THE STUDY ON THE INTEGRATED RURAL DEVELOPMENT IN THE SAN-PÉDRO PLAIN

FINAL REPORT

MAIN REPORT

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ABBREVIATIONS

ANADER	Agence Nationale d'Appui au Développement Rural *Supporting National Agency for Rural Development*
ADRAO (WARDA)	Association pour le Développement de la Riziculture en Afrique de l'Ouest *West Africa Rice Development Association (WARDA)*
AGRIVOIR	*Ivoirean Agriculture (Rice milling Company)*
AISA	Association Ivoireenne des Sciencces Agronomiques *Association Ivorian for Agronomy Science*
ANAM	Agence Nationale des Aérodromes et de la Météorologie (- 1997) *National Meteorology Agency(-1997, presently SODEXAM)*
ANDE	Agence National de l'Environnement National Agency of Environment
ARSO	Autorité pour l'Aménagement de la Région du Sud-Ouest (1968-1980) *Southwestern Region Development Authority(1968-1980)*
BAD (AfDB)	Banque Africaine de Développement *African Development Bank*
B/C	Rapport de Bénéfice par Coût Benefit-Cost Ratio
BEIE	Bureau d'Etude d'Impact sur l'Environnement Beureau of Environmental Impact Assessment of ANDE
BIRD (IBRD)	Banque Internationale pour la Reconstruction et le Développement *International Bank for Reconstruction and Development – World Bank*
BNDA	Banque Nationale pour le Développement Agricole *National Bank for Agricultural Development*
BNETD	Bureau National d'Etude Technique et de Développement National Office for Technique and Development Studies
BOAD	Banque Ouest Africaine de Développement *West African Development Bank*
CA	Conseiller Agricole Extension Worker
CAISTAB Or CSSPPA	Caisse de Stabilisation et de Soutien des Prix des Productions Agricoles (1955-1992-) *House for Stabilization and Support of Agricultural Products Prices*
CFA	Communauté Financière Africaine *African Financial Community*
CFMAG	Centre de Formation à la Méchanisation Agricole *Mechanized Agriculture training Center, Grand Lhou*
CIAPOL	Centre Ivoirien d'Anti-Pollution *Anti-Pollution Center of Côte d'Ivoire*
CIDA	*Canadian International Development Agency*
CIDT	Compagnie Ivoirenne pour le Développement des Textiles *Ivorian Company for Textile Development*
CIDV	Compagnie Ivoirienne pour le Développement du Vivrières *Ivorian Company for Food Crop Development*
CIE	Compagnie Ivoirienne d'Electricité *Ivorian Electric Company*
CIRES	Centre Ivoirien de Recherches Economiques et Sociales *Ivorian Social and Economic Researches Center*

CIRT	Centre Ivoirienne Recherches et Technologique *Ivorian Center for Technological Research*
CITES	*Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)*
CNRA	Centre National de Recherche Agricole *National Center for Agricultural Research*
COOP	Coopérative *Cooperative*
COOPEC	Coopérative d'Epargne et de Crédit *Saving and Credit Cooperatives*
CREP	Caisse Rurale d'Epargne et de Prêts *Rural Saving and Loan Office*
CTFT	Centre Technique Forestier Tropical *Tropical Forest Technical Center*
DCGTx (BNETD)	Direction et Contrôle des Grands Travaux (BNETD) *Office for Management and Control of Detailed Design and Works (presently BNETD)*
DD	Direction Départmentale, MINAGRA *Department Directory, MINAGRA*
DE	Direction de l'Environnement Direction of Environment
DGA	Direction Générale de l'Agriculture, MINAGRA *Direction General of Agriculture, MINAGRA*
DMC	Direction de la Mutualité et de la Coopération, MINAGRA *Direction of Mutual Aid and Cooperation, MINAGRA*
DP	Direction de la Programmation, MINAGRA *Direction of Planning, MINAGRA*
DPN	Direction de la Protection de la Nature *Direction of Natural Protection*
DR	Direction Régionale, MINAGRA *Regional Directory, MINAGRA*
EECI	Energie Electrique de Côte d'Ivoire *Electrical Energy of Côte d'Ivoire*
EIA	Evaluation de l'Impact sur l'Environnement *Environmental Impact Assessment*
EL	Elevation *Elévation*
ENSEA	Ecole Nationale de Statistique et d'Economie Appliquée *National School for Statistic and Applied Economy*
EU	Union Européenne *Europian Union*
FAC	Fonds d'Aide à la Coopération *Aid Funds for Cooperation*
FAO	Fonds des Nations Unies pour l'agriculture et l'alimentation *Food and Agriculture Organization, United Nation*
FAD	Fonds Africaine de Développement *African Development Fund*
F CFA	Franc CFA *CFA Franc (FCFA 1.0 = FF 0.01)*

FF	Franc Français *French Franc*
FMI (IMF)	Fonds Monétaire International *International Monetary Funds*
FOB	Freight on Board *(Prix à Bord)*
FRAR	Fonds Régionaux d'Aménagement Rural *Regional Fund for Rural Développement*
FRAU	Fonds Régionaux d'Aménagement Urban *Regional Fund for Urban Développement*
GI	Groupement Informel *Informal Group*
GOCI	Gouvermente de la République de Côte d'Ivoire *Government of the Republic of Côte d'Ivoire*
GOJ	Gouvermente du Japon *Government of Japan*
GVC	Groupement á Vocation Coopérative *Cooperative Group*
HCH	Haut Commissaire à l'Hydraulique *High Commissioner of Hydraulic*
I2T	Institut de Technologie Tropicale *Institute for Toropical Technology*
IDESSA	Institut des Savanes *Savanna Institute*
IDEFOR	Institut des Forêts *Institute for Forest*
IEE (EIE)	Examen Initial de l'Environnement *Initial Environmental Examination*
INS	Institut National des Statistiques *National Institute of Statistics*
IRAT	Institut de Recherche en Agronomie Tropicale *Tropical Agriculture Research Institute*
JICA	Agence Japonaise de Coopération Internationale *Japan International Cooperation Agency*
KR-II	Kennedy Round n° II *The Second Kennedy Round (Increased Food Production Aid)*
LANADA	Laboratoire National d'Appui au Developpement Agricole *National Laboratory for Agricultural Development Support*
LANEMA	Laboratoire National d'Essais de Qualité, de Métrologie et d'Analyses *National laboratory of Quality Tests, Metrology and Analyses*
METT	Ministère de lEquipement des Transports et des Télecommunications *Ministry of Telecommunication, Transportation and Equipment*
MFPF	Ministère de la Famille et de la Promotion de la Femme *Ministry of Women Promotion and Family*
MLCVE	Ministère du Logement, du Cadre de Vie et de l'Environnement (-1998) Ministry of Habitation, Life Quality and Environment (-1998)

MINAGRA	Ministère de l'Agriculture et des Ressources Animales *Ministry of Agriculture and Animal Resources*
OCPV	Office d'Aide à la Commercialisation des Produits Vivriers *Office for Support to Commercialization of Food Crops*
O.M. (O&M)	Opération et Maintenance *Operation and Maintenance*
OMS (WHO)	Organisation Mondiale de la Santé *World Health Organization*
ONG (NGO)	Organisation Non-Gouvernementale *Non-Government Organization*
OPA	Organisation Professionelle Agricole *Agricultural Professional Organization*
ORSTOM	Office de la Recherche Scientifique et Technique d'Outer-Mer *Office for Overseas Technical and Scientific Research*
PASA	Programme d'Adjustement Structurel Agricole *Structural Adjustment Programme in Agriculture*
PNAE	Plan d'Action National de l'Environnement *National Action Plan for Environment*
PNASA	Programme National d'Appui au Service Agricole *National Program for Agricultural Supporting Services*
PNB (GNP)	Produit National Brut *Gross National Product*
PNGERNAT	Projet National de la Gestion des Ressources Naturelles et de l'Environnement *National Project for Management of Natiral Resources and Environment*
PRB (GRP)	Produit Régional Brut *Gross Regional Product*
PNR	Projet Nationale Riz, MINAGRA *Rice National Project, MINAGRA*
RYMV	Rice Yellow Mottle Virus *Virus Causant de Taches Jaunes sur Paddy*
SAPH	Société Africaine de Plantation d'Hévéa *African Rubber Plantation Company*
SATMACI	Société d'Assistance Technique pour la Modernisation de l'Agriculture en Côte d'Ivoire (1958-1994) *Public Corporation of Technical Assistance for Agriculture Modernization in Côte d'Ivoire (especially Coffee and Cacao) (1958-1994)*
SODECI	Société de Distribution d'Eau en Côte d'Ivoire, *Water Distribution Public Corporation*
SODEFOR	Société de Développement des Forêts, MINAGRA *Forese Developmet Public Corporation, MINAGRA*
SODEPALM	Société pour la Développement des Palmerais *Palm Tree Farming Development Public Corporation*
SODEPRA	Société de Développement de la Production Animale *Animal Production Development Public Corporation*
SODERIZ	Société pour le Développement de la Rizculture, MINAGRA (1977-1984) *Rice Farming Development Public Corporation, MINAGRA(1977-1984)*

SODEXAM	Société de Développement d'Exploitation Aéroportuaire, Aéronautique et Météorologique *Development of Airport, Aeronautic and Meteorology Public Coperation*
SOGB	Société des Caoutchoues de Grand Béréby *Grand Béréby Natural Rubber Public Corporation*
SOPRORIZ	Structure d'Organisation et de Promotion de la Rizieulture (Projet National Riz), MINAGRA *Public Corporation for Promotion of Rice Farming (PNR), MINAGRA*
SORIZCI	Société des Rizeries de Côte d'Ivoire *Rice Mills Public Corporation*
TIR(E) *EIRR*	Taux Interne de Rendabilité Economique *Economic Internal Rate of Return*
TIR(F) FIRR	Taux Interne de Rendabilité Financière *Financial Internal Rate of Return*
TS	Technicien Spécialisé *Technician on Speciality*
UNEP (PNUE)	Programme des Nations Unies pour l'Environnement *United Nations Enviornmental Program*
UNESCO	Organisation d'Education, de Science et de Culture *United Nations Educational Scientific and Cultural Organization*
UNFPA (FNAP)	Fonds des Nations Unies pour la population *United Nations Population Fund*
USA	Etats Unis d'Amérique *United States of America*
VAN (NPV)	Valeur Actualisée Nette Net Present Value
WFP (PAM)	Programme Alimentaire Mondial *World Food Program*
WHO (OMS)	*Organisation Mondiale de la Santé* *World Health Organization*
MCM	*Million de mètres cubes* *Million Cubic Meters (X 1,000,000 m^3)*

CHAPTER 1 : INTRODUCTION

1.1 Background of the Study

After its independence in 1960, Côte d'Ivoire achieved the high economic development so called "Miracle of Ivorian" up to 1970's. It was supported by stable export of cacao, coffee and timbers. Since the rapid drop of international prices of cacao and coffee in 1978/79, the national economy was seriously impaired and international debt increased rapidly. Consequently the structural reform and rescheduling of external debt was started under the IBRD/IMF supports in 1984. The Government of Côte d'Ivoire (hereinafter referred to as "GOCI") started the economic reform through the Seventh 5-Year Development Plan (1991-1995) and the devaluation of CAF Franc which was devaluated by 50% in January 1994, aiming the reinforcement of international competitiveness and expansion of national economy. The medium term development plan (1995-1997) was also carried out. As a result of these efforts, the national economy recovered gradually, the GDP has grown on average between 6 to 7 % per year after the devaluation of CFA Franc. The medium term development plan (1998-2000) has been implemented since May 1998.

Average annual production growth of main staple foods, roots and tubers (yam, taro etc.), cassava and rice, between 1976 and 1995 was estimated at 1.8%, 2.7% and 4.6%, respectively. Comparing to the estimated annual population growth of 4.0%, production of staple food except rice could not meet the requirement. Since cheaper imported rice and wheat were introduced to urban area in 1970's, people have intend to buy them instead of the traditional staple foods (yam and cassava). Rice import increased to 320,000 tons in 1990's from 113,000 tons in 1970's. The imported rice counted 50% of total domestic products and shared 5% of total import value in 1990. The rice import of the country is the largest among the West African countries. Rice is mainly produced in the western and southern part of Côte d'Ivoire including the Study Area.

In the Study Area, San-Pédro Dam with a storage capacity of 25 million m^3 was completed the construction in 1983 for the hydropower, domestic and industrial water supplies and irrigation. Paddy irrigation project covering about 350 ha (planned area was 650 ha) was implemented by pumping irrigation water from the San-Pédro river by ARSO/SODERIZ. Irrigated rice cultivation was started by about 200 migrated farmers (130 households) under the government subsidies and Taiwanese technical assistance. It was shortly stopped because of interruption in government subsidies and difficulty in pump operation due to high operation and repair costs. Presently approximately 70 farm householders remain in the area and are cultivating rainfed paddy, cassava, yams and maize. Other farmers abandoned their farming in the area and migrated to San-Pédro City or other areas.

Under the above-mentioned circumstances, GOCI made a request to the Government of Japan (hereinafter referred to as "GOJ") to extend its technical cooperation for formulating a master plan for the integrated rural development in the San-Pédro Plain and to conduct feasibility studies in the priority project area(s) in May 1996.

In response to the request of GOCI, GOJ decided to conduct the Study on the Integrated Rural Development in the San-Pédro Plain (hereinafter referred to as "the Study") in accordance with relevant laws and regulations in force in Japan. Accordingly, Japan International

Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of GOJ, dispatched a preparatory study team to Côte d'Ivoire on 15th June 1997. The scope of work of the Study (hereinafter referred to as "S/W") was agreed between JICA and the Ministry of Agriculture and Animal Resources of GOCI (hereinafter referred to as "MINAGRA") on 24th June 1997, as attached in Appendix A of this report.

Based on the S/W, JICA organized and dispatched a team to conduct the Study (hereinafter referred to as "the Study Team") under the leadership of Mr. Masahito YAMANAKA of Pacific Consultants International. The Phase I Field Survey for the master plan study was carried out from February to August 1998. The Phase II Field Survey for the feasibility study in the high priority project area was conducted from December 1998 to March 1999. The draft final report explanation and discussion was conducted from June 1999 to July 1999.

1.2 Objectives of the Study

The objectives of the Study stated in the S/W are:

(1) to formulate master plan of the integrated rural development project in the San-Pédro Plain, placing particular emphasis on the paddy-field agricultural development and improvement of rural infrastructures;
(2) to conduct feasibility study of the priority project area(s) selected through the master plan study; and
(3) to carry out, in the course of the Study, technology transfer to the counterpart personnel of Côte d'Ivoire.

The irrigated paddy cultivation using the water resources of San-Pédro Dam was introduced in the Study Area. However, it was abandoned recently because of several reasons. Then the Study includes 1) to re-cultivate rice crop in the reclaimed paddy land, 2) to formulate the sustainable farming practices especially for paddy and 3) to resettle the abandoned farmers in the Study Area. These measures will increase the rice production, and finally achieve the improvement of farmers' living standard and activate the regional economy.

