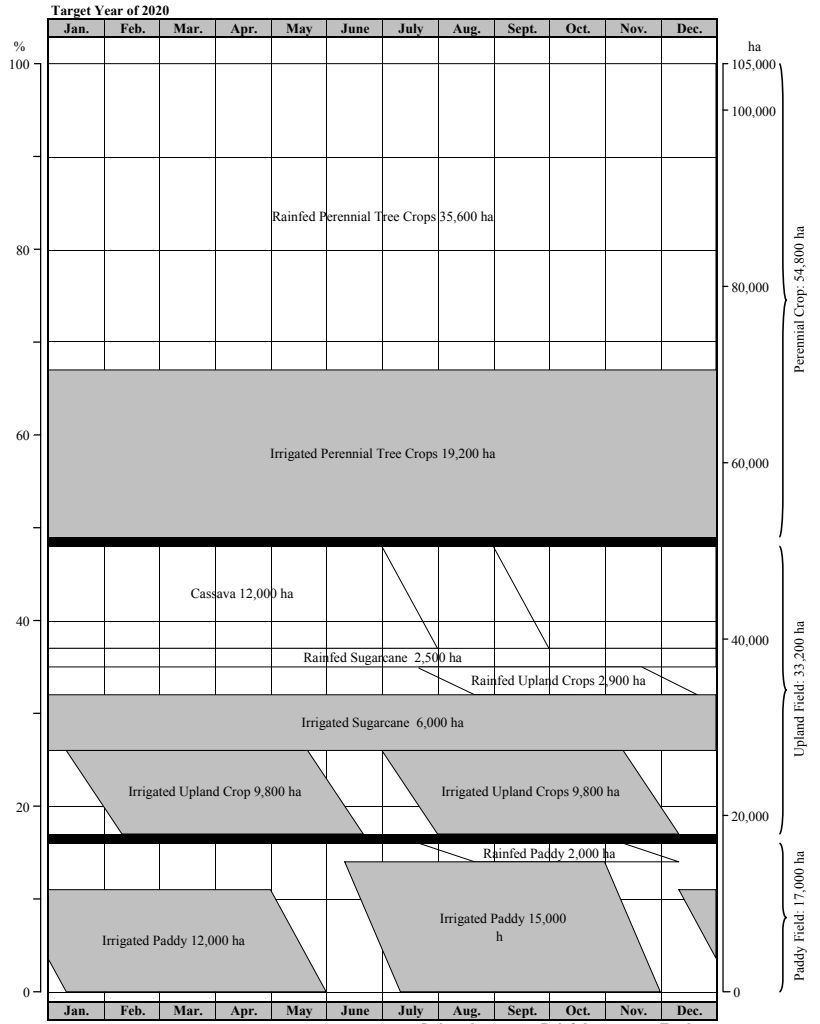
		Irrigated	Rainfed	Total
Paddy Crop Field		74,000 ha	8,000 ha	82,000 ha
Upland Crop Field		54,800 ha	28,200 ha	83,000 ha
Perennial Crop Field		57,200 ha	82,800 ha	140,000 ha
	Total	**186,000 ha**	**119,000 ha**	**305,000 ha**

