

### 3.4 Agriculture

The agriculture conditions in 1997 in the Study Area has been made clear through the interview survey carried out for 912 farm households having farming land in the Study Area and also detailed survey for 100 farm household selected from the above farmers with use of questionnaire to the farmers. Both surveys were conducted by the JICA Study Team in collaboration with ANADER San-Pédro zone office.

#### 3.4.1 Number of Farm Households and Farming Land

According to the survey, the number of farm household is estimated at 912, and the total farming land is estimated at 5,458 ha in the Study Area. The average land holding per farm household is 6.0 ha, ranging from 0.3 ha in minimum to 48 ha in maximum.

As shown in the following table, tree crops, mainly cacao and coffee, are the major crops in the Study Area. In recent years, the areas of rubber and coffee are increasing among the farmers in the area. Rice is cultivated in lowland (*bas fond*) by more than 70 % of the farmers.

Crop	Area Cultivated		No. of Cultivators		Area per Farmer(ha)	Crop	Area Cultivated		No. of Cultivators		Area per Farmer(ha)
	(ha)	(%)	(No.)	(%)			(ha)	(%)	(No.)	(%)	
Cacao	2,576.9	47.2	618	67.8	4.2	Rubber	160.6	2.9	48	5.3	3.3
Coffee	1,074.7	19.7	510	55.9	2.1	Vegetable	110.4	2.0	135	14.8	0.8
Rice	783.5	14.4	650	71.3	1.2	Yam	82.6	1.5	123	13.5	0.7
(Upland Rice)	(13.5)	(0.2)	(15)	(1.6)	(0.9)	Colat	30.0	0.5	20	2.2	1.5
(Lowland Rice)	(770)	(14.1)	(635)	(69.6)	(1.2)	Oil Palm	16.0	0.3	12	1.3	1.3
Maize	388.0	7.1	395	43.3	1.0	Banana	9.0	0.2	15	1.6	0.6
Cassava	224.8	4.1	302	33.1	0.7	Mango	1.0	0.0	1	0.1	1.0
Study Area	5,457.5	100.0	912	100	6.0						

Source: JICA Study Team-ANADER San-Pédro Zone Office, 1998

#### 3.4.2 Farming and Production

##### (1) Crop Production

The crop yields in the Study Area were estimated for both 1997 and the high-yield year based on the interview survey. The yield in 1997 was remarkably low, especially in the lowland paddy, due to severe drought and submergence, being estimated at 33.9% of the high-yield year. The average yield per ha in 1997 was 1,178 kg for lowland paddy, 866 kg for maize, 2,314 kg for cassava, 343 kg for cacao and 447 kg for coffee. In the recent years, the yield of cacao has tendency to decrease. The cause seems to be disease and poor soil quality. At present, a scientific study is being carried out in IDEFOR.

The total production in the Study Area was estimated at 3,770 t in 1997. The lowland paddy had the largest share of 24.1% of the total production even in the severe drought year, followed by cacao (23.4 %), cassava (13.8 %), coffee (12.7 %), maize (8.9 %), rubber (5.3 %), yam (5.0 %), oil palm (3.4 %) banana (3.0 %) and upland rice (0.3 %). On the other hand, the total production in the high-yield year was estimated at 7,990 t corresponded to 2.1 times that of 1997. The lowland paddy shared 33.5 % of the production.

##### (2) Farming Type in the Study Area

Farming types in the Study Area can be classified into seven types. The most popular farming type is mixed crop farming of lowland crop, upland crop and tree crop, which shares 67.1 % of the total area and 48.7 % of the total farmers. Single farming type such as lowland farming,

upland farming and tree crop farming occupy only 11.1 % on area and 23.1% on number of farmers in total. The details of the farming type are shown below:

Farming Type	Area by Type		No. of Farmers by Type	
	(ha)	(%)	(No.)	(%)
Lowland (L)	53	1.0	40	4.4
Upland (U)	38	0.7	28	3.1
Tree Crop (T)	512	9.4	142	15.6
(L)+(U)	158	2.9	58	6.3
(L)+(T)	563	10.3	118	12.9
(U)+(T)	468	8.6	82	9.0
(L)+(U)+(T)	3,657	67.1	444	48.7
Total	5,449	100.0	912	100.0

In the lowland (Bas-fond), paddy is generally cultivated once a year from March to August using the rainfall in the main wet season. However, in 1/4<sup>th</sup> of fields, it is cultivated from June to November using the rainfall of the 2<sup>nd</sup> wet season, which depend on the field conditions. While, in the severe drought years, some fields have no cropping throughout a year. The land utilization ratio of the lowland in the wet season was 61.7% on average in the last 6 years, while, that of the dry season only 1.7 %.