1.3 The Study Area

The Study Area is located in Department (*Département*) of San-Pédro of Bas-Sassandra Region (*Région*), which spreads across the western part of the country facing the Bay of Guinea. The Study Area covers approximately 10,000 ha of San-Pédro Plain along the San-Pédro River from the San-Pédro Dam to San-Pédro city, the capital of Bas-Sassandra Region. It is surrounded by San-Pédro Dam, the San-Pédro River, National Highway connecting San-Pédro and Soubre, and urban area of San-Pédro City. The original Study Area shown in S/W included a part of the Rapide Grah classified forest. However, this forest preservation area was excluded from the Study Area through the discussions on the Inception Report for the Study with MINAGRA/SODEFOR in March 1998.

Lower plain with elevation between 5 and 20 m is comprised of alluvial soils mixed with yellowish-brown clay, silt and sandy gravel. Undulated elevated area (elevation between 20 and 50 m) which surrounds the lower plain is covered with yellowish-brown clayey soils, and cassava, yam and maize are mainly cultivated by shifting cultivation. Small-scale cacao and coffee cultivation is practiced in higher elevated area.

CHAPTER 2 : BACKGROUND OF THE STUDY

2.1 Brief Description of the Republic of Côte d'Ivoire

2.1.1 General

(1) Land

The Republic of Côte d'Ivoire is located in the central part of the coastal West Africa facing the Gulf of Guinea. Its territory covers an area of about 322,500 km^2, extending itself between the equator and the tropic of Cancer with 500 km of the coastline. It borders with Ghana at the east, Liberia and Guinea at the west, and Burkina Faso and Mali at the north.

The land is roughly divided into three topographic zones, i.e., 1) the southern plain that used to be covered mainly with tropical forest, 2) the northern plateau with savanna and 3) the west and northwest mountainous zone with tropical intact forest. In the north, there are two seasons a year, dry and wet, whereas in the south, there are four seasons a year. Four major rivers, i.e., the Cavally, Sassandra, Bandama and Comoé, originate from the north, the length of which ranges between 600 km and 950 km, cut through the terrain to the south into the ocean.

Côte d'Ivoire is one of the low-income food-deficit countries, according to the classification made by FAO, even though she has been famous for her production of diversified industrial crops, starting with so-called six C majors in French, *Cacao*, *Café* (robusta coffee), *Caoutchouc* (rubber), *Coton* (cotton), *Cocotier* (coco-palm) and *Canne à Sucre* (sweet potato) along with Oil-Palm, Pineapple and Banana. As shown in the following table, agricultural land for the above main products are limited to only 11.6%.

	Arable Land	Perennial Crop	Permanent Pasture	Forest & Woodland	Other Land	Total
Area(1,000 ha)	2,430	1,260	13,000	7,079	8,031	31,800
Share (%)	7.6	4.0	40.9	22.3	25.3	100.0

Source: FAOSTAT 1996

(2) Population

According to the previous population census in 1988, it was estimated at 10.82 million people in Côte d'Ivoire. In 1995 economically active population was estimated by FAO at 5.2 million, 36.4% of the estimated population of 14.23 million; rural active population at 2.97 million, 57.1% of the total active population. Average life expectancy during the same period was estimated at 56 years. The census was carried out in November 1998, but its preliminary results were not yet been announced as of March 1999. Concentration of population in urban area has been accelerating. The ratio of urban and rural area population was 1 to 1.5 in 1985, and it is estimated to be 1.25 to 1 in 2010.

People living in the country are ethnically very much diversified and they can be classified into the four principal ethnic groups; 1) the Akan (primarily Baoulé and Agni) constitutes about 35 % of the total population and lives in the south-east, 2) the Krou (primarily Krou, Bété, and Wé) lives in the south-west, 3) the Voltaic Group (primarily Sénoufo and Lobi-Birifor) in the north-east and 4) the Mandé (primarily Mandé and Malinké) in the north-west.

(3) Political System and Administration

Côte d'Ivoire is a unitary republic, whose legal system is based on the 1960 constitution and the Code Napoléon. National legislature is National Assembly, whose 175 members are elected at five year interval. Head of state is President elected by universal suffrage for a seven-year term. National Government consists of Prime Minister and his appointed Council of Ministers. At present, the government consists of offices of President, the Prime Minister, 30 ministers and three high commissioners. There are 16 regions (*Régions*); which are divided into departments (*Départments*) and then further to sub-prefectures (*Sous-préfectures*). Both region and department are administered by governor (*Préfet*), sub-prefecture by head of sub-prefecture (*Sous-préfet*).

On the other hand, at the local level, cities (*villes*) which consist of areas (*communes*) are governed by elected mayors (*maires*) and city councils (*conseils municipal*). Decentralization is in process and in earnest; laws concerning regionalization in the context of institutional and budget arrangement have been examined by the parliamentary committee.

2.1.2 Socio-Economic Situation

(1) National Economy

A drastic step was taken to devalue the CFA Franc 50 % in terms of exchange rate against French Franc to F.CFA 100 per 1.0 French.F. on 12th January, 1994, which became a turning point of the national economy. The process of restructuring the centrally planned economy, guided by IMF, has gained its momentum. The annual real GDP growth rates have been positive since then, and in 1997 the per capita GDP was estimated to reach F.CFA 434,000 (US$ 743 as of 1997). In July 1998, with the agricultural reform and budget restraint in mind, IMF has reached agreement with GOCI to disburse a new $385 million three-year, between 1998 and 2000, enhanced structural adjustment facility for 1998 (Table 2.1.1). The total outlay of the each National Budget, the recurrent and the development, in1995 was F. CFA 560 billion and 264 billion, respectively. A nominal average growth rate of recurrent budget between 1990 and 1995 was 4.6 %, and that of the total development budget was 15.3 %; then that of the agricultural sector was 1.7 %.

The 1999 budget was passed in December 1998. According to Fraternité Matin, a national daily, the total estimated revenue is set at F.CFA 1,952.5 billion, 6% up from the 1998 budget. The recurrent expenditure is estimated at about F.CFA 700 billion, development budget at about F.CFA 500 billion, and the rest of F.CFA 200 billion will cover the debt service. Consumer Price Index (CPI) for households workers, technicians and craftsmen in two consecutive years of 1996 and 1997 are 4.4% and 5.2%, less than a half of CPI in 1995, in spite of food price rise in the first half of 1997.

Privatization has helped the government to increase its coffer. As of October 1997, there were six national ranches and one national vegetable growing company, none of them are not big, in the list of the companies scheduled for privatization along with SIR - an oil refinery and CIDT - a cotton textile monopoly.

Cacao, an industrial crop, is the mainstay of the national export earnings. Like other cash crops, it always faces the two uncertainties, the weather in Côte d'Ivoire and the weather in other producer countries. As the primary measure, Côte d'Ivoire has been diversifying into other

industrial crops, and coffee has become the second export crop, whose sale reached at about fifth of cacao's in 1996. The second diversification has directed to oil export, whose sale reached about 36 % of the cacao's in 1997. Côte d'Ivoire will increase its export by five-fold by 2000, which will reflect in the forecast of export growth.

Since 1994, thanks to CFA Franc's devaluation, along with the effort on economic restructuring, Côte d'Ivoire has been getting a breathing space in her economy. Starting from 1st January 1999 the CFA franc has been directly tied to the Euro instead of French franc at a fixed exchange rate of CFA franc 655.957 per 1.00 Euro. The risk of an overvalued CFA franc stemming from a strong Euro is the last thing the countries need to concern about. So, seeing an increase of capital flight from Côte d'Ivoire, the BCEAO took a precaution in November 1988 to get Ivorian banks to increase their capital reserves six-fold and to raise its discount rate to 6.75 %. But, the rate was returned to the previous level of 6.25 % in January again, after seeing the Euro's slight depreciation against the US dollar.

(2) National Economic Development Plan

It had been seven years since the IMF initiated its intervention in Côte d'Ivoire's national economic structure in 1984, when 'the Seventh Medium Term Economic Development Plan (1991-96) (7MTEDP)' was implemented. The focus of the plan was clear-cut; stabilization of national economy by introducing restructuring measure, which, on the one hand, would reinforce the competitiveness of cash crops on the international market, then, on the other hand, would be supported by the development effort of human resources.

When CFA Franc was devalued by 50 % in 1994, an enhanced structural adjustment facility (ESAF) was agreed upon between GOCI and IMF. The delayed new three-year ESAF (April 1998- March 2001) was signed in June 1998, and "*Cadre de politique économique et financière pour 1998-2000*" was subsequently announced, in which the five pillars of the reforming theme, i.e., 1) smaller government, 2) privatization, 3) development of human resources, 4) decentralization and 5) alleviation of poverty, have been resounding throughout.

(3) Social Problems and Efforts to Address Them

With the advancement of restructuring of the national economy as a whole, the bi-polarization of the middle social stratum has become an acute social phenomenon, especially in the periphery of Abidjan. The social reform policies envisaged in the framework emphasize the need to attend the poorer sections of the population, in the form of improving education, especially of girls, public health services and revitalization of rural areas. Problems in the periphery of Abidjan are being planned to be solved by the creation of young farmers' groups, which will produce vegetable for the markets in Abidjan. As of July 1998, the poverty line lies at the level of monthly income of F.CFA 94,600, and those who are below the line comprise 37 % of the total population.

2.1.3 Agriculture

(1) Major Crops and Food Self-sufficiency

In Côte d'Ivoire, perennial cash crops occupy 60 % of the total crop area. The major crops are cacao (31 %), coffee (24 %) and oil palm (3 %). While, the food crops occupy 40 % of the total crop area, and the major crops are maize (12 %), paddy (10 %), yam (5 %), cassava (4 %), taro

(4 %), plantain banana (2 %), groundnut (2 %) and sorghum/millet (1 %). The remainder is industrial crops of cotton (0.4 %) and sugarcane (0.3 %) (Table 2.1.2).

The production zone is clearly obeyed by the meteorological conditions. In the tropical rain forest zone, cacao and coffee are the major crops, and diverse farming with oil palm, rubber, poyo banana, mango, cola, citrus, pineapple, maize, rice, cassava, yam, plantain banana etc. has been carried out. In the central guinea savanna, food crops and cash crops such as vegetables, banana and mango are produced. In the northern guinea savanna, cotton, sugarcane, paddy, sorghum, yam, cassava, groundnut etc. are produced. In the last 10 years from 1985 to 1994, the cash crops of cacao, cotton, oil palm and rubber showed the great increase of over 35 % in production. The food crops of millet, sorghum, taro and paddy also had the increase of over 30 %. While, coffee, sugarcane, pineapple and plantain banana decreased.

According to the balance sheet (average 1992-96) of FAO, the main food crops are yam, cassava, rice and maize. Their per capita annual supplies in Côte d'Ivoire are 109.6 kg, 100.6 kg, 60.4 kg and 27.6 kg, respectively. Rice supplies 23 % of total calories and protein as primary supply sources. Therefore, it is possible to say that rice is the most important food crop in Côte d'Ivoire. The amounts of domestic food crop production almost meet the domestic demand except rice. The self-sufficiency ratio of rice was estimated at 58 % in 1994 with the domestic production of 455,650 tons and the imported amounts to 329,000 tons, and the consumption amounts of 57 kg per person per year. In order to meet the national demand for rice by the domestic production, the Government has made the 10-year plan '*Plan de Relance de la Riziculture, 1996-2005*'. The target is to increase the production at an annual rate of 9 % with the following targets:

Rainfed paddy:	Expansion of land from 573,000 ha to 852,000 ha
	Increase in yield from 1.2 ton/ha to 2 ton/ha
Irrigated paddy:	Expansion of land from 22,000 ha to 78,000 ha
	Increase in yield from 3.2 ton/ha to 5 ton/ha

(2) Livestock

Poultry are the most common and 26,200,000 heads are raised in the country in 1999, followed by cattle (1,231,000 heads) and sheep (1,251,000 heads). Pig accounted for only 403 thousand heads. Number of livestock raised in San-Pédro Region is only 7.2 % on cattle and 9.3 % on ruminant of sheep and goat. On the supply and demand of livestock, cattle, sheep and goat, pig and poultry met 32.7 %, 56.2 %, 83.9 % and 91.2 % of the domestic demands in 1994, respectively. The egg production is self-sufficient, while the milk production met only 19.0 % of the domestic demand.

(3) Irrigated Agriculture

Main agricultural production in Côte d'Ivoire is tree crop such as cacao and coffee. They are usually grown in the rain forest area where there is enough rainfall. Therefore, they are not irrigated. Modern paddy and vegetable cultivation depend on the irrigation. The irrigated area was estimated at 20,000 ha by the FAO in 1970, but it increased up to 73,000 ha in 1994. Among the 73,000 ha, the paddy irrigation area occupies about 40 %.

(4) Agricultural Marketing for Food Crops

The commercialization of the food crops is very much dispersed, on the contrary to that of cash crops that is handled by a score of specialized establishments, the majority of which are owned by the ethnic Lebanese whose population in Côte d'Ivoire is estimated at 120,000.

Generic marketing of food crops starts with the visits of middlemen to farmers' fields, where contracts are bound at the spot, and the produce is transported to the designated market place. The middlemen have the upper hand over the farmers in this situation. The latter have been trying to make the situation an even bargain by organizing themselves in the form of, at least, "*Groupement Informel* (GI)" or, better still, "*Groupement à Vocation Coopérative* (GVC)" with the help of government agencies.

"*Office d'Aide pour Commercialization des Produits Vivriers* (OCPV)", was established in the Ministry of Commerce in 1994 by a policy of achieving self-sufficiency of food to assist to raise efficiency in the commercialization system of the food crop production. It spreads such economic and commercial information on food crops as prices, quantity, time table, area of production, etc; upgrades infrastructures of markets in question to such a degree to fit into the level of its national network; and supports the commercial transactions between producers, wholesalers, transporters, retailers and consumers.

(5) Agricultural Supporting Systems

1) Technology Development Support

Technology development for agriculture is carried out by eight (8) institutes; namely IDEFOR, IDESSA, CIRT, CIRES, I2T, LANADA, SODEXAM and WARDA. The main activities of some important institutes are as follows:

IDEFOR (*Institut des Forêts*)
IDEFOR is an organization in charge of agronomic research in forestry zone, belonging to National Center for Agricultural Research (CNRA) under the Ministry of High Education, Research and Technical Innovation. The main research activities are selection and improvement of variety, development of production and post-harvest technologies on the tree crops of coffee, cacao, cola, oil palm, coconut, rubber and fruits. In addition, research activities on forestry and forestry agriculture are carried out. There are five departments, i.e., coffee and cacao (DCC), forestry, fruits and citrus fruits, rubber plants and oil palm plants. DCC has six (6) research stations. One of them, the San-Pédro Research Station is located in the Study Area with an area of 717 ha.