Figure D.21 Present Cropping Pattern of Sesan River Basin



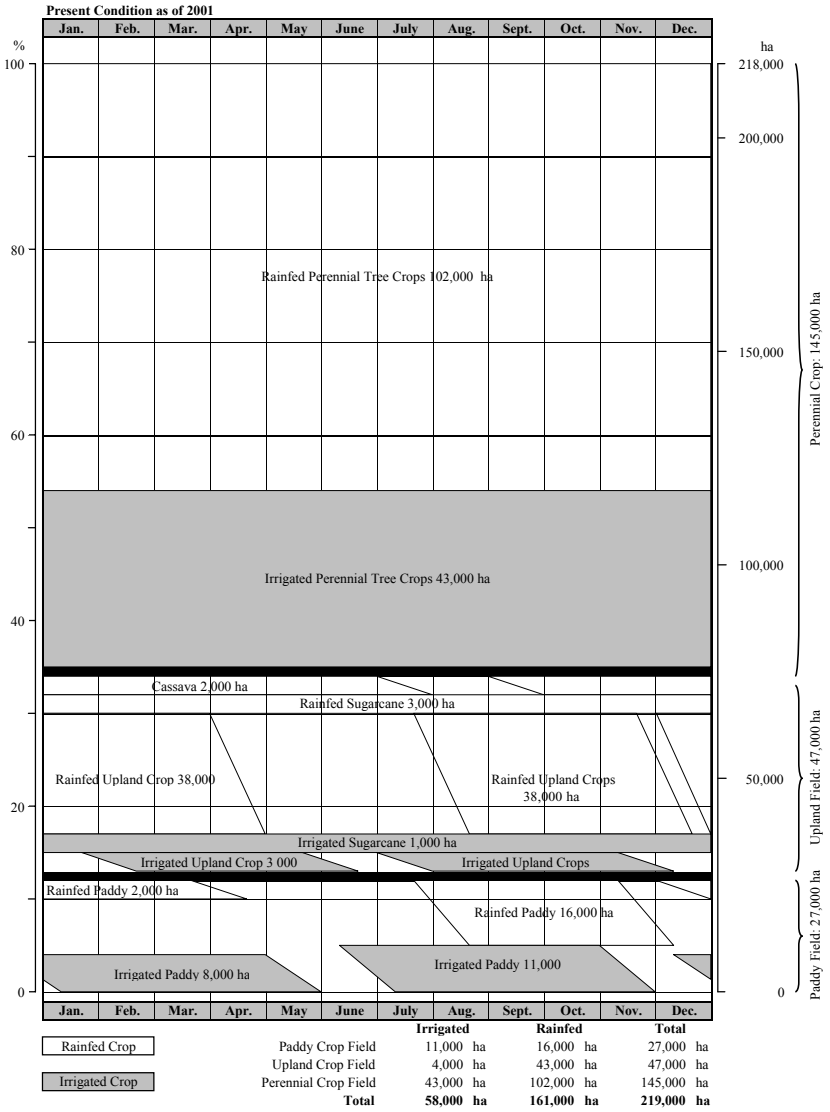
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	13,000 ha	13,000 ha	26,000 ha
	Upland Crop Field	1,500 ha	36,500 ha	38,000 ha
Irrigated Crop	Perennial Crop Field	8,000 ha	33,000 ha	41,000 ha
	Total	**22,500 ha**	**82,500 ha**	**105,000 ha**