In the upland, various types of cropping pattern are found out. Mixed-cropping of maize and cassava or maize and rice is common. The average land utilization of upland during the last six years was 46.7 % in the wet season and 8.3 % in the dry season. Cassava and yam, which need longer growing period, are cultivated up to dry season. Maize is cultivated even during the small rainy season between September and December.

### (3) Labour Inputs and Production Cost

The labor input in the area for crop cultivation is the minimum requirement. In the annual crops, around 75% of the labor input is allotted to the land preparation, seeding and harvesting which are the minimum requirement indispensable for cultivation. The remaining is allotted for weeding and bird control (paddy only). The total labor input for the cultivation of lowland paddy is only 131 man-day/ha, which is below 1/3<sup>rd</sup> of that of other Southeast Asian countries. Such extremely low input is because of very rough land preparation and results in low yield.

The production cost is the greatest in lowland paddy (F.CFA 163,661/ha) among the crops, followed by upland paddy (F.CFA 157,869/ha), vegetables (F.CFA 137,295/ha), maize (F.CFA 99,829/ha), cacao (F.CFA 67,377/ha) and coffee (F.CFA 48,454/ha). The fertilizer cost which positively increase in yield is only 0 to 4 % except cacao. It seems that the crop cultivation in the area is still remained as traditional shifting cultivation.

### (4) Consumption and Sale of Products

39% of the paddy farmers, 21 % of the maize farmers, 33 % of the cassava farmers and 67 % of the yam farmers sold 45%, 26 %, 30 % and 25 % of their products with the prices of F.CFA 159, 104, 53 and 100/kg on average, respectively. The markets they sell the product are mainly local ones. The products of cacao, coffee, rubber, cola (white variety) and oil palm were sold with the prices of F.CFA 402 /kg, 520 /kg, 172 /kg, 1,000 /kg and 32 /kg on average, respectively. The markets are mainly company for cacao, coffee rubber and cola and wholesale market for oil palm.

## (5) Crop Income

The total net income in the Study Area was F.CFA 257 million in 1997 and F.CFA 1,128 million in the high-yield year, and the net income per farmer was F.CFA 281 thousand in 1997 and F.CFA 1,237 thousand in the high-yield year. The net income in 1997 corresponded to 23 % of that of the high-yield year. The net income per ha in the high-yield year was highest on cola (F.CFA 584 thousand) followed by banana (F.CFA 520 thousand), lowland rice (F.CFA 389 thousand), yam (F.CFA 384 thousand), coffee (F.CFA 317 thousand), oil palm (F.CFA 314 thousand), cacao (F.CFA 135 thousand), upland rice (F.CFA 100 thousand), rubber (F.CFA 109 thousand), cassava (F.CFA 108 thousand) and maize (F.CFA 98 thousand).

Farming incomes by type in the high-yield year was estimated in Table 3.4.1. The average net income per farmer in the Study Area was estimated at F.CFA 1,240,294 with F.CFA 211,260 /ha. The mixed-crop farming had the maximum net income of F.CFA 1,699,615 per farmer, which was 37 % higher than the average in the area. The upland farming showed the minimum net income per farmer which corresponded to 8 % of the average due to the smallest farming area and the minimum net income per ha (F.CFA 113,374 /ha). The net income of the lowland farming corresponded to 42 % of the average in the area due to less farming area in spite of the net income per ha had the greatest (F.CFA 389,341) among the types.

Recently, the low productivity of cacao become a problem in the Study Area, Its low yield seems to be due to unsuitable natural conditions for cacao cultivation such as soil drying during December to February and the soil acidity, below pH 6.0. According to the interview survey, the low productivity area of cacao is estimated at 27 % of the total cacao production area with 35 % of cacao producers in the Study Area.

The farm production in 1997 evaluated by the farmers themselves was the worst in upland farming (U), not so good in lowland farming (L), (L)+(U) farming, (L)+(T) farming and (L)+(U)+(T) farming, and standard in tree crop farming (T) and (U)+(T) farming.

## (6) Lowland Paddy

### 1) Field Conditions

Almost all of the lowland paddy fields are of rainfed. At present, irrigable fields in the Study Area are limited to only 10 to 20 ha located along the San-Pédro river. Irrigation to these fields is carried out by pumping the river water. However, in the severe drought years, the river water is unusable due to salinity. The existing irrigation and drainage facilities in the Study Area are not functioning and the surface of the fields is not leveled. Such field conditions largely restrict cropping time of paddy and bring unstable yields. Concerning the distance from the house to the field, 24 % of the fields are located within 1 km from their living houses, 59 % are 1 to 5 km and the remainder is over 5 km. The size of cultivation plots is below 0.1ha for 83 % of them.