IDESSA (*Institut des Savanes*)
IDESSA is only one research and technology development organization in Côte d'Ivoire responsible for food crops, livestock and fishery, belonging to CNRA. The institute consists of four departments, i.e., food crop, livestock, industrial crop and fishery. The Food Crop Department deals with both lowland and upland rice, maize, sorghum, millet, yam, manioc, vegetables, soybean and groundnut. The Livestock Department and the Industrial Crop Department deal with sheep, goat, cattle, poultry and others, and sugarcane and cotton, respectively. The Food Crop Department has five regional centers in Bouake, Gagnoa, Man, Korhoga and Abidjan.

CIRT (*Centre Ivoirien de Recherches et Technologique*)
CIRT is also an organization for technology development, belonging to CNRA together with IDEFOR and IDESSA under the Ministry of High Education, Research and Technical Innovation. At present, these institutes are under restructuring of the organizations as a semi-government agency with a government share of 35 % capital.

WARDA (West Africa Rice Development Association)
WARDA is an international research organization under the Consultative Group for International Agricultural Research (CGIAR) dealing with scientific and technological development of rice production, which is located in Bouaké. The organization has contributed to the increase of rice production in Côte d'Ivoire through the development of new varieties, which are adaptable to various ecological conditions and resistant to disease, pest and physiological problems.

2) Technology Extension Support

"*Agence National d'Appui au Développment Rural* (ANADER)" was established in accordance with "*Le Programme National d'Appui aux Services Agricoles (PNASA)-Phase I*" in 1994 as a successor of CIDV, SATMACI, and SODEPRA. It incorporated itself in a particular type of mixed economic society with the capital of F.CFA 500 million, in which the government was the majority shareholder as of July 1998. It has the sole objective of contributing to the welfare of the rural area as a whole by building up the professional agriculturists, be they farmers, foresters, animal breeders, fish growers, or fishermen. Its strategies are integral and its activities are versatile. It plans and executes a system of developing qualities of producers by:

- gives technical assistance to '*Organisations Professionelles Agricoles* (OPA)';
- collects and distributes useful information;
- does practical application of the achievements of research and technology development;
- feeds information to researches to help keep them in perspective;
- identifies the constraints that hinder rural development;
- identifies the relevant and competent government bodies to remove them; and
- participates in all the programs/projects of rural development.

It has five directorates at the national level besides that for general affairs. They are 1) agricultural extension, 2) R&D, 3) supporting OPA, 4) development and management of human resources and 5) financial and accounting matters. At the regional level, it has five technical services for the corresponding directorates at the center, except for the facts that 1) and 2) at the national level are combined and that for follow-up and evaluation is included. The latter has the corresponding unit under the general directorate at the national level.

It has further decentralized its function into the departmental level to satisfy the specific needs of individual agriculturists. The detail description is given in section 3.4.8. In pursuit of bringing up the rural families both in the food crop production and in the industrial crop production, the second phase of PNASA is going to be implemented in continuation to the first phase, while ANADER itself has been restructured.

(6) Agro-Industry for Food Crops Production

Among the post-harvest processing of the food crops in Côte d'Ivoire, scale-merit expected from industrialization is counted only for that of paddy/rice; at present, the local maize production has no competition with imported ones, and wheat is not grown in Côte d'Ivoire.

AGRIVOIRE used to build and run ten big scale rice mills of 44,000 ton processing capacity a year in average with silos of 10,000 ton/unit around the country. And MOTOGARI controlled the mechanization process of the agriculture when the government bodies controlled the whole range of industries before they are privatized. After privatization, some of them were relocated according to the new owners' commercialization strategy. One in San-Pédro, a port city, for example, was dismantled and transported to the production centers, as the imported rice are mostly polished. There are about 3,000 small-scale mills in Côte d'Ivoire.

(7) Agricultural Development Plan for Food Crop Production

Within the framework of the 7MTEDP, MINAGRA announced "*Plan directeur du développment agricole (1992-2015)*" in 1993 after a long conceiving period. It depicts the policies with the numerical long-term target for all the crops, food as well as industrial, on the platform set by the "Structural Adjustment Program in Agriculture (PASA)". It includes the medium term program for each crop (Table 2.1.3). After the devaluation of CFA Franc, MINAGRA has reviewed the program. As one of the revised detail programs, "*Plan de relance de la riziculture*" was announced in 1996 in the perspective of food self-sufficiency. Population growth, in general, demands increased food crops production; concentration of population in the urban area demands the concentration on the specific foodstuff, i.e., rice, wheat flour, meat and milk products. So increased rice production has special implication in this context.

At the same time, the policy makers feel it necessary to remind the theme of the overall food self-sufficiency, in which diversification of food crops, another pillar of the policy, should always be pursued in order to reduce the pressure of boosting rice production. When all the aspects of the program work out according to the plans envisaged by MINAGRA, the medium term future production of paddy will result in the figures given in Table 2.1.4. Without the program, the rice deficit will reach 600,000 ton in 2005, whereas, with the program, the deficit will only amount to 100,000 tons. The estimated savings derived from the import substitution will reach some F.CFA 110 billion at 1997 price.

The plan counts generation of wastes after harvest as one of the unsatisfactory results of the food crops production and mentions the necessity of ameliorating the situation. It does not yet elaborate a plan to quantify the process. If it is introduced, sizable amounts of rice may be reclaimed from the wastes. How the external assistance on the irrigated rice production would help the realization of the said targets is found in Tables 2.1.5 and 2.1.6.

(8) External Assistance in Agricultural Sector

It covers very wide range of activities in the sector as shown below:

USA: PL-480: Amount of F.CFA 6 billion for 1998 in two loan agreements of equal amount. The latter half is specifically meant for importing brown rice from USA. This is the tenth agreement since PL-480 started in 1989, and the total have reached F.CFA 63 billion, equivalent to US$ 106 million at the present exchange rate.

China: As of the end of 1997, completed 45 % of the Guiguidou irrigated rice culture project in the Sud-Bandama Prefecture, i.e., two dams with 20 km access road, and 68 ha of irrigated rice field, which are to be cultivated by 164 farmers. The project was started in 1996. After the project was re-evaluated, the original scale of 442 ha was reduced into a quarter, and the total cost was estimated at F.CFA 10.2 billion, in which China's share was F.CFA 7 billion. For further finance, China has agreed to provide about F.CFA 3.6 billion.

France, FAC, 1997: F.CFA 1.5 billion for agronomy research programs.

ADF, 1997: US$34 million grant, for studies on agro-processing industries.

WFP, Oct. 1997: 2,200 tons of rice (equivalent to F.CFA 500 million) donation for school canteens. (at the rate of F.CFA 227,000 / ton)

Japan, JICA, 1996: Detailed design and implementation of an earth-dam construction on the Lokakpli river, which irrigates 126 ha of paddy field.

IBRD, 1995: 5.83 million for Agricultural Export Promotion and Diversification Project which will be completed in 2001. The project is co-financed by GCI, CIDA, EU, Japan, and Agricultural Producers/Exporters. The total cost is equivalent to US$16.4 million.

If we limit the subject only to the recent, on-going and forth coming projects on irrigated paddy production, Table 2.1.5 gives the gist of the external involvement. An estimated increase in irrigated area generated by the projects' implementation as of 2000 will consist of 21 % of the rehabilitation plan and 40 % of the new installation plan. The plan is actually implemented according to the schedule. Lokapili Project has been implemented ahead of schedule; a part of N'zi project was tendered, and implementation works on seven swamp areas in the Cavally basin and one in the Sassandra in the Ouest/Man project financed by BAD/ CI, for example, are being tendered on 6th July, 1998.

2.1.4 Environmental Protection

(1) Institutional Organization

1) Environmental Institutions

The Environmental Law is the basic law for environmental conservation and protection, and it provides ambitious objectives. Very few application decrees have been enacted, and there is neither environmental standards nor criteria. The list of the main legislative and regulatory texts having environmental objectives pertinent for the Study is presented in the Supporting Report.

Each governmental agency is responsible for taking care not to cause adverse impact on the environment while performing its objectives. The Ministry of Housing, Livelihood and Environment is newly reorganized into the Ministry of Environment and Forest, co-ordinates these sector-based actions according to environmental policy objectives, which are specified in

"the National Action Plan for Environment (PNAE 1996-2000)"; (refer to the Supporting Report). At the regional level, the Direction of Environment is mandated for the application of the directives given by the tutelage central agency, the Direction of the Environment. Actually, the main task that is performed by these regional offices is to manage the permitting system of the classified installations. At the local level, communes depend on the directives given by the Ministry of Interior and National Integration, but they must follow the directives of the Regional Directories of Environment for those environmental issues that are not directly the prerogative of the communes.

Under tutelage of the Ministry of Environment, the Direction of the Environment elaborates the national environmental policy. One of the main tasks of the Direction of the Environment is to translate the biodiversity international convention into national policy through a biodiversity conservation strategy document. The Direction of the Environment will, however, not be entitled to execute the biodiversity policy objectives since the task of managing natural habitats and living species is entirely passed on to the Direction of the Nature Protection (Ministry of Agriculture and Animal Resources). It is the Direction of the Environment that is responsible for the national project of Management of the Natural Resources and the Environment (PNGERNAT). It is noted that the present ministerial re-organization has led to the transfer of the attributions of the General Directory of Water and Forest of MINAGRA to the newly established Ministry of Environment and Forest. The main environmental agencies that have been established at national level are the following:

- The National Agency of Environment (ANDE, 1997);
- The Bureau of Environmental Impact Assessment (BEIE, 1996), which is a temporary agency set up to supervise the environmental impact assessment procedure (EIA); this duty officially belongs to ANDE;
- The Anti-Pollution Center (CIAPOL) follows up the quality of water and air through its observation network.

2) Overview

In general, environment management is emerging according to new rules and reorganization, but this process is not yet achieved. Then, in practice, the current national regulatory system is unable to manage the problems raised by environmental management, and as a substitute, international conventions or criteria (WHO, FAO, UNEP) are used as guidelines for the environmental policy.

The protection and conservation of nature is based on a set of laws (Law of Protection of Fauna and Hunting 1965, Forest Law 1965, Fishing Law 1986) that are regarded as being no more appropriate to the present situation. There is awareness that a complete reformulating of the legislative and regulatory network is needed in the field of management of the environment and the natural resources. Accordingly, the actual transition period between the outdated system and the new actualized system is generating confuse and unclear management rules. There is a national consensus about the existing institutional gaps and the urgency to find out the appropriate solutions. Presently, the institutional problems that have been prevailing in environment are:

- A major gap between the objectives of an integrated management of the environment and the institutional capacity of implementation.

- A confusing distribution of jurisdictions among the managing agencies and the lack of coordination;
- The lack of definition of clear rules or criteria that would ensure the integration of sustainability in rural development projects, although sustainable agriculture has been set up as a priority objective of environmental and agricultural policies.

(2) Natural Habitats

1) Forests

Forests are protected according to the system of protection areas under the responsibility of the General Direction of Water and Forest, namely Direction of Natural Protection and SODEFOR. SODEFOR is responsible for the management of the classified forests. In addition, a half of the existing botanical reserves are actually managed as classified forest by SODEFOR. The number of classified forests in Côte d'Ivoire remains unclear, but there are estimates giving a total number of 169 classified forests. Protected areas have been defined according to different levels of protection:

- Integral reserves (Mount Nimba and Lamto): Only scientific activity is permitted;
- National parks (8 areas): Dedicated to tourism only;
- Fauna and flora reserve of the Haut Bandama area: Mining prospecting is authorized;
- Biological reserves, which have boundaries inside the classified forests; mining prospecting is authorized;
- Botanical reserves (17 areas): Hunting is authorized; and
- Fauna reserves (2 areas): Use of flora species is authorized.

2) Rivers, River Banks and Wetlands

The conservation or protection of riverbeds and riverbanks is not regulated. It is a duty of DE to set policies for the protection of rivers, but this remains to be done. The San-Pédro river has been defined as a conservation area within the development plan of the classified forest of Rapide Grah by SODEFOR. However, the left bank of the San-Pédro river is outside the jurisdiction area of SODEFOR. Moreover, the decree that defines the attributions given to SODEFOR within the scope of the management plans does not mention the protection of rivers.

As a conclusion, there is no obligation to protect the rivers. The protection of the river habitats is actually almost entirely depending on the system of the regulation of impact sources through EIA (measures to limit the impacts), together with the system of classified installations (control of discharge and water quality).

Since the Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971) has been ratified by Côte d'Ivoire, valuable wetlands can be identified and included in the Ramsar list in order to enforce their protection. Actually only one site has been defined (Asagny). There are, however, several priority sites that could be the object of classification as Ramsar site. The mangroves that lie at the San-Pédro River mouth have not been retained as a priority site.

(3) Biodiversity, Flora and Fauna

1) Conservation of Biodiversity

Conservation, management of the living species and biodiversity are responsibility shared between Direction of Environment which manages the application of the Biodiversity Convention and Direction of the Natural Protection which manages the application of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Convention on the Conservation of Wildlife Migratory Species (Bonn, 1979) has not yet been signed by Côte d'Ivoire. The important fauna species of Côte d'Ivoire, from the viewpoint of ecological value, are shown in I.1.4 of the Supporting Report.

2) Protection and Management of Fauna and Cynegetic Resources

Fauna and cynegetic resources are managed under the Hunting Law of 1965, which was amended in 1994 according to the list of CITES. Hunting activity has been prohibited by decree in 1974, before reopening in 1994. The list of protected species of CITES is revised every two (2) years. However, since the amendment law of 1994, no revision has been made of the existing list of protected species in Côte d'Ivoire that is attached to the amendment law of 1994. Then, the available legal lists of the fauna species that are protected in Côte d'Ivoire (list of 1965 and list of 1994) need all to be actualized.

As a result, there is globally no clear regulatory tool for the protection of fauna species and application of CITES. The integration of CITES into a national law is under way and belongs to the more general purpose of reforming the protection system of fauna and the hunting rules. Within the list of 1994, species are classified according to three protection classes with different rules for hunting.

- Class I: integrated protection, hunting is submitted to scientific license;
- Class II: partial protection, hunting is submitted to specific license (sport game hunting);
- Class III: hunting is submitted to a standard license for small game.

3) Protection and Management of Fish Species and Fishery Resources

Continental fishing is controlled by the Bureau of Aquaculture and Fishing, which belongs to the Directory of Fishing, itself part of the General Direction of Animal Production. The Bureau of Aquaculture and Fishing is in charge of registration of the fishermen, follow-up of the fishing activity and others. Police of the fishing activity is made by the so-called Agents of Water and Forest, who institutionally belong to the Bureau of Aquaculture and Fishing and not the General Direction of Water and Forest. The fishing license is delivered by the head of sub-prefecture.