Figure D.22 Target Cropping Pattern of Sesan Basin



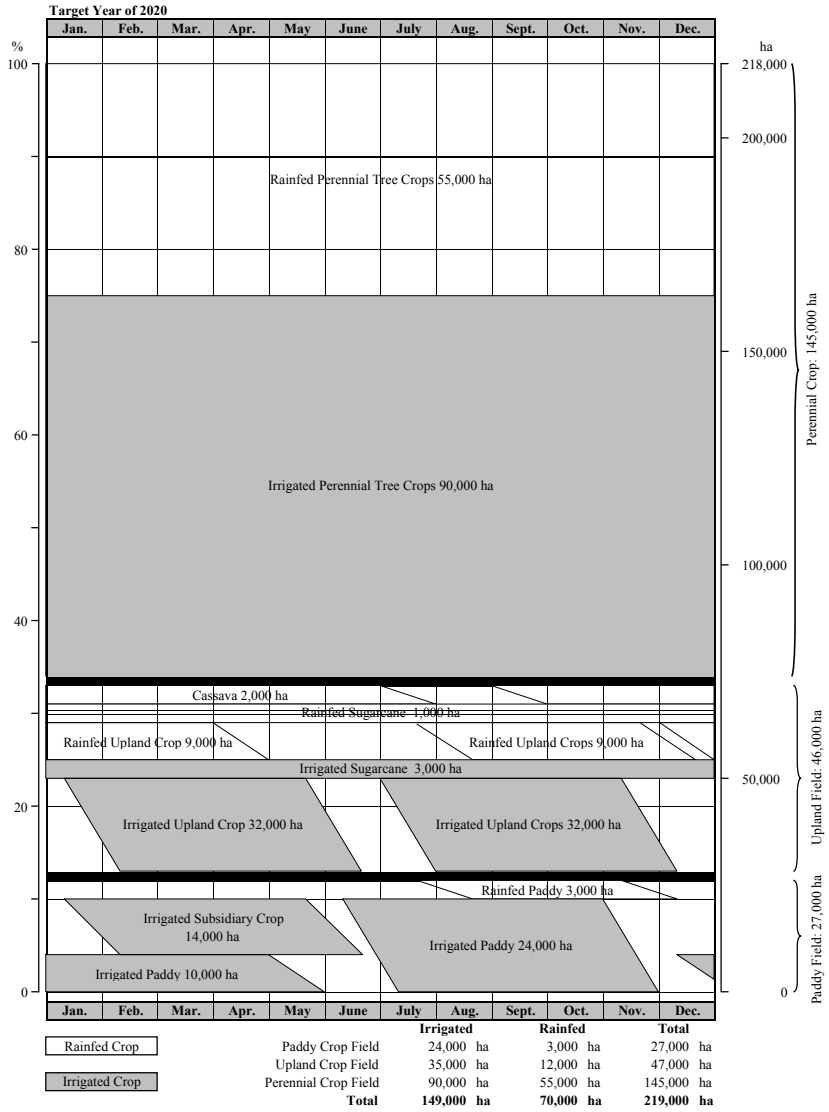
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	15,000 ha	2,000 ha	17,000 ha
	Upland Crop Field	15,800 ha	17,400 ha	33,200 ha
Irrigated Crop	Perennial Crop Field	19,200 ha	35,600 ha	54,800 ha
	Total	**50,000 ha**	**55,000 ha**	**105,000 ha**

Figure D.23 Present Cropping Pattern of Srepok River Basin



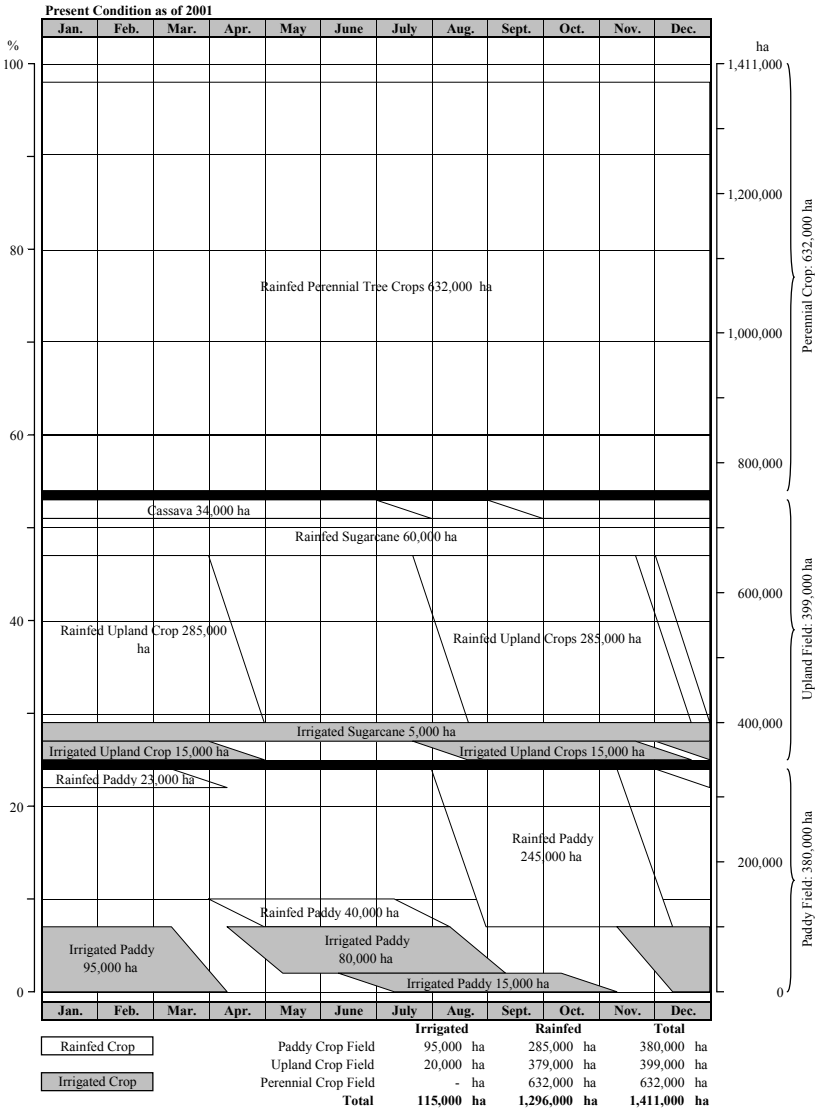
		Irrigated	Rainfed	Total
Paddy Crop Field	11,000 ha	16,000 ha	27,000 ha	
Upland Crop Field	4,000 ha	43,000 ha	47,000 ha	
Perennial Crop Field	43,000 ha	102,000 ha	145,000 ha	
Total	**58,000 ha**	**161,000 ha**	**219,000 ha**	