### 2) Sowing and Transplanting

62 % of the farmers are adopting direct sowing with broadcasting under the dry field condition, 23 % direct sowing with the drill sowing under the dry field condition and only 5 % of the farmers adopt transplanting under the wet or submerged field conditions. Transplanting in the wet field is carried out by making planting holes with *daba* (hoe). The farmers are practicing different cultivation methods in the same field using different varieties. Such a condition makes

it difficult to manage the crop cultivation.

### 3) Variety and Seed

B-189 variety is the most recommended variety of IDESSA based on the easiness of production. 73 % of the farmers are using B-189 and the remainder cultivate local varieties. 91 % of the farmers are using own produced seeds and 9% purchased seeds from ANADER. Seed selection with water or salt water is not popular and only 2 % of the farmers are selecting seeds using water. For the seed treatment, 86 % of the farmers are using non pre-germinated seeds. This may be caused by the unreliable rainfall. The seed rate is 56.6 kg/ha on average.

### 4) Nursery Preparation

The information was obtained from only 2 farmers. They prepare upland nursery in a part of their main fields. The nursery period is 21 days for both farmers. One farmer applies fertilizer once and controls weeds once but another farmer applies no fertilizer and no weeding was done. Even though the farmers recognize that the transplanting more difficult than direct sowing, they don't think that it will contribute for increased production.

### 5) Land Preparation of Main Field

#### Clearing of land before plowing

76 % of the farmers burn down weeds before plowing, 22 % clean weeds with sickle or hoe and 13 % control weeds with herbicide. These operations are carried out by family labor (62 %), contract labor (29 %) and both (9 %).

#### Plowing

44 % of the farmers do not perform plowing, 35 % perform plowing once and 22 % twice. Plowing is done under the wet field condition (67 %) and the dry field condition (33 %). The operation is done with *daba* (55 %), power tiller (36 %) and tractor (10 %). The labor force is provided by family (71 %) and contractor (29 %).

#### Harrowing and Puddling

Only 8 % of the farmers have harrowing or puddling. The operations are done with draft animal (67 %), power tiller (17 %) manpower (17 %), family labor (67 %) and contract labor (33 %).

### 6) Crop Management in the Main Field

#### Weeding

All of the main fields receive weeding once (69.8 %) or twice (28.3 %) by manual with hoe or sickle (58.1 %), by manual (20.9 %), with chemical (4.7 %), and with manual and chemical (16.3 %). The weeding operation is done by family (73.5 %), contractor (10.2 %) and both (16.3 %).

#### Application of Fertilizer and Disease and Pest Control

Ratios of the farmers who applied N, P and K were 23.6 %, 20,0 % and 20.0 %, respectively, and those of the farmers who controlled disease and pest was 27.3 % in 1997.

#### Harvesting and Post-harvesting

80.4% of the farmers are harvesting by cutting paddy hills and the remainder by picking panicles. Threshing is done by beating panicles on board (77.6 %) or by trampling panicles (22.4 %). Grain drying is done mainly at house yard (56.6 %) and the field (32.1 %) on roadside

(1.9 %). The harvested paddy is kept at living house (56.6 %), storage (22.6 %) or other places (1.9 %). Polishing of rice is done with machine (100 %), but occasionally by man-power (61.4 %).

Above mentioned low land paddy cultivation, is presently characterized by the farmers experiences of 1) economical risk for agricultural input against the drought and flooding, 2) low accessibility to the agricultural inputs because of farmers' financial inability, 3) lack of farmers' knowledge on rice cultivation. Same reasons will also be applicable to the following upland paddy cultivation in the Study Area.

#### (7) Upland Paddy

##### 1) Variety

83 % of the farmers are using local variety such as *Klouon*, *Kouissa*, *Namlondji* and *Pôhssoumman*, and 27 % B-189 for lowland paddy. The growing period of these local varieties is around 4 months.

##### 2) Land Preparation

Land clearing is done in all the fields by burning weeds. Plowing is done in the fields with use of daba (43.6 %) by family labor (53.3 %) or contractor (40.0 %), and the remainder (56.4 %) is not plowed.

##### 3) Sowing

Generally, sowing is done from March to April by drill sowing (76.2 %) or broad casting (23.8 %) with the seed rate of 57 kg/ha on average. Non selected or non pre-germinated own produced seeds are used.