The Fishing Law of 1986 has remained without application decree. The control of continental fishing is entirely based on isolated orders. There is no regulated period of fishing, neither prohibited areas for fishing in view of resources conservation. There are no fish species protected by law.

(4) Agrochemicals

In Côte d'Ivoire, the quantity of used pesticides was about 4,500 tons in 1994, and 6,000 tons in 1996, of which 63% are insecticides. Rice production actually consumes 8% of the total used quantity, which amounts about 0.73 kg/ha on average. The integrated pest management concept

has been introduced since 1995 in the irrigated rice cultivation. This experience will be extended to other crops and specially food crops. Beside the integrated pest management, the biological pest management approach has been applied through several projects in Côte d'Ivoire.

The Decree 89-02 (4/1/89) is the text that is applied for regulating the quality of pesticides and herbicides the production and market activities and the application on crops by cultivators and by professionals. The inter-ministerial committee on pesticides is supervising the quality of agrochemicals that are going to be introduced on the market, and is responsible for approval of product quality. The product agreement is given by the ministerial order with recommendation of the committee. The committee is composed of representatives of 9 ministries in charge of the environment, and it is opened every three (3) months.

The agency designated for supervising the application of products and use criteria quality is the Direction of Vegetable Production and Quality Control (DPVQ). At the level of the Regional Offices of Agriculture, the technicians of DPVQ supervise the conditions of storage and sale of the agrochemical products. The criteria that are applied here are those of FAO. On the field, the methods of application of agrochemicals are followed up by the technicians of ANADER, who also organize awareness campaigns.

(5) EIA Requirement

The requirement of an environmental impact assessment (EIA) of development projects has been stated in the Environmental Law of 1996. The rules regarding the environmental impact studies procedure are presented in the application decree No.96-894 (8/11/1996). This decree provides that, in terms of fulfilling the environmental evaluation requirements, a project belongs to one of the following cases:

- The project is not subject to any environmental study;
- The project is subject to an environmental report which can be assimilated to an EIA; and
- The project is subject to EIA

The decree also stipulates that those projects that are implemented in sensitive areas should require an EIA. None of the sensitive areas mentioned in the decree can be found in the Study Area.

When an EIA is required, the BEIE must define the Terms of Reference (TOR) of the study in coordination with the parties involved in the project. The EIA performance is subject to specific rules: The study team for an EIA must be composed of national experts or consultants, at least for 2/3rd of its staff. Cost of the EIA is at the burden of the owner of the project. EIA is also submitted along with a special tax fee going to the environmental fund, but this requirement is not yet in application.

The EIA report has to be submitted to the BEIE and is analyzed by a committee of experts: BNETD (state agency directly linked with the president), ANDE, DE, and technical experts. The BEIE can then provide its advice to the MOE about the fulfillment of the TOR and the results of the EIA. It also launches the procedure of the public debate following the EIA. The public debate must involve NGOs and the target population. Rules for the public debate have

not yet been defined. Upon the successful completion of EIA procedure, MOE authorizes the project.

2.2 Brief Description of the Region

2.2.1 General

Bas-Sassandra Region is located at the south-western corner of Côte d'Ivoire along the coast, bordered with Liberia at its west, flanked with Montagnes Region at its north-west, with Haut Sasandra Region at its north-east, and with the Sud-Bandama Region at its east.

The Region, which was renamed from the Sud-Ouest Region, consists of four Departments, Sassandra, Soubré; San-Pédro, and Tabou. The San-Pédro Department consists of two sub-prefectures; Grand Béréby and San-Pédro. Its area constitutes 8.4 % of the total Côte d'Ivoire. The area, population of the Region by sub-prefectures are given in the table below:

Administrative Level	Name	Area (km^2)	Population (capita)	Density (persons/km^2)
Sub-prefecture	San-Pédro	4,576	132,297	28.9
	G.Bereby	2,336	35,877	15.4
Department	San-Pédro	6,912	168,174	24.3
	Others (3)	19,505	476,632	24.4
Region	Bas-Sassandra	26,417	644,806	24.4

Source: AISA,'Cinquiemes Assises de L'AISA', 1993

As the Region has been attracting many migrants from other regions of Côte d'Ivoire and neighboring countries, its population increased three fold between 1975 and 1988. However, the migration movement into the forest area of the south-west region of Côte d'Ivoire by the groups of east and north was not on the large scale but in the form of infiltration of minute groups, indeed, of isolated individuals, according to AISA conclusion made in its 1993 meeting.

A household consists of 6.4 members on average, in which 3.6 are economically active. About 79 % of the heads of households are engaged in agriculture, but many of them are engaged in other activities as secondary profession. In San-Pédro Department, many people have taken up fishery as their second job.

2.2.2 Regional Infrastructures

Founding of all the important new infrastructures in the region after 1968 was credited through ARSO.

(1) Seaport

Sassandra had been an important trading post along with small trading roadsteads in Grand Béréby and Boubélé, before a port of international standard was built in San-Pédro. San-Pédro port was built from nothing starting from March 1968, received the first cargo ship in May 1971, and the official inauguration ceremony was held in December 1972 at the same time as that of Kossou dam. Two roadsteads, Sassandra and Grand Béréby, had ceased to function before the ceremony, then finally Boubélé, the home base of the Krou's navigation activity, in April 1975.

Around 500 cargo ships of 6,000-ton class on average have been visiting the port per year. Much of the timber and its products, palm-oil, cacao beans, latex and coffee are exported from here, and necessary foodstuff like rice and wheat and industrial goods for local market have been imported. The port has an expansion plan to have 500ha of industrial zone and 200ha of commercial zone as well as that of port facilities such as anchoring and quay berths. Some of these expansion area overlaps the southern part of the Study Area.

(2) Road

Before the ARSO's presence, the road A-5, from the defunct Sassandra port to Tengrela, a border city to Mali, was the only south-north axis in the western part of Côte d'Ivoire. The paved road B-201 from San-Pédro which runs northward to join with National Highway A-5 at Tapeguia was completed by the initiative of ARSO. This new south-north artery, B-201 + A-5, was paved as north as Kani as of 1995. National Highway A-7, another one from Tabou, goes up along the western border to Odienne and beyond via Man. The western part of the paved coast road, 'la Cotière', between Fresco and Tabou, a westward extension of B-109, is another achievement of ARSO.

(3) Airport

There are three (3) airports: one (1) with paved runway in San-Pédro, and two (2) with earthen runway at Grand Béréby and Boubélé. There are two (2) landing strips in Sassandra and Tabou as ARSO visualized a potential for attracting tourists to the coast. San-Pédro airport has a 1,500 m runway and is regularly connected with Abidjan by 'Air Continental' Airlines. As of July 1998, it was operating a flight service of four return trips a week by a 16-seater Melan.

(4) Electricity

Electrification in the urban area is the norm in Côte d'Ivoire, but rare in the rural area. As of the end of 1997, only 1,760 rural districts out of around 10,000 were connected to the national grid. About 700 of these have been connected within the past three years, in which the village, Fahé, of the Study Area is included. Now, 250 additional districts will be connected in the coming three years. In and around the Study Area, Petit Pédro is included in the list along with Gabiaji and Tui on the road to Meaji, which is already connected. Along the coast to Grand Béréby, Baba and Gikla are in the list. This is the initial plan in the long-term rural electrification project in which 1,100 rural districts with 1.8 million people are envisaged to be linked to the grid, at a cost of F.CFA 50 billion (US$83 million of 1997 price), about US$ 46 per capita.

In Côte d'Ivoire, *Energie Electrique du Côte d'Ivoire* (EECI) installs the facilities, and *Compagnie Ivoirienne d'Electricité* (CIE) maintains them and manages the business of selling electricity. The present users have been contributing about 2 % of their payment for future rural electrification. As it costs the consumers F.CFA 80/kwh, only 31.4 % of population of San-Pédro could enjoy the utility as of 1997. Also in Fahé, the village which enjoys the benefit of new electrification, some of its economically sensitive inhabitants see battery charged TVs under kerosene lamps. A hydropower station of maximum 1,000 kw x 2 capacity was installed at San-Pédro dam and it is connected to the national grid. The station is affiliated to Buyo hydropower station.

(5) Water Supply and Sewage

La Société de Distribution d'Eau de Côte d'Ivoire (SODECI) is responsible for supplying potable water. Its San-Pédro branch extracts water from the San-Pédro River at the rate of 6,000 m^3/day at the 15 km point from its river mouth, and supplies with it to 30 % of the residents of San-Pédro City in 1997. The facilities were built by *Companie General d'Eau* (renamed to VIVENDI) which has built 35 water towers in Côte d'Ivoire since 1953. The customers experienced a supply restriction in certain period of February and March 1998, when a spell of exceptionally dry weather reduced the river flow in some parts to nearly zero. SODECI has a grand project of supplying potable water to 16 villages in the Montagnes Region, the northwestern neighbor of the Bas-Sassandra Region. The sewage system originally planned by the ARSO is a simple one. Open channel which flows through the main street, collecting the sewage flow from the both sides. In the rest of the area, it is individually treated.

(6) Communication

Before ARSO, there were only two telephone centers in the region, Sassandra, and Tabou. The regional head office of southwest of CI-TELCOM (*Côte d'Ivoire Télécommunication* - Côte d'Ivoire Telecommunication) inherits the area administered by ARSO. In the telephone directory of 1997, there were 1,312 listed subscribers in San-Pédro, 240 in Soubré, 168 in Sassandra, 104 in Tabou, 88 in Fresco, and 18 in Grand Béréby excluding those of the governments and the mayor's office. In the region administered by the regional office, there were 2,848 connections in 1995, that increased to 3,627 in 1998 with an average annual growth rate of 8.4 %. With installation of an '*organe de commande binaire*' with the capacity of 6,400 lines at San-Pédro Center with four satellite stations, it will become the center of the regional telephone networks. Two cellular telephone services are available in San-Pédro. As of 1997, about 6 % of the citizens of San-Pédro have an access to the telephone.

(7) Education

Côte d'Ivoire adopts the 6-4-3 system of education. Almost every village has '*école primaire*', The institutions of the next level, the first cycle of the secondary school, are found in most of the principal cities of the sub-prefectures. *Lycée* is the institution for the second cycle of the secondary school level. It is found in the principal cities of the departments except for Tabou. There is a *lycée professional* in San-Pédro, where mainly architecture and civil engineering are taught. The students are accepted only from those who finish the 'colleges techniques' (one in San-Pédro), which is equivalent to the first cycle of the secondary school. Higher educational institutions than the level of *lycée* including teachers' college (EMI) are only found either in Abidjan or in Yamoussoukro.

(8) Public Health

The Regional Directorate of Public Health manages all the clinical units in the region including the central hospital of the Region, which is located in San-Pédro and also administers all the matters related to public health in the region. There are departmental administrators under the regional directorate, does the same in the department. In Sub-prefecture of Grand Bérébi, there is an urban health center with a medical doctor, two nurses, and two mid-wives in the township of Grand Bérébi. In the sub-prefecture of San-Pédro, Gabiadji has a rural dispensary with a nurse and a mid-wife. Seven rural dispensaries are scheduled to build under present development plan in Sub-prefecture of San-Pédro, one of which is allocated to Blaou, a village

adjacent to the Study Area. In the rural area of the department of San-Pédro, both companies, SOGB and SAPH, which run rubber plantation, have a clinic with a medical doctor, and HEVEGO has a dispensary with a nurse.

The Regional Agencies for Public Hygiene depend on the Ministry of Health but are directly joined to the National Institute of Hygiene, and not to the Sanitary Districts. These agencies are responsible for vaccination of children at school, but also deal with salubrity problems. They participate to the National Program of Fight against Malaria within the field of anti-vectors actions. Public awareness actions as regards to the hygiene and sanitation matters are also initiated by these agencies. It is worthwhile to note that the human resources of the Regional Agency for Public Hygiene in San-Pédro is constituted of nine persons in total, of which only one technician for all the District, and no laboratory infrastructure.

2.2.3 Gross Regional Product (GRP)

The Gross Regional Product (GRP) of San-Pédro Region in 1996 was F.CFA 139.6 billion. If the import duties and export tax levied at the port are included, the amount came up to F.CFA 228.8 billion, which was a little bit above 4 % of GDP of Côte d'Ivoire. The per capita GRP of San-Pédro was estimated at F.CFA 840,000, twice as much as the national average according to ENSEA.

2.2.4 Land Use

Originally the region was mainly covered by the two different types of forest, i.e., 1) evergreen forest in the humid area in the west between the lower reaches of the Cavally River and the isohyete contour line of 1,900 mm (area of annual rainfall above 1,900 mm), and 2) semi-deciduous forest in the east and the north between the river Sassandra and the isohyete contour line of 1,800-1,900 mm. The intermediate forest was found in the middle. Then people started to come in and in 1988, cultivated land amounted to some 6,300 km^2, 24 % of the total area of 26,500 km^2. The ratio is four (4) % above the national average. Estimated land use of the region is given in the following table:

Category	Area (km^2)	%	Category		Area (km^2)	%
Total Area	26,417	100%	Cultivated land		6,295	100%
Cultivated land	6,295	24%	Family Farm**	Food crops	1,057	17%
Classified Forest	5,789	22%		Perennial	4,506	72%
National Park Tai*	2,770	10%	Plantation	Rubber	208	3%
Buyo Lake	270	1%		Oil-palm	472	7%
Other land	11,293	43%		Coco-palm	52	1%
			Perennial Crops		5,238	83%

Notes *: 60 % of Tai +70km^2 of N'zo
** 645000*80%/6.4= 80,625 household

2.2.5 Food Crops Production

There is an estimation of seven items of food crops in the departments of Sassandra and Soubré for 1984 and five crops in the above two departments in 1992 prepared by San-Pédro Antenna office of the OCPV as shown below:

(Unit :ton)

Year	Department	Paddy	Maize	Yam	Cassava	Groundnuts	Plantain	Taro
1984	Sassandra	40,000	13,000	24,200	117,000	240	32,000	5,400
	Soubré	7,200	11,000	24,300	119,000	250	29,000	5,600
	Total	47,200	24,000	48,500	236,000	490	61,000	11,000
1992	Total	45,000	52,250	70	10	na*	255	na

Source: AISA, ibid, 1993 *na= not available

If the data of 1992 are reliable, the interval of eight years had brought three patterns among the food crops production. Paddy production showed a weak decrease, maize production was doubled, and production of three other crops showed catastrophic decline. The causes of decline are not given, but it is quite clear that such food crops as yam, cassava and plantain have been brought from other regions.