Figure D.24 Cropping Pattern of Srepok River Basin



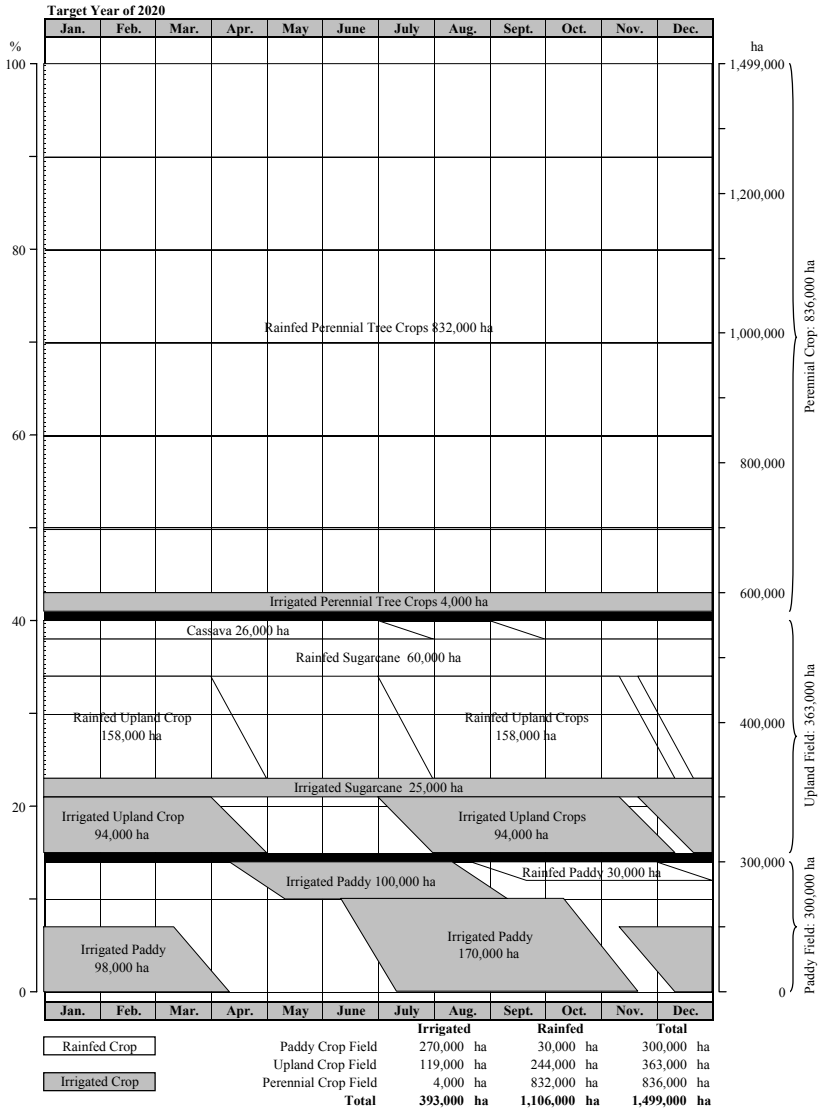
		Irrigated	Rainfed	Total
Paddy Crop Field	24,000 ha	3,000 ha	27,000 ha	
Upland Crop Field	35,000 ha	12,000 ha	47,000 ha	
Perennial Crop Field	90,000 ha	55,000 ha	145,000 ha	
Total	**149,000 ha**	**70,000 ha**	**219,000 ha**	