##### 4) Crop Management

Weeding is done in all the fields by manually (94.7 %) or with chemicals, but there are no fields where the fertilizer or disease and pest control are applied.

##### 5) Harvesting and Post-harvesting

Harvesting is done in August by picking panicles (82.1 %) or cutting hills (20.5 %). Threshing is done by beating panicles on board (83.3 %), trampling them (12.5 %) or by man-power thresher (4.2 %). Drying grains is mainly done at house yard (38.2 %) or field (29.4 %). 74.4 % of farmers keep paddy in store and 33.3 % at living house. All the farmers use machine for polishing of rice but 69.9 % of the farmers are polishing rice at home by man-power also.

#### (8) Other Crops

Weeding is done by almost all the farmers, but the farmers who are applying fertilizer are negligible except for vegetable and cacao farmers. Control of disease and pest is taken at 42 to 54 % of the vegetable farmers, 58 % of the cacao farmers and 40 % of the rubber farmers.

Low productivity of cacao is attributed to the unfavorable natural conditions exist in the Study Area. Under these conditions, ANADER recommends shifting cacao tree to coffee.

#### (9) Yield Constraints and Farmers' Intention

Yield constraints on major crops ranked by the farmers are shown in Table 3.4.2. The main

yield constraint on the annual food crops is water stress followed by soil fertility and weeds. On cassava, soil fertility is the greatest constraint rather than water stress. This ranking seems to be reasonable because cassava is relatively tolerant to drought. In vegetables, the greatest constraint is disease and pest. In the perennial tree crops, disease, pest and soil become the greatest constraint rather than water stress. In addition to this, for the commercial crops, marketing price is also a large yield constraint.

Concerning the way to increase the farming income, as shown in Table 3.4.3, the farmers give the highest priority to the increase of yield and give the 2<sup>nd</sup> and the 3<sup>rd</sup> priority to the improvement of market, and expansion of land and introduction of new crops, respectively. Looking from the view point of farming types, the upland farmers who have the smallest income give the highest priority to the expansion of land than the increase of yield. Their ideal area is 10 ha. While, the lowland farmers give the least priority to the extension of land with the ideal area of 3 ha. The result suggests that the present area is enough for the lowland farming. In the farming of (L)+(U), the farmers expect an introduction of tree crops with expansion of land of 8 ha. It is worthy to note that the farmers of (U)+(T) farming and (L)+(U)+(T) farming give the highest priority to the strengthening of GVCs.

In connection with the farmers' intention for the project, as shown in Table 3.4.4, the farmers give the highest priority to the technology support and improvement of irrigation facility. The 2<sup>nd</sup> priority is given to the improvement of drainage facility, leveling of land, construction of farm road and social infrastructures. And the lowest priority is given to the financial support. In the lowland farming, the priority to the technology support is lower than that to the improvement of irrigation and drainage facilities. The results indicate that the technology support is the most important subject to the farmers. However, in the lowland, the technology support has not much effect on their farming without the improvement of irrigation and drainage facilities.

### 3.4.3 Animal Production

In the Study Area, a poultry is the most common livestock, which are raised by 60 % of the farmers. Sheep, goat and pig are bred by 8 %, 8 % and 5 % of the farmers, respectively. There are no farmers who breed cattle. Number of live stock raised per farmer is 9 heads on sheep, 7 on goat, 14 on pig and 36 on poultry. Number of livestock sold per farmer in a year is one head on sheep, 5 on pig and 7 on poultry. The selling unit price is F.CFA 25,000 on sheep, 5,000 on pig (only one case) and 2,500 on poultry. 13 pieces of egg are produced per head per year and sold at F.CFA 58 per piece. While, 1 sheep, 2 pigs and 10 poultry are consumed at home per farmer in a year. In recent years, new-castle disease is widely spread among poultry and the vaccination is recommended.

### 3.4.4 Aquaculture

Some varieties of carp, catfish and shrimp are found in the San-Pédro Dam and river. People who live in the zone are earning by forest management and fishing. They have know-how of building wooden two men fishing boats, digging canoes and weaving fishing nets. Surplus catch of a day is sold on the dyke of the San-Pédro dam in the morning. There are a few fish ponds in the area. They grow either tilapia or catfish.

In and around the Study Area, the oldest and biggest pond is found in Cpt. Bernard, a small barrage of about 4.7ha. It was built as part of 20ha poultry and aquaculture complex by ARSO/SIACO. The enterprise is now owned by a private hand. Besides producing tilapia and carp in the pond, it grows coffee, runs a nursery of rubber trees, and farms of poultry, pig and sheep. A small-scale pisciculture is found in each of three villages of Petit Pédro village, Konan Kro, Pont Bascule and Zilé Kro.