2.2.6 Agricultural Household Economy

Table 2.2.1 shows the average farm household size in the region as 6.4 members (3.9 economically active persons). Average farm size is 6.9 ha. 81 % of the farm holding grow four cash crops; cacao, coffee, oil palm and coco-palm. 19 % grow two food crops; paddy and maize. Paddy is cultivated in three different natural conditions; i.e. upland, marsh and irrigated land. Food is almost self-sufficient. Besides those major crops listed in the table, they grow cassava, yam, taro, plantain and vegetables. Poultry and their eggs and goats are at their service. Manpower is also self-sufficient. Enough spare manpower to attend other work allows them to seek other income sources like fishing and commercial activities. In this way, income sources are diversified into two types.

The monthly income from the sale of the industrial crops and surplus food crops is about F.CFA 70,000. For reference, the poverty line as of July 1988 was estimated at a monthly income of F.CFA 94,600, in which more than 41 % accounts for food in the case of the poorer citizens in San-Pédro urban area.

2.2.7 Regional Development Plan

The founder of the modern south-west region is ARSO. It was founded in 1969 and resolved in 1980. It was established as the counterpart of '*L'Autorité pour l'Aménagement de la Vallée du Bandama*', which had been founded to solve the socio-economic problems caused by the creation of Kossou dam (800 km^2) on the middle reaches of the Bandama.

ARSO came into the region where people living were mostly the Krou with population densities of between one and six per km^2. For the Krou population, agriculture and navigation are inseparably bound with each other as a means of living. They engaged in agriculture of subsistent nature by using shifting cultivation method and navigation, which resulted in the sea-trader. However, with the advancement of modern technology, they had transformed themselves into nothing but the supplier of their own manual labor in the log export business at the small rudimentary open roadsteads of Tabou, Grand Béréby and Sassandra.

The area is presently under ARSO's control is 37,000 km^2, 40 % bigger than the present Bas-Sassandra Region. It includes such adjacent sub-prefectures as Fresco, Taï, and Guiglo. The

master plan was completed in February 1970, with forest resources, potentials of agriculture and industries taken into account. Agricultural development has three facades, i.e., industrial agriculture, family-size agriculture and animal production. 10,000 ha of rubber plantation was planned in Grand-Béréby by Michelin and 5,000 ha of rubber plantation with 9,000 ha of family size plantation in Bas-Sassandra by Goodyear; 20,000 ha of industrial plantation of oil-palm, around 10,000 ha of family size plantation and 2,500 ha of coco-palm plantation along the coast were also envisaged in the plan (1,500 ha for industrial and 1,000 ha for villagers size).

Then housing and land for agriculture for immigrants from Kossou region who were given priority to settle were prepared. 16 new villages were to be provided for the 20,000 to 40,000 of them. Immigrants from other areas would also be allocated to 28 to 45 villages. In the industry sector, development of sawing industry including the factory of producing flooring with the capacity of 100,000m^3 in San-Pédro and processing of palm oil and rubber were envisaged. A pulp mill with 200,000 tons capacity and a steel pellet mill using ore from the region of Man was also on the list of project formulation.

All the said plans, however, required the blessings of the people of Krou, the obliging host of ARSO. ARSO built an international deep-water port, to begin with, as the central pivot of the projects. ARSO then built the city of San-Pédro, adjacent to the port area. It consists of three topographically different zones, i.e., narrow coast, steep hill and mangrove grown marsh.

The recent external assistance a part of which have been allocated to the City of San-Pédro and its surrounding area are on the following chronological lists:

1) Regional level:
   i) 1988: F.CFA 450 million for the program of regional services aimed at repair of urban and communal roads financed by the World Bank,
   ii) 1991: for the program of electrification financed by BOAD,
   iii) 1993-1997: F.CFA 1.8 billion for the program of development of coastal communes,
   iv) 1993-1996: for the program of construction and rehabilitation of primary schools financed by AfDB,
   v) 1995: for the program of electrification financed by the French development fund, and
   vi) 1995-1997: F.CFA 13 billion for the construction of a fishery port, the major part of the fund were financed by JICA.

2) National level:
   i) 1995-1999: F.CFA 2 billion out of some 112 billion for the urban sector program, and
   ii) 1996-1998: F.CFA 11.2 billion out of some 1,100 billion for the program of public investment.

Seeing from the initial investment having been impressive, the present investment level even for maintenance, as is found from the above lists, has contrasted sharply, which one could feel from the apparent degradation of urban environment in the city.

Table 2.1.1 Major Economic Indicators of Côte d'Ivoire

Item	Unit	1990	1991	1992	1993	1994	1995	1996
Population	million	11.72	12.19	12.67	13.18	13.74	14.23	14.65
GDP (Market Price)	bil. F.CFA	2,939	2,960	2,952	2,947	4,256	4,988	5,474
GDP per Capita*1	US$	n.a.	n.a.	878	783	547	691	667
Exports, FOB	bil. F.CFA	963	819	744	933	1,571	1,926	2,228
Import, CIF	bil. F.CFA	797	799	830	814	1,409	1,782	1,439
Reserves	bil. F.CFA	n.a.	2.9	1.8	2.0	40.0	263.2	606*a
Total Public Debt	bil. F.CFA	3,267	3,568	3,899	4,280	7,731	8,070	20*b
Debt Service Ratio	%	18.5	23.4	23.7	21.0	23.9	24.2	19.7
Cocoa Production*2	1,000 ton	704	804	748	702	869	1,235	1,254
Coffee Production*2	1,000 ton	285	199	257	139	146	180	165
Exchange Rate (average)	F.CFA/$	n.a.	n.a.	n.a.	283	555	499	512
National Budget, Recurrent	bil. F.CFA	447	447	560	443	443	500	560
NB(*3), Development	bil. F.CFA	130	112	264	119	142	223	264
External Sources for NB Develop.	bil. F.CFA	51	52	90	55	61	101	90
External Sources / NB Develop.	%	39	46	34	46	43	45	34
NB Develop.-Agriculture Sector	bil. F.CFA	53	42	58	35	35	62	58
NB Agriculture / NB Development	%	41	37	22	30	24	28	22

Remarks : *a : million US$, *b : billion US$
Notes : *2: Crop Year begins on Oct.1st, *3 : National Budget
Source : INS, Memento Chiffer de la Côte d'Ivoire 1985-1995, *1 : BCEAO, INS, MINAGRA etc.

Table 2.1.2 Agricultural Production in 1994

Crop	Cultivated Area (ha)	Production(ton)	Yield(ton/ha)	Cultivated Area (%)
Cacao	1,800,000 **	868,965	0.48	31.2%
Coffee	1,385,000 **	296,171	0.21	24.0%
Oil palm	152,947	127,298	0.83	2.7%
Coconut	53,140	33,345	0.63	0.9%
Rubber	63,495	64,301	1.01	1.1%
Total Perennial Crop	3,454,582	-	-	59.9%
Sugarcane	19,985	1,200,345	60.06	0.3%
Cotton	21,298	258,343	12.13	0.4%
Total Industrial Crop	41,283	-	-	0.7%
Yam	260,000	2,824,000	10.86	4.5%
Cassava	245,000 *	1,564,000	6.38	4.2%
Taro	212,000 *	343,000	1.62	3.7%
Banana(Plantain)	133,000 *	1,276,000	9.59	2.3%
Maize	675,000 *	536,000	0.79	11.7%
Rice	545,000 *	701,000	1.29	9.5%
Sorghun/Millet	74,000 *	80,000	1.08	1.3%
Groundnut	127,000 *	138,000	1.09	2.2%
Total Food Crop	2,271,000	-	-	39.4%
Total	5,766,865	-	-	100%

Source: ANNUAIRE DES STATISTIQUES AGRICOLES, 1994, MINAGRA and FAOSTAT
Remarks: * FAOSTAT, ** MINAGRA Planning Department 1995

Table 2.1.3 Agricultural Production Target
Master Plan of National Agriculture (1992-2015)

(Unit : 1,000 ton)

Crops	Target Year					Annual Growth (%)	Required Action
	1995	2000	2005	2010	2015		
Coffee	250	320	360	400	400	2.0	Renewal of trees, Quality improvement, Expansion of lobster
Cacao	800	820	850	900	950	0.6	Reconstruction, Improve productivity
Oil Palm	250	239	235	230	232	0.0	Strengthen the competitivity, Self-sufficiency
Coconuts Oil	23	23	23	23	23	0.0	Value-add
Rubber	95	140	210	270	366	7.1	World market share 4% by year of 2010
Sugarcane	190	210	260	320	350	3.1	Self-sufficiency
Cotton	300	375	470	587	734	5.0	Increase productivity, Diversification of fiber and garments
Banana	217	267	329	404	496	4.2	Increase productivity, Improvement of infrastructure
Pineapple	269	481	601	751	1,032	6.5	Increase of productivity, Improve quality, Reconstruction, Increase market
Citrus for Juice	23	28	35	44	55	5.0	Expand manufacturing and export
Other Fruits	56	70	88	109	137	5.0	Production in off-production season, Expand manufacturing, Self-sufficiency expand export
Rice (Paddy)	1,171	1,609	2,260	2,990	3,990	9.0	Development of production potential, Free market, Combination of production and processing
Maize	553	645	737	875	1,020	3.0	Intensification, Storage
Other cereals	80	90	100	110	120	1.9	Research & Development
Yam	2,530	2,805	3,120	3,445	3,818		Storage, marketing, processing, production during off-production season
Cooking Banana	1,400	1,843	2,180	2,685	3,343		Storage, marketing, processing, production during off-production season
Cassava	1,678	1,710	2,050	2,420	3,600	2.8	Manufacturing, Production near to the consumption
Groundnuts	162	195	224	255	297	3.3	Spreading area, Intensification, storage, marketing, manufacturing and production during off-production season
Vegetables	526	648	781	890	1,040	6.6	Self-sufficiency, Expand export

Table 2.1.4 Plan of Boosting Paddy Production

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	AAGR*2
Consumption	Paddy (1,000 ton)	1,724	1,791	1,861	1,933	2,008	2,087	2,168	2,252	2,340	2,431	3.9%
	Rice*1 (1,000 ton)	862	896	930	967	1,004	1,043	1,084	1,126	1,170	1,216	0.5
Estimated Production Growth without Project	Total Weight (1,000 ton)	868	903	939	976	1,015	1,055	1,097	1,141	1,187	1,234	4.0%
	Rainfed (1,000 ton)	799	831	864	898	934	971	1,010	1,050	1,092	1,135	4.0%
	Irrigated (1,000 ton)	69	72	75	78	81	84	88	91	95	99	4.1%
	Total Area (1,000 ha)	592	616	640	666	692	720	749	778	809	842	*3
	Rainfed (1,000 ha)	571	593	617	642	667	694	721	750	780	811	1.4
	Irrigated (1,000 ha)	22	22	23	24	25	26	27	29	30	31	3.2
Deficit of Paddy without Project	Paddy (1,000 ton)	856	888	922	957	994	1,031	1,070	1,111	1,153	1,197	3.8%
	Rice*1(1,000 ton)	428	444	461	479	497	516	535	556	577	599	0.5
Estimated Production Growth with Project	Total Weight (1,000 ton)	1,050	1,136	1,230	1,333	1,447	1,573	1,713	1,868	2,042	2,236	8.8%
	Rainfed (1,000 ton)	966	1,034	1,108	1,186	1,270	1,360	1,457	1,560	1,671	1,789	7.1%
	Irrigated (1,000 ton)	84	101	122	147	177	213	256	308	371	447	20.4%
	cycle/year*4	1.25	1.27	1.30	1.32	1.34	1.37	1.39	1.42	1.44	1.47	1.8%
Unit Yield	Rainfed (ton/ha)	1.50	1.54	1.59	1.63	1.68	1.73	1.78	1.83	1.89	1.94	2.9%
	Irrigated (ton/ha)	3.20	3.35	3.50	3.66	3.82	4.00	4.18	4.37	4.57	4.78	4.6%
	ton/ha/cycle	2.56	2.63	2.70	2.77	2.85	2.92	3.00	3.08	3.17	3.25	2.7%
	Average (ton/ha)	1.57	1.62	1.68	1.74	1.81	1.87	1.95	2.03	2.11	2.20	3.9%
Area	Total Area (1,000 ha)	670	700	732	766	802	839	879	922	967	1,016	4.7%
	Rainfed (1,000 ha)	644	670	697	726	755	786	818	851	886	922	4.1%
	Irrigated (1,000 ha)	26	30	35	40	46	53	61	71	81	94	15.2%
Irrigated Area with Two Crops	Irrigated (1,000 ha)	21	24	27	30	34	39	44	50	56	64	13.1%
	Annual Increase		3	3	4	4	5	5	6	7	7	
Deficit of Paddy without Project	Paddy (1,000 ton)	674	655	631	600	562	514	455	384	298	195	-12.9%
	Rice*1 (1,000 ton)	337	328	316	300	281	257	228	192	149	98	0.5
Gains by Saving Rice Import	Paddy (1,000 ton)	182	233	291	357	432	518	615	727	855	1,002	20.9%
	Rice*1(1,000 ton)	91	117	145	178	216	259	308	364	428	501	0.5
	Saving*5(billion CFA)	20.7	26.4	33.0	40.5	49.0	58.8	69.8	82.5	97.1	113.7	227

Notes : *1: Paddy x 0.5 *2: AAGR= Average Annual Growth Rate
*3: Estimated Unit Yield *4: for irrigated crop
*5: Unit price per ton= F.CFA 227,000: 1997, CIF Abidjan.