Figure D.25 Present Cropping Pattern of Dong Nai River Basin



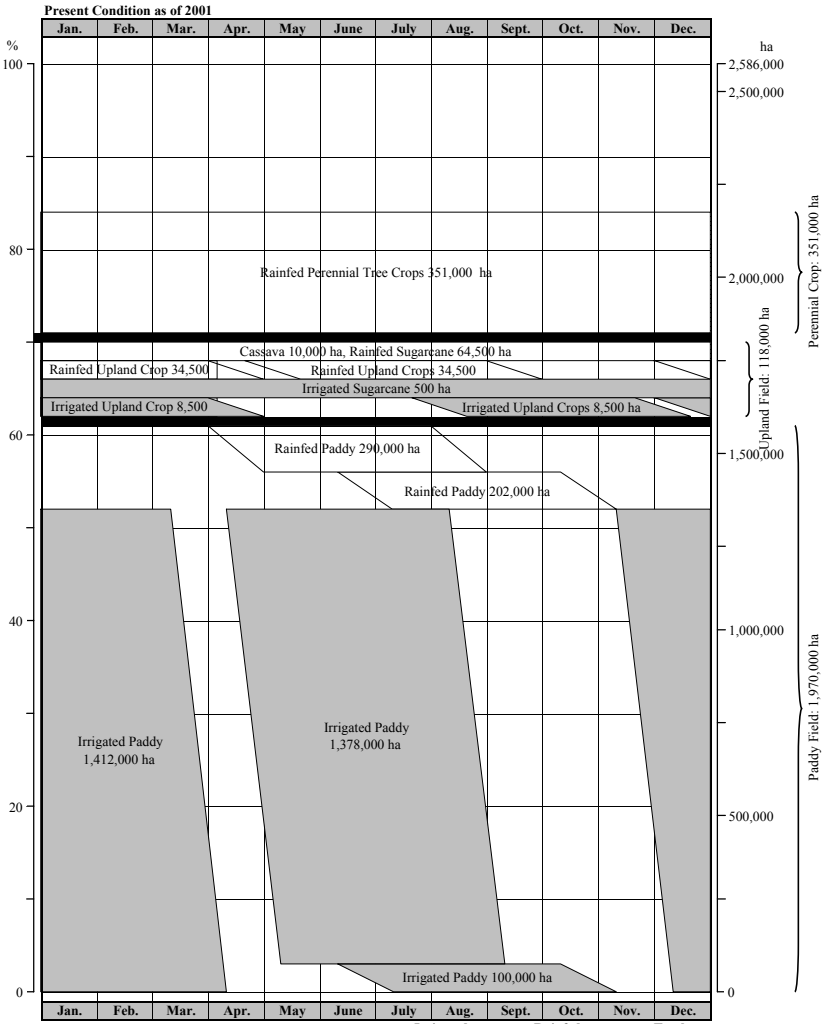
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	95,000 ha	285,000 ha	380,000 ha
	Upland Crop Field	20,000 ha	379,000 ha	399,000 ha
Irrigated Crop	Perennial Crop Field	- ha	632,000 ha	632,000 ha
	Total	**115,000 ha**	**1,296,000 ha**	**1,411,000 ha**