### 3.4.5 Farm Household Economy

#### (1) San-Pédro Department

Table 2.2.1 shows the average farm household economy of San-Pédro Department. An average farm holding per household is estimated at 6.1 ha; 88 % of the average of the region. They do not grow oil palm, but grow coco-palm twice as many as the region's average. The area for paddy growing is 71 % of the region's average. They grow other crops more or less at the level of the region's average. Assuming the number of household members and economical active members, unit labors and farm gate prices etc. is equal to those of region's averages. The incomes from the farm as well as labor requirement are 86 % of the region's average.

San-Pédro city where rural population constitutes 8.6 %, spent F.CFA 277,000 per head after saving F.CFA 36,000 in 1996. 41 % of the expenditure went to food, 8% to energy and water. If an average farm household is self-sufficient in food, energy and water, and without saving, their average disposable income is estimated at 81% of the average citizen's consumption level.

#### (2) The Study Area

The data collected by questionnaire survey is analyzed in section 3.6.4. 1997 was an exceptionally lean year. The data, therefore, does not easily conform to those of the normal year. There is a phenomenon in the Study Area that some families try to manage more land than the family labour can do. They have to pay for hired labor without having corresponding production in the end. They are too poor to make a calculated risk in doing agriculture. It is conspicuous especially in lean years like 1996/1997.

### 3.4.6 Agro-industry and Agricultural Marketing

#### (1) Agro-Industry of Food Crops

Among food crops, only rice production requires processing industry, whether it is manual or machine, till it reaches consumers' hands. In the Study Area, there used to be a rice mill with a stock capacity of 10,000 tons built by AGROPAC at 2.5 km on San-Pédro - Soubré road. The facility had not been utilized properly partly because of lack of modern transportation and partly because of insufficient running costs according to AISSA report. It was sold to OCTIDES Industries, a private company, at the time of privatization. OCTIDES tried to re-generate irrigated paddy cultivation in the village of Cité Agricole, but left after a trial of single crop because of unemployment problems and the participant farmers declined to continue. It was then changed hand to Jean Abile Gal, a big cacao-coffee exporter, which relocated the mill to one of its operation center in Bonguanou, located in the central east part of Côte d'Ivoire. The remaining silo is now used to keep cacao and coffee beans collected from the private growers in the surrounding area. A rice mill with dry-yard was installed by CIDV at the northeast corner of the Cité Agricole Campus II in early 1990s. During the course of time, it deteriorated and operations ceased. At present, it is unreparable condition and is not functioning any more.

Another silo in the port is owned by Grand Moulin, Abidjan. It is used to keep imported wheat. Flour units of mill is attached to the silo.

Imported rice does not require any industry to polish but warehouses. Local rice produced around the area is quantitatively not much, and very small-scale polishing machine can do the job, which are found at the back of the San-Pédro market. In the Study Area, there are two rice mills now; one in Petit Pédro owned by a GVC, the other in Cité Agricole owned by a private hand, which does a job of milling for the nearby farmers at the rate of F.CFA 20 /kg. This entrepreneur owns a coffee mill jointly with another neighbor in the village.

## (2) Agricultural Marketing of Food Crops

Our questionnaire survey has found out that an average farming household earned around F.CFA one million from the sale of their crops in 1997. They are mostly from industrial crops. There is not much surplus production of food crops including paddy, not to speak of market-oriented production of food crops with a few exception of vegetable cultivation in and around the Study Area. On the contrary, in 1997 partly because it was a lean year, an average sample household allocated 42 % of its expenditure for foodstuffs.

Scaf and Fahé as well as Gabiadji have a daily market. A weekly village market, where barter transactions also take place, opens on Fridays at Petit Pédro, and on Sundays at Blaou and Cpt. Colonel. Cpt. Bernard is too close to the San-Pédro market to hold a weekly market. Small-scale vegetable cultivation such as tomatoes and eggplants are found in many villages. They have been trying to penetrate into the San-Pédro market.

As to the rice market, imported rice has been filling the gap between demand and domestic production. Around 80 % of the imported rice are of the quality of 16 % broken, less than the standard chosen by the World Bank as a representative price of the international commodity (FOB Bangkok, 10% broken). Outside Abidjan port, imported rice has also been unloaded at San-Pédro port at the rates of between 12 and 20 % to the total unloading according to the recent records. The Government has set an indicative sale price to the imported rice according to its quality.

On the other hand, for the domestic paddy production, the Government set an indicative farm gate price of paddy at F.CFA 110 /kg before devaluation. As of 1997, paddy was normally sold between F.CFA