Source: MINAGRA/PNR, 'Plan de Relance de la Riziculture', 1997

Table 2.1.5 Recent Project on Irrigated Rice Production

Type	Area Name*1	Project Area (ha)	Financial Sources	Amount (million F CFA)	Duration	Initial Year	Program of Creating Paddy Field (ha)						Program of Creating Paddy Field (million F CFA)					
							1996	1997	1998	1999	2000	Total	1996	1997	1998	1999	2000	Total
Rehabilitation	Riz-N	1,890	GTZ/KFW/CI	3,910	6	1994	315	315	315	315		1,260	652	652	652	652		2,608
	C/ C-N	1,384	FED/CI	5,711	5	1996		346	346	346	346	1,384		1,428	1,428	1,428	1,428	5,712
	Sub-Total	3,274		9,621			315	661	661	661	346	2,644	652	2,080	2,080	2,080	1,428	8,320
New installation	Guiguidou*2	442	China/CI	5,400	4	1995	71	181	190			442	867	2,211	2,321			5,399
	C/ C-N	768	FED/CI	6,163	5	1996		192	192	192	192	768		1,541	1,541	1,541	1,541	6,164
	S-O	645	HCR		3													
	Tanda	280	BOAD/CI	649	5	1997		93	93	93		279		216	216	216		648
	Bond./Bouna	2,040	BOAD/CI	305	5	1996		510	510	510	510	2,040		76	76	76	76	304
	O/ Man	3,839	BAD/CI	16,558	5	1994		960	960	960	960	3,840		4,140	4,140	4,140	4,140	16,560
	Sub-Total	8,014		29,075			71	1,936	1,945	1,755	1,662	7,369	867	8,184	8,294	5,973	5,757	29,075
Support	Input	KR II	JICA/CI	12,500	5	1996							2,500	2,500	2,500	2,500	2,500	12,500
Grand Total		11,288		51,196			386	2,597	2,606	2,416	2,008	10,013	4,019	12,764	12,874	10,553	9,685	49,895
Studies	C/Locakpli	126	JICA/CI	2,725	2	1997		63	63			126		1,363	1,363			2,726
	C/O:rehabil	1,500	CFD/CI	1,659	3	1997		500	500	500		1,500		553	553	553		1,659
	C/O:new	500	CFD/CI	1,500	3	1997		167	167	167		501		500	500	500		1,500
	Bond./Kpoda	250	yet to be decided	2,894	3	1998			83	83	83	249			965	965	965	2,895
	C/C-O:N'zi	453	JICA/CI	7,114	3	1998			151	151	151	453			2,371	2,371	2,371	7,113
	C/C-O:N'zi	4,185	yet to be decided	35,234														
	Bou/Sirasso	1,800	yet to be decided	20,000														
	Riz Savanes	2,066	Kuwait	11,300														
	Total	10,880		82,426				730	964	901	234	2,829		2,416	5,752	4,389	3,336	15,893

Notes : *1: N=Nord, C=Center, S=South, O=Ouest. *2: refer the text, 2.1.3 (7)

Souce: MINAGRA/PNR, DOCUMENT TECHNIQUE ANNEXE ALA COMMUNICATION EN CONSEIL DES MINISTRES, 1997

Table 2.1.6 Irrigated Rice Cultivation Plan and External Assistance

(Unit : ha)

	Rehabilitation							New Installation						
Area in ha	1996	1997	1998	1999	2000	Total	%	1996	1997	1998	1999	2000	Total	%
Plan	4,000	4,000	4,000	4,000	4,000	20,000		4,300	4,300	4,300	4,300	4,300	21,500	
Financed	315	661	661	661	346	2,644	13%	71	1,936	1,945	1,755	1,662	7,369	34%
Yet financed	3,685	3,339	3,339	3,339	3,644	17,346	87%	4,229	2,364	2,355	2,545	2,638	14,131	66%
Ready to be Financed	0	500	500	500	0	1,500	8%		230	464	401	234	1,329	6%
Finance to be sought	3,685	2,839	2,839	2,839	3,644	15,846	79%	4,229	2,134	1,891	2,144	2,404	12,802	60%

Table 2.2.1 Regional Agricultural Household Economy

Department*1		SS	SB	SP	TB	Average		P*/ha	L**/ha	IP*/ha	P***	L*	IP*	Pr*/kg	Income
Farm/household		6.4	7.1	6.1	8.2	6.9 ha	ha	ton	m-d*	CFA	ton	m-d*	CFA	CFA	CFA
Cacao		42	63	68	64	59.6 %	4.1	0.4	50	12,000	1.65	206	49,423	364	550,238
Coffee		30	10	14	7	14.6 %	1.0	0.4	48	5,500	0.40	48	5,549	416	162,328
Oil palm		4	2	0	16	6.1 %	0.4	5.7	n.a.	n.a.	2.43	-	-	20	47,411
Coconuts*2		2	0	2	0	0.9 %	0.06	1.5	n.a.	n.a.	0.09	-	-	110	10,238
Paddy	irrigated	0.4	0.9	0.2	0.0	0.4 %	0.03	2.5	210	18,000	0.06	5	456	100	5,884
	marsh	1	1	3	0.2	1.2 %	0.1	1.6	180	0	0.13	15	0	100	13,296
	up-land	14	18	8	9	12.2 %	0.8	1.6	180	0	0.38	152	0	100	38,466
Maize		7	5	5	4	5.2 %	0.4	2.2	110		0.47	39		40	18,631
		100	100	100	100	100 %	6.9					466			846,492

*1: SS = Sassandra, SB = Soubre, SP = San-Pédro, TB = Tabou
*2:coprah

*:P = Production, L = Labour, m-d = man-day, IP = Input, Pr = Price
**: < max. 200*3.6 = 720
***:-auto consumption;

Source: AISA, ibid, 1994 (@upland paddy:100kg/0.66+maize:50kg)*6.4

CHAPTER 3: THE STUDY AREA

3.1 General

3.1.1 Location and General Features

The Study Area spreads mainly to the left bank of the lower reaches of the San-Pédro River below the San-Pédro dam which is located at about 49 km from its newly diverted mouth excavated by ARSO. In the upper part of the area, three tributaries, the Niré, Kpohou and Gonou, flow through the Study Area and join the San-Pédro River at 38 km, 37 km and 25 km each, along which the marshy land dominates the terrain.

In the middle part, the paved road from San-Pédro to Soubré makes the eastern border of the Study Area. Several villages are located along the road, which attract people from the bush for the benefit of closeness not only to markets but also to the modern facilities of education and public health. The village Petit Pédro, for example, has moved from its old site at the mouth of the Brimé river. Here, close to the national road, IDEFOR owns 715ha of hilly area to run a demonstration farm with nurseries and training facilities. Just below the confluence of the San-Pédro and the Gonou rivers located a pumping station, which used to supply water to the abandoned irrigation area of some 330 ha when the new village of Cité Agricole was founded. From here downward alluvial plain spreads out.

In its lower part, starting from the intake of the water supply to the San-Pédro city at 15 km, the Study Area includes some patches of paddy fields on the right bank. Here the Study Area crosses the northern boundary of spontaneously extended urban area of the San-Pédro city.

3.1.2 Administration

There are ten villages in and around the Study Area. Three villages in the upper part of the area belong to San-Pédro Sub-prefecture, and the rest to San-Pédro Municipality. Among the villages outside the Study Area, the Study has focused only those which have either a branch village or some of their residents have farm lands in the Study Area. Chief of the village governs the village seconded by the village council, and represents the village. Its authority extends to its branches.

3.1.3 Population

Table below gives the population of the Study Area in 1988 and an estimate for 1997. In nine years between 1988 and 1997, different villages had shown different population growth rates. The average annual growth rate of population in San-Pédro Municipality was 7.6% on average.

	1988	1997	AAGR*		1988	1997	AAGR*		1988	1997	AAGR*
Bernard	1,888	2,713	4.1%	Petit Pédro	1,195	1,717	4.1%	San-Pédro City	77,153	149,300	7.6%
Cite Agricole	400	497	2.4%	Poro	72	107	4.5%	Blaou	2,162	3,828	6.6%
Ivobois	267	384	4.1%	Others	2,646	6,800	11.1%	Fahe	72	1,036	34.5%
Grand Gabo	41	59	4.1%	Rural Area	6,594	12,800	7.6%	Scaf	1,722	2,520	4.3%
Petit Gabo	85	523	22.4%	Urban Area	70,559	136,500	7.6%				

* Average Annual Growth Rate

Source: 1988: Year-Book, Bureau du Sous-Prefecture San-Pédro

Source: 1997:ICEF,ENSEA, ibid, 1998

Source: 1997:Bureau du Sous-Prefecture San-Pédro

3.2 Natural Conditions

3.2.1 Topography

The area is divided generally into two (2) categories; hilly areas with small and low valleys and low-lying flat areas. The hilly areas have many narrow and small valleys, and usually the bottoms of such valleys are suffering from poor drainage. The slope of the hilly area is used for tree crop cultivation such as coffee and cacao. The elevations of hilly area reaches 50 to 60m. The following three (3) flat plains are identified in the Study Area as illustrated in Fig. 3.2.1.

- The flat plain area of about 700ha extending in the southern part of the Study Area, which has been used for the paddy cultivation under the San-Pédro Paddy Project. The plain shares about one-fourth of the Study Area, and includes the suburb of the San-Pédro city. The plain is considered generally flat with a mild undulation from 3.5 to 8 m. Most of this plain is considered to be flood-prone area because of its low elevation.

- The plain of about 100ha situated near the Cpt. Colonel village, which is covered mainly by the forest and upland fields. A part of the plain is occupied by the depression of drainage from the hilly area situated east of this plain to the San-Pédro river. The elevation of this plain varies from 10 to 12 m.

- The plain of about 400 ha extending downstream the San-Pédro dam. The southern end of this plain is low and the drainage route of the Nire and Kpohn rivers runs through this plain so that the southern part of this plain is considered to be flood-prone area. The elevation of this plain varies from 13 to 15m from south to north.

3.2.2 Geology and Groundwater

(1) Geology

The San-Pédro river basin area belongs to the Sasca domain, which is separated from the Man domain by a major fault lying on the west of the San-Pédro area. The domain of Man is slightly affected by the Eburneen orogeny of Precambrian and is then mainly constituted of materials presented before such movements, classified as the Liberien materials. The domain of Sasca, to which the San-Pédro area belongs, has been largely reshaped by the Eburneen orogeny, characterized by violent tectonics with formation of geosynclines. The belonging to the Sasca domain explains the presence of two (2) major groups of materials in the area, namely those of the Liberien megacycle made of granite and granodiorite, and those of the Eburneen magacycle made of micashist, schist and quartzite (flysh formation which belongs to the Birrimien formation).

The San-Pédro river basin area lies mainly on the old Antecambrien substratum of the Liberien orogenic stage, which has then remained stable, and partly on the substratum of the Eburneen orogenic stage, which has followed the latter, on its extreme south part. The Liberien substratum presents some oriented intrusion, like NW-SE oriented dykes of magmatic materials (dolerite), apparently organized according to the distortions of the Liberien sustratum, and due to the existing rock joints that are contemporary of the Hercynien tectonics. It is possible that these intrusions have determined some morphological features, specially NW-SE orientation of the San-Pédro river, downstream.

The overall geological structure is, however, covered with more recent materials, especially those of lateritic nature, due to the climatic effects of the Quaternary period. This laterite cover is between 20 and 50 m in the southwest region. Cover materials also include the Tertiary deposits (pieces of these sediments can be found in the extreme south of the river basin) and the Quaternary fluvial deposits that can be found along the main riverbeds downstream, in the San-Pédro plain.

(2) Groundwater

There exist 31 tubewells constructed in 23 villages scattered in and around the Study Area under the rural water supply schemes of the Ministry of Economic Infrastructure. These wells are constructed to utilize the fissure water in the granite zone extending widely in the area, and their target fractures are suited 20 to 40 m deep. The depths of these wells vary from 36 to 88 m with an average depth of about 59 m.

The results of pumping tests conducted during the construction of tubewells show that the optimum yields are within the range from 0.5 to 11.0 m^3/hr and an average is calculated as 3m^3/hr. It is considered hardly possible to utilize the groundwater for irrigation development of the area, but is available for the rural water supply. As for the water quality, the iron content is considered high exceeding the allowable range in most of the tubewells in the area.

There are a lot of open wells, used by private farms and communities in the villages. The depths of wells are less than 10m in most of the wells, and seasonal variation of the well water is so large that no well water is available during the dry season according to the interview survey. According to the well survey on seven (7) and 16 wells in the Cité Agricole and the Grand Gabo villages, the pH values of the private well water are within the range from 4.0 to 5.0, and the electric conductivity varies from 100 to 300 μS/cm.

3.2.3 Meteorology and Hydrology

(1) San-Pédro River Basin and San-Pédro Dam

The San-Pédro river, total length of which is measured to be about 150 km, originates in the west of the Taï National Park, and flows in the Rapide Grah Classified Forest Area toward south-eastern direction. At about 78km point from the river mouth, the Go river joins the San-Pédro river. The San-Pédro river runs southward and flows into the San-Pédro dam reservoir, which is located about 50km from the river mouth. The river further flows southward along the western edge of the Rapide Grah Classified Forest Area to the point near the intake of the San-Pédro municipal water supply system (SODECI Pump Station). The San-Pédro river flows along the northern and eastern side of the San-Pédro city area flowing into the Gulf of Guinea about 2.5 km west of the city. The total catchment area of the San-Pédro river basin is measured to be about 3,340 km^2.

The San-Pédro dam located near the Fahé village was constructed in 1980 in order to utilize the San-Pédro river water for the irrigation of downstream farm land, the municipal water supply of San-Pédro and the industrial water supply for the pulp and iron factories to be promoted near the dam site. However, since the planned industrial development was not realized, a hydropower station was additionally constructed in 1983, and its operation was started in November of the same year.

The capacity of the dam reservoir is 56.97 million m^3 (MCM) at the high water level (HWL: 23.10 m) and 24.96 MCM at the top of the spillway crest (FWL: 20.80 m). The crest elevation of concrete spillway was heightened by 0.8 m to utilize the reservoir water efficiently when the hydropower station was constructed. An irrigation water outlet of circular section and a blow-off of square section are provided in the center pillar of the spillway. An intake structure was installed for the industrial water supply, but it has never been used since the construction of the dam. The intake structure of the hydropower station is constructed at the south end of the dam.

(2) Meteorological and Hydrological Situations

1) Meteorological and Hydrological Networks

There are six (6) meteorological and three (3) hydrological observation stations in and around the Study Area, and there are three (3) river-water-gauging stations in the San-Pédro river as shown in Fig. 3.2.2. Various meteorological and hydrological data and information on these stations have been collected for the hydraulic analysis of the Study.

2) Meteorology

The Study Area belongs to the tropical rain forest climate zone, which is characterized by abundant rainfall of 1,360 mm and constant high temperature of 26.3°C throughout the year. There are two (2) meteorological stations in the Study Area; the IDEFOR (San-Pédro) and the San-Pédro Airport stations located north and south of the area, respectively. The monthly mean values of meteorological parameters observed are shown in the table below and Fig.3.2.3:

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
San-Pédro(1984-1997)													
Rainfall (mm)	19.0	24.8	60.2	94.1	273.3	383.2	107.4	63.5	56.5	114.0	128.5	54.7	1,379.1
Rainy Days (day)	2.3	2.8	5.9	8.7	17.6	20.4	12.2	13.7	13.6	14.3	13.2	6.8	131.6
Temperature (°C)	26.7	27.4	27.5	27.6	27.0	26.0	25.1	24.9	25.4	26.1	26.5	26.4	26.4
Relative Humidity (%)	81.0	81.9	81.8	83.1	85.3	87.2	85.6	87.7	87.6	86.4	85.7	83.4	84.7
Sunshine Hours (hr/day)	4.9	5.6	5.3	6.1	5.2	3.3	3.5	3.1	3.7	5.9	6.3	4.9	4.8
Wind Velocity (m/sec)	2.6	2.8	2.9	2.8	2.5	2.7	2.9	2.9	3.0	2.8	2.6	2.2	2.7
IDEFOR-San-Pédro Satiation (1972(75)-1997)													
Rainfall (mm)	17.5	48.3	82.9	108.0	239.7	366.0	91.4	66.5	76.2	128.4	90.3	38.8	1,351.1
Temperature (°C)	26.5	27.2	27.7	27.5	27.0	25.7	24.8	24.7	25.4	25.7	26.4	26.3	26.2

Sources : SODEXAM, Jul. 1998 and IDEFOR San-Pédro Station

3) Hydrology

The variation of monthly mean discharge observed at the gauging stations of Fahé and the SODECI Pump Station is tabulated below:

(Unit: m^3/s)

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Fahé (2,127 km^2)													
(1983-96)	3.55	3.26	7.66	12.03	23.11	52.85	23.96	23.70	29.99	37.41	19.99	9.17	20.56
Municipal Water Pump Station (3,300 km^2)													
(1969-96)	13.28	17.09	15.49	19.28	36.25	93.79	57.88	27.14	39.00	51.62	44.57	19.28	36.22
1969-79	14.73	16.39	15.43	18.69	39.10	115.50	64.03	24.91	40.52	51.81	48.09	18.64	38.99
1980-96	12.60	17.46	15.53	19.55	34.65	84.84	54.43	28.40	38.34	51.50	42.70	19.64	34.97

The river discharge also varies as the same pattern as that of the rainfall, having the peaks twice in June and October since the hydropower station at the San-Pédro dam started its operation in 1983. The monthly mean discharges of the municipal pump station are calculated before 1979

and after 1980 as shown in the above table. The mean discharge before 1979 is larger than those after 1980. This decrease may be caused by the decreased rainfall volume since 1950s.