Figure D.26 Target Cropping Pattern of Dong Nai Basin



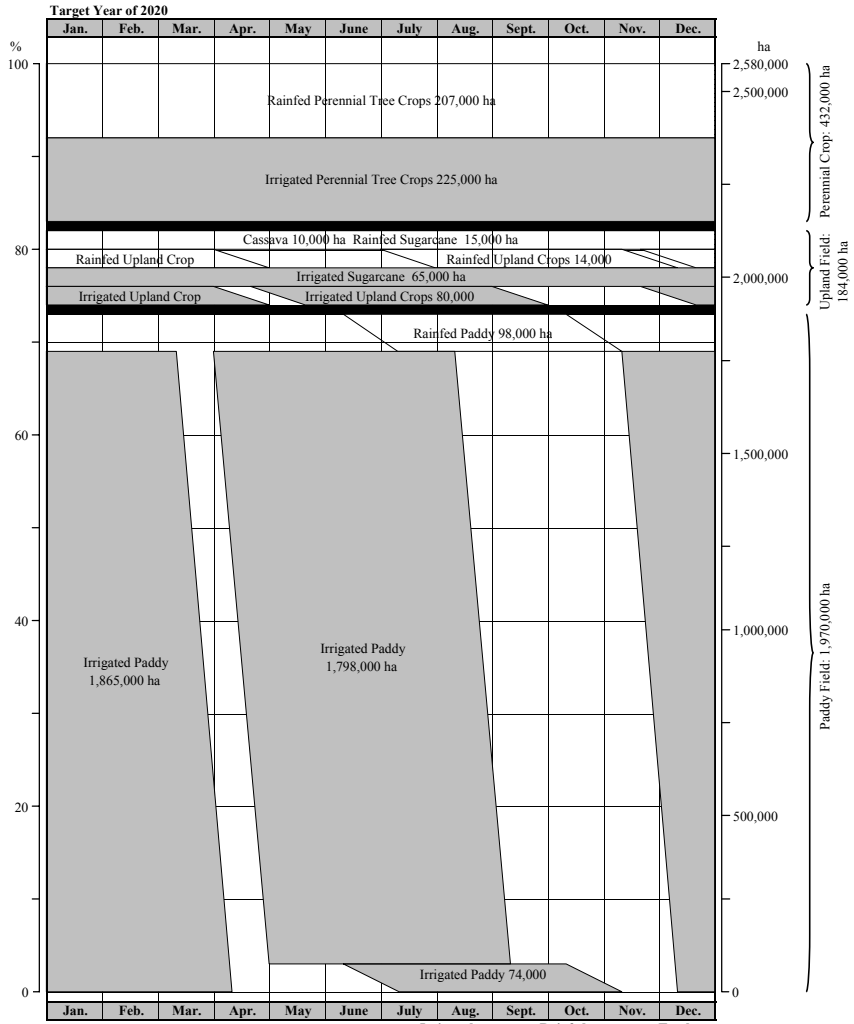
		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	270,000 ha	30,000 ha	300,000 ha
	Upland Crop Field	119,000 ha	244,000 ha	363,000 ha
Irrigated Crop	Perennial Crop Field	4,000 ha	832,000 ha	836,000 ha
	Total	**393,000 ha**	**1,106,000 ha**	**1,499,000 ha**

Figure D.27 Present Cropping Pattern of Cuu Long Delta Basin



		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	1,478,000 ha	492,000 ha	1,970,000 ha
	Upland Crop Field	9,000 ha	109,000 ha	118,000 ha
Irrigated Crop	Perennial Crop Field	- ha	351,000 ha	351,000 ha
	Total	**1,487,000 ha**	**952,000 ha**	**2,439,000 ha**

Figure D.28 Target Cropping Pattern of Cuu Long Delta Basin



		Irrigated	Rainfed	Total
Rainfed Crop	Paddy Crop Field	1,872,000 ha	98,000 ha	1,970,000 ha
	Upland Crop Field	145,000 ha	39,000 ha	184,000 ha
Irrigated Crop	Perennial Crop Field	225,000 ha	207,000 ha	432,000 ha
	Total	**2,242,000 ha**	**344,000 ha**	**2,586,000 ha**