The specific discharges of annual mean are calculated to be 0.010$m^3/s/km^2$ and 0.011$m^3/s/km^2$ for the gauging stations of Fahé and the municipal water pump station, respectively. The recorded maximum flood discharges are 252 m^3/s for Fahé (June 19, 1988) and 443 m^3/s for the municipal water pump station (July 2, 1970).

(3) Water Right and Water Users

The surface water of the San-Pédro river basin is at present used for the municipal water supply and the electric power generation as described below:

1) Water Users

Industry

When the San-Pédro dam was constructed, the water of 4.9 m^3/s was planned to be allocated for the industrial purpose such as pulp and ironworks factories. No industrial development was, however, realized since then. Any promotion of new industry in the San-Pédro city area has not been informed so far, and there may be no necessity to consider the industrial water allocation.

Irrigation

The irrigation pumping station was constructed in 1976 to supply the water to the irrigation area of the Cité Agricole Rice Project Area (450 ha from 1973 to 1977 and 650ha from 1977 to 1979) extending in the southern part of the San-Pédro plain. The pumping station has three (3) units of diesel-engine-driven pump with a total lifting capacity of 0.7 m^3/s. This pumping station functioned until the beginning of 1994. Apart from this pumping station, there were four (4) small pumping stations along the San-Pédro river to supply the irrigation water to those small flat lands. All of them were abandoned and have been left unused to date. In the feasibility study of the San-Pédro dam, the discharge rate of 0.37 to 1.54 m^3/s was allocated for irrigation water supply.

Municipal Water Supply

During 1970s, the pumping station was constructed on the right bank of the San-Pédro river for the municipal water supply of San-Pédro. The water treatment plant with a production capacity of 6,000 m^3/day was also constructed near the pumping station. According to the SODECI's operation record of the treatment plant, the plant produces 4,500 to 5,000 m^3/day (about 0.06 m^3/s) of water at present. The discharge rate of 0.5 m^3/s was allocated for municipal water supply in the feasibility study of the San-Pédro dam in 1977.

Electric Power Generation

The power generation was commenced in November 1983 and stopped in June 1985 due to the mechanical trouble. No power generation was made except for the period from 1988 to 1991, and in 1997 when its operation was re-started. Two (2) turbine generators are installed in the station, and the discharge of 30m^3/s/unit is required for their operation in maximum. The generator operation is stopped when the reservoir water level becomes below 19.55m. The hydropower station is operated and managed by Ivorian Electric Company (CIE), including operation of the San-Pédro dam.

2) Water Right and Charge

There is no system for collection of water charges in the country. In the San-Pédro river basin also, no water charge has been collected so far, and the operation of dam is made by CIE depending only on the electricity demand, since the irrigation water supply was stopped in 1994. In 1996, the Office of High Commissioner for Hydraulics (HCH) was established in order to realize the appropriate and fair water resources management in river basins of the country. The establishment of the appropriate water allocation system (water right) and the proper collection system of water charge is considered to be one of the most important HCH's functions.

3) Technical Consulting Committee on Water Use of San-Pédro Dam

The first meeting of the Technical Consulting Committee on Water Use of San-Pédro Dam (the Water Committee) was held in San-Pédro on July 29 1998, the second one on December 14, 1998 and the third one on June 28 1999. The organizations concerned to the water resources utilization of the San-Pédro river basin were invited to the Committee's meeting, and the discussions on various aspects were made among the attendants. Subsequently, the following issues are confirmed, i) the importance of municipal water supply and the environmental protection of the Rapide Grah Classified Forest Area, ii) the role of Water Committee as the government body on determining the optimum use of the dam water, iii) the priority order of municipal water supply, irrigation and power generation from the top, and iv) formulation of regulatory measures for the San-Pédro dam operation among the agencies concerned under the charmanship of HCH. The related documents are presented in Databook of the Report.

(4) Hydrological Analysis

1) Available Surface Water Resources and Water Allocation

The present water allocation at the SODECI pump station is presented in the following table on monthly average basis:

(Unit: MCM)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Run-off Volume	35.56	41.34	41.50	49.97	97.10	243.09	155.03	72.69	101.10	138.25	115.51	51.63	1,143
Municipal Water	0.16	0.14	0.16	0.15	0.16	0.15	0.16	0.16	0.15	0.16	0.15	0.16	2
Irrigation	1.75	0.93	1.79	1.52	1.26	0.55	0.86	0.38	2.13	1.25	1.23	1.23	15
Balance	31.90	39.34	37.76	46.77	94.42	241.84	153.15	71.77	96.69	135.59	112.90	49.01	1,126

In the above table, the municipal water supply volume of two (2) MCM is estimated based on the present daily production of 5,000 m^3, and the irrigation water supply volume of 15 MCM is estimated based on the operation records (1981) of the existing irrigation pumping station kept by ANADER. The annual runoff of 1,143 MCM seems to be enough to fulfill the demands of the municipal and the irrigation water supplies on the monthly average basis. Since the hydropower generation has been made intermittently, it is not included in the above table. Most of the balance volume is used for the power generation, when the water is available in the dam.

As for the dam reservoir capacity, it is 24.96 MCM at the crest elevation (20.80 m) of the dam spillway, and this volume of water is considered enough to provide the supplemental water for the irrigation and the municipal water demand even during the dry season. A simulation analyses have been conducted to grasp the drought run-off of the river basin, and the drought run-off of 80% probability (5-year return period) has been worked out on monthly basis as tabulated below:

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total/Ave.
San-Pédro Dam													
Discharge (m³/s)	3.7	3.3	6.2	10.5	12.0	26.8	14.4	13.3	21.3	22.8	16.1	7.3	13.1
Run-off Vol. (MCM)	10.0	7.9	16.6	27.2	32.3	69.5	38.6	35.5	55.3	61.2	41.7	19.5	415.2
SODECI Pump Station													
Discharge (m³/s)	5.7	5.1	7.5	11.9	15.2	43.0	18.7	16.9	23.3	25.3	17.6	8.4	16.5
Run-off Vol. (MCM)	15.4	12.4	20.0	30.9	40.7	111.3	50.0	45.4	60.4	67.8	45.5	22.5	522.2

The annual run-off volume of 5-year return period is calculated to be 415.2 MCM and 522.2 MCM for the San-Pédro dam site and the SODECI Pumping Station, respectively. The run-off volume of the whole catchment area is calculated to be 527.2 MCM. It is important to utilize the reservoir water of the San-Pédro dam effectively especially during the dry season from December to March.

2) Present Capacity of San-Pédro River and Flood Discharge

The flood discharge of the San-Pédro river is worked out based on the available discharge records, and the following results are obtained:

(Unit: m^3/s)

Return Period	Fahe Station	SODECI Pump Station	San-Pédro Dam	River Mouth	Junction with the Kre River
1/100	353.1	545.6	402.9	552.4	435.0
1/50	324.0	503.4	369.7	509.6	399.3
1/20	284.8	444.9	324.9	450.4	351.1

The flow capacity of the San-Pédro river is examined by non-uniform flow calculation. As a result, it is confirmed that the river has the maximum capacity to convey the run-off water with the discharge of 100 to 150 m^3/s. The capacity increases gradually toward upstream of the river, and it reaches 450 m^3/s at the 33 km point from the river mouth near Cpt. Colonel. The results of tide analyses for the San-Pédro port reveals that the mean spring high tide is so high as 0.97 m that most of the lagoon area extending in both sides of the downstream reach is inundated only by high tide.

The location of the river-mouth of the San-Pédro river was changed during the construction of the San-Pédro Port as well as the river flow is controlled by San-Pédro Dam and the operation of hydropower station. As a result, every year the river-mouth is clogged during low water stage in dry season (December to March) together with strong sand drift. It sometimes causes inundation in lower reaches even under small intensity rainfall.

3) Saline Water Intrusion, Sediments and Water Quality

The river stretch from the river mouth to the SODECI Pumping Station is found to be the tidal compartment. According to the survey conducted by ORSTOM in 1960s the saline water intrusion effects are considered to reach upto the bridge of the San-Pédro - Soubré national road, which has been confirmed by the water quality analyses carried out for the Study.

There exists neither data nor record on the sediment load in the rivers. But a load factor of $27m^3/km^2/year$ is applied for the San-Pédro Dam in the feasibility report on the construction of the San-Pédro Dam in 1977. Since the river water decreases in the dry season from December to March, the mouth of the San-Pédro river is frequently clogged due to the sediment effects of a strong tidal flow from the Gulf of Guinea. Once the river mouth is clogged, the river water level

increases until such sediments are flushed away in the next rainy season, and the most of the low lying areas along the downstream of the San-Pédro river are inundated. The farmers who have the land being suffered from such inundation remove the sediments by themselves. As discussed earlier, the change of the river course during the construction of San-Pédro Port is considered as one of the causes to this phenomenon.

As per the water quality analyses, the San-Pédro river water is found to be a little bit acidic and contain more general bacteria and iron ion, but is considered to be of acceptable quality for domestic and irrigation water supplies. As described above, however, since the saline water intrusion is confirmed in the downstream stretch along the northern edge of the San-Pédro Municipality area, it is necessary to pay careful attention to the manner of water intake such as timing of intake and location of intake facilities.

3.2.4 Vegetation and Soils

(1) Vegetation

The vegetation in the Study Area is classified to be tropical lowland rain forest, and was covered with the tropical rain forest as same as Rapide Grah Classified Forest and Tai National Park. Since the development of the region, more than 50% of the Study Area have been cultivated mostly by the immigrants. Natural forest remains mainly in IDEFOR area (300ha) and spreads to some part of hills and swampy areas of lowland near the San-Pédro river and other tributaries. The grassland spreads in the swampy area mainly at the upper reaches of the Kpohou river (120ha) and Ganou river (35ha). They are included in the abandoned shifting cultivation area. In the tidal swamp area (600ha), near the estuary of San-Pédro river, mangrove (mainly *Rhizohora, Avicennia sp. and Pandanus spp.*) is found.

(2) Soils

According to the Soil Map of the World (FAO/UNESCO, 1973), the Study Area is classified as Ferric Acrisols. Futhermore, soils in the Study Area can be divided mainly into 1) ferratic soils on hills, 2) hydromorphic collvium soils in lowland area lying on the foot of the hills and 3) alluvial soils in the plain of San-Pédro and its tributary.

In 1968, Office for Overseas Technical and Scientific Research (ORSTOM) made the reconnaissance soil survey for confirming the agricultural potential development in the Study Area. The reconnaissance morpho-pedological survey of the remaining area of the Study Area, except for Port Authority Expansion Area covering 6,000ha, was conducted by the Pedology Center of National Bureau for Technical Study for Development (BNETD) under the supervision of JICA Study Team. The survey included the confirmation of soil physical and chemical properties in the above ORSTOM surveyed San-Pédro Paddy Project Area. ORSTOM classified the San-Pédro Paddy Project Area into six soil groups. BNETD has prepared pedolo-morphological map covering 6,000 ha of additional survey area and the area surveyed by ORSTOM. BNETED has classified the area into 13 morpho-pedological groups as shown in Fig. 3.2.4. Most of soils in the Study Area are acid soil with pH ranging from 4.4 to 5.5 because their parent material is granite and are formulated under the tropical forest conditions. Organic nitrogen content and effective phosphate present in the soil are low and hence need to be supplied as fertilizer for the agricultural development. Major soil type is lowland soil (US-s and UC-g, covering 30% of total area) - clayey sand colluvial soils sedimented on the basic foundation. The secondary major soil type is Alluvial plain and large lowland soils which are

clayey-muddy deep soil and semi-permanent clogging in nature. Soil type of UC-27c (19%) and UC-19 (12%) are residual soil on the rather steep slope of convex, fertile sandy clay having the risk of erosion. These soil have high potential for agricultural development and as reasonably, the first two soils are used for paddy cultivation, and the third one is used for tree crop cultivation. The details are shown in the Supporting Report.

3.3 Social Conditions

3.3.1 Population and Ethnic Composition

As a result of the continuous flow-in of immigrants, the Study Area has the diversified social structures characterized as "multiethnic" and "multicultural", as shown in the table below:

	Nationality	Ethnic group	Religion	Staple food
Indigenous	Ivory Coast	Kourmen, Bakoué, Wané	Christian (Harriste)	Rice
Immigrant		Baoulé, Gouro, Yacouba, etc.	Christian, Animist	Yam, Cassava
		Diola, Sénoufo, Lobi, etc.	Muslim	Maize
	Burkina Faso, Mali, Guinea, etc.	Mossi, Songhai, Dogon, etc.	Muslim, Christian	Millet, Maize

Since 1968, the roads passing through the jungle have been constructed in the Study Area. It has facilitated some nearby indigenous families to move into the area and new villages have been created along the roads. Consecutively many people have immigrated into this area from not only inside but also outside of the country with the reasons summed up below, then the city of San-Pédro and surrounding villages have expanded progressively.

Situations of emigrant areas	Situations of immigrant area
<Common factors> Lack of cash income sources **<Central part of the country>** Exhaustion of existing industrial crops' plantations (coffee, cacao, etc.) and lack of arable land for them **<Northern part of the country and neighboring countries>** Poverty and uneasiness at the life based on rainfed food crops' cultivation (maize, millet, etc.)	– A large quantity of employment created by Development Project of the southwest Region (such as construction of roads, port, dam, etc.) – Low population density and abundant area of virgin forests suitable for plantation – Development of the Paddy Project supported by GOCI

Today in the Study Area, as shown in Fig.3.3.1, immigrant population is far larger than indigenous population and especially Burkinabé people are more in number than whole Ivoirien nationals. And there are several nationalities and ethnic groups even in a same village living side by side keeping their own traditions, customs and religions.

Both introductions of own culture traits and adoption of local ones by immigrants are also observed. For example, Dioula and Baoulé have brought indigenous yam cultivation and use of *Daba*, a plowing tool, which did not exist there before. On the other hand, rice is becoming more popular as staple food among the 2nd generation of immigrants. However, direct contacts with different cultures are leading each ethnic group to have some ethnocentric ideas. This "ethnocentrism" seems to reinforce the unity among the members belonging to the same ethnic groups on one hand, but it is, on the other hand, sometimes disturbing mutual understandings of cultural differences among different ethnic groups, which may lead them into assimilation within multiethnic society.

Continuous and friendly contacts among different ethnic groups may enhance the process of assimilation, that is, the Area seems to have a potential for creating common culture and new society in the future. But it is still just midst of the transitional period. The "diversity", which characterizes the Study Area, may generate "dynamism" and sometimes perhaps "disorder".

3.3.2 Health and Sanitation

(1) Disease

Malaria is the most common disease recorded by over 70 % of the households interviewed by using questionnaire. About 40% of the households answered that they encounter it in the rainy season, 20% rather in the dry season and the rest throughout a year. Many farmers believe that the fatigue due to a hard farm work often causes this disease.

Diarrhea (or bellyache) is also considered as one of the most common diseases. Over 40 % of the households answered that they suffer from it throughout a year. The villagers as well as the nurses living in villages attribute it to the bad quality of drinking water. In the rainy season, water of wells without protection mixes with polluted water coming in from sewage (due to lack of appropriate sanitary facilities); whereas in the dry season, water shortage forces villagers to consume water of bad quality. The treatment of this disease is done in a modern and/or a traditional way. Farmers in general prefer a modern treatment using new medicines with consultations at hospital. However, due to their financial inability, they often have no choice but rely on a traditional and a domestic way using medicinal plants growing wild in the fields or forests around the residential area.

Buruli Ulcer (called "large wound"), one of the fatal diseases, inspires fear among villagers, and it appears that occurrence of this disease is reported more at the places close to the water in the Study Area. Particularly in Cité Agricole, 38 villagers, equivalent to about 10 % of its present population of 370, were infected and nine of them died so far. But no newly infected case has been reported since 1998. No treatment method has been established yet so that most villagers count on traditional healers or prayers.

A questionnaire investigation has been carried out by the Sanitary District of San-Pédro about this disease in November 1997. This investigation has covered 397 villages (including small villages) and two cities, mainly in the San-Pédro department. The investigation has shown the following points:

- A total of 386 cases has been declared; Mortality rate is about 7.7 %, and after effects concerns 20 % of the total;
- The occurrence of the disease started in 1976 for San-Pédro, but exploded in 1992 with an optimum in 1996 and 1997. About 60 % of the cases reported within the last 10 years have been recorded during the last 2 years only.

(2) Medical Installations

Since there is no public medical establishment in the Study Area[1], villagers depend on the following medical services (Table 3.3.1):

[1] A dispensary is now under construction in Blahou by EU funds.

Private infirmaries exist in the principal villages being managed by one or some qualified nurses (men in many cases), but actual consultation activities are being carried out by non-qualified trainee-nurses.
Traditional healers, who are usually old women having much knowledge about treatments or traditional medicine such as leaves and barks. In the cases of serious conditions, public or private medical facilities in San-Pédro, especially Regional Hospital (CHR), are used by the villagers.

"To pay medical care" is one of the principal causes of debt for villagers, since medical fees (costs of consultations, medicines and hospitalization, if necessary) are generally expensive. In addition, transportation to the medical facilities is also very expensive and troublesome for the inhabitants living far from paved road.

(3) Sanitary Facilities

50% of households use individually owned or communal simple toilets, while the other half relieve themselves in the open air. In most cases, bathing and washing are done inside the house and rarely done beside wells or by the river.

(4) Maternal Health and Family Planning

Expectant mothers are required to have a maternity record book and undergo periodical check-up as well as deliveries are basically taken place in the maternity clinic in San-Pédro. In the cases of deliveries at night or pregnant women living in a village far from paved road, women with rich experience in delivery usually attend her. According to villagers and nurses, no mother or child has died during deliveries.

As a part of propaganda on the prevention of AIDS or women supporting program, WHO and UNFPA have been carrying out awareness activities about contraceptives as well as family planning. Therefore, both village men and women seem to have a knowledge of contraceptive methods, although results of interview to village women show that only a few households practice family planing leaving such activities to be taken only by women. Though many women feel that pregnancy in every two to three years is burdensome, they cannot undertake family planning, because of the refusal of their husbands to do it or they want to have more children. Moreover, there is a tendency among some women of making fun of those who are practicing contraception and dissuading other women from practicing it. This tendency may be attributed to traditional value of having many children as a symbol of wealth and/or religious precepts that regard contraception as an evil doing. Due to these constraints, it seems to take long time to change the idea of both men and women on this subject.

3.3.3 Education

(1) Facilities

In the Study Area, the following institutions are providing education to children:

1) Public primary schools: Established by the State (partially constructed by villagers) located in principal villages, with teachers dispatched by the State;

2) Private primary schools: Built and managed by villagers in the hamlets far from the main villages. They are often intended to educate lower grade children of CP1 to CM1 who may have difficulties in attending distant public schools. When reached certain grade, the children can be transferred to the public schools.
3) Koranic schools: Established and managed by Muslims through contribution located in the villages where mainly inhabited by Muslims, which provide not only Koranic education but also lessons in French and/or arithmetic. After graduating these village schools, it is possible for children to enter *Madrasa* in San-Pedro city.

As the Area has no secondary school, the village children have to go to San-Pedro, Sassandra or other big cities for attending junior high school. There is no literacy educational activity in the Area at present, but a program is being planned with the support of the World Bank or other organizations in Blahou and Cité Agricole either in French or in their mother tongues.

(2) Problems

School fee is also one of the heavy burdens in the family budget. Minimum expense for a primary school child is estimated to be F.CFA 12,000 - 15,000 a year. In order to prepare school fees for a new school year (in October), parents often have to sell products such as rice, poultry and livestock products even when the market prices are relatively low, and/or to borrow money from middlemen of coffee-cacao or from GVCs. According to the results of the survey, average amount of school expenses is about F.CFA 120,000 a year for a family having school children. This amount is equivalent to about 10 % of average annual income of the interviewed households. Consequently, not all school-aged children often can attend the school due to economic reasons. The result of the survey shows that in the Study Area, 39 % of the children aged between 7 and 14 years old don't go to school (57 % for girls). This figure becomes higher for foreign immigrants or children in the isolated hamlets.

The most serious problem for the schools not only in the Study Area but also in all over the Region is the shortage of teachers sent by the government against the number of classes. In San Pedro district, 16 out of 112 schools are closed due to lack of teachers in this school year. In the Study Area, for example, Cité Agricole has received only 3 teachers (including two non-remunerated fresh teachers) from the government for 6 classes. Therefore, the PTA has to manage to run the school by hiring two young educated men. Since the salaries for two fresh teachers and two young men are paid by the parents, it again causes the increase in school fees.

(3) School Education and Agriculture

In the rural area, a few go to junior high school while most other children are expected to enter farming after graduating or even during primary school. Taking this situation into account, the Ministry of National Education (MEN) has introduced group farm work into extra-school activities of primary schools in the rural area and is giving children chances to familiarize themselves with farming i.e. their future job. Activities such as vegetable gardening, poultry raising, contract farm work etc. are carried out by pupils under the guidance of teachers and PTA. The income they earn from these farm works is used for the activities carried out by pupils' association. The teachers and pupils mention some problems such as; inadequate guidance given by teachers who have never had technical training in agriculture, lack of suitable arable land and lack of farming equipment & tools.

As for the organization of farmers, schools also seem to play an important role in the Study Area where schools are regarded as models of multiethnic society. In the past, GVCs organized by the 1st generation immigrants often collapsed due to mutual distrust or conflicts generated by differences on religion or ethnicity. Now their children, 2nd generation, are studying together at schools. It is, therefore, important that the children, as members of newly created community, learn how to cooperate and coexist with others (other ethnic groups) through school education and group farm work. Additionally, farmers are now trying to support schools through their farm products. Four villages in the Study Area, have been giving school lunch with help of WFP. Preparing to withdraw from school lunch supporting program, WFP is now planning to organize villagers, especially women in cooperation with MEN, to let them produce substitute foods (rice, cassava, vegetables etc.), ultimately aiming at managing school lunch themselves. Since villagers also hope to continue school lunch, both villagers and supporting organizations have to solve many problems on organization, land, fund, technique etc. before realizing the plan.

3.3.4 Land Holding and Problems

(1) Land Law and Property Right

At present, two kinds of land rights co-exist in Ivorian society.

1) Customary land right: In the customary land law, the "ownership" means in general the users' right (or more precisely "usufruct") held and authorized for use by groups such as communities, lineage or villages, without any concept of right for transaction. In other words, the land is not to be owned by individuals and not the thing to be sold or purchased. For the use of land, the group of chiefs called "earth chief" permits and manages by giving users a usufruct for farming or dwelling (refer to 3.6.1).
2) Modern land right: In modern law, only registered land can be owned. The Sub-prefecture office issues an ownership permit after the registration section of MINAGRA regional office surveys the land. The registered land is subject to taxation. This law is commonly exercised in urban area at present.

In the rural societies where the customary land law is still widely exercised, the modern property right has not been exercised yet. Therefore, farmers hesitate to invest their capital into their farms in fear of their removal from the land they are using, as their land ownership remain uncertain. Moreover, since the absence of the clearly defined boundaries of village bars the villagers from correctly recognizing demarcation of the land allocated to them, they sometimes get into conflicts with neighboring villages. This "obscure" property situation has been hindering agricultural development in rural areas. In consideration of this situation, GOCI had been making efforts for a long time to enact a land law adaptable to the reality of rural societies and ultimately, the bill <Rural Domain Land Law> was adopted by National Assembly in December 1998. The bill commences with the article saying <Any individuals and/or legal entities can have access to them, but only Ivorian nationals can own them>, followed by articles related to the procedures, time limit of registration required for acquiring property rights, the owners' obligation to develop acquired land, the jurisdiction of the State on land management and so on.

(2) Land Holding and Access Mode in Rural Area

Most of the Study Area is located in the rural area where the customary land law still remains deeply rooted. In this area, all the earth-chiefs who manage land use belong to one of the three indigenous ethnic groups of Kroumen, Bakoué and Wané which jointly constitute a large Krou Group and live in neighboring villages. Accordingly, they inherit more or less similar cultures in customs related to land. Here are the sample cases with the Kroumen.

In the villages of Kroumen, the land was collective property. It was divided into plots and each family chose the site appropriate for cultivation and opened it. Though the cultivated land was inherited from the head of family to his eldest son, each family held just its usufruct. Unopened part of land was kept with earth-chiefs who were also village chiefs. They also gave permission to outside families to come and live in their villages. Then newcomer families obtained the usufruct of land from the earth-chiefs free of charge or in exchange for spirits and they were placed under earth-chiefs' protection. The earth-chiefs and their families had the right to receive some return or benefits from new-comers, and it was usually paid in the form of labor, supply of commodities on ceremonial occasions or rent.

Starting early 1970s, the influx of immigrants has drastically changed the situation. The earth-chiefs have begun selling usufruct of land to immigrants and its price went up as the number of immigrant increase. Moreover each indigenous family also started selling usufruct of land which had been inherited in the family to immigrants. Thus, customary land law in which the land is exclusively managed by earth-chiefs has collapsed.

As most of immigrants are interested in suitable land for the plantation of coffee or cacao, the objective land for sale is only forest (upland). Consequently the lowland normally used for food crop production naturally remains under collective management of the indigenous communities or families who have inherited its usufruct. As lowland is often rented to immigrants, it becomes the source of regular income for indigenous people. In short, the majority of immigrants in the Study Area have obtained the usufruct of the land directly from indigenous people, which was formerly controlled by earth-chiefs based on the customary law. In this case, the transfer of the usufruct, whether accompanied with payment in money or in any kinds, is just a private affair not authorized by the State at all. Meanwhile, there is another mode of access to land i.e. the distribution of land by the State to immigrants (called "settlers" in this case) as described below:

(3) Land Problems

Although land problems are seen in all over Côte d'Ivoire, their manifestations differ depending on population pressure as well as natural, social and economic conditions of each area. In this Region characterized by the influx of immigrants, the increase of population pressure along with the decrease in virgin forests causes some disputes between earth-chiefs of different ethnic groups or between indigenous people and immigrants. In addition to this situation, some governmental development projects carried out in the past are giving different aspects to the land problems in and around the Study Area as shown below:

Projects	Period	Concerned Villages or Zones
1 Resettlement of Baoulé who were moved from Kossou Dam site	1968 -	Bas Sassandra Region
2 Opening of Paddy Fields in San-Pedro	1972 -	Grand Gabo (Poro)
3 Classification into forest preserve	1972	Scaf, Fahé
4 Construction of the San-Pedro dam	1978	Fahé

In these cases, the expropriation of the indigenous people's land was done by the State in the name of development project, and followed by redistribution of the land to settlers in Cpt. Colonele and upland inside and around Cité Agricole in the Study Area. The word "Project" often evokes mistrust among indigenous people, since the State didn't compensate them for the expropriation sufficiently or at all. In addition, the settlers never transact land with indigenous people based on the customary law since their land was not given by indigenous people thus having no obligation to return a favor to or to obey indigenous people. As a result, they often confront against each other especially when there is a clash in interests.

3.3.5 Rural Infrastructures

(1) Road Networks

Total length of the main rural roads in the Study Area is 29 km. They are used for the livelihood of the villagers and transportation of agricultural products to the market. All of the rural roads are of non-paved running at higher level such as ridge of the hill, with about 3 m width and connecting to the national highway A-5. They are maintained by the villagers. There are a few road structures such as drainage culverts at the stream-crossing portion. In most cases, it is difficult to drive except for 4-wheel drive vehicles during the wet season.

(2) Electricity Supply

The rural electrification has been completed only in the Fahé village in the Study Area. Because of high investment cost to lead the electricity to the house, a few rich villagers only can enjoy the electricity. According to EECI/CIE, there is no future plan of rural electrification in the Study Area.

(3) Rural Water Supply

There is no piped water supply system in the Study Area except for San-Pédro city. Hydrogeology Department of Ministry of Economic Infrastructure constructed 10 tube wells for potable water in the Study Area. Their average yield is $3m^3/hr$. The results of groundwater quality analysis show poor pH, ranging between 5.9 and 7.1, and iron (Fe) content more than 0.19mg/lit, but acceptable for domestic use. Generally village people drinks water drawn from shallow open-wells which dry up during the dry season.

(4) Communications

No telephone and postal communication is available in the Study Area except for the San-Pédro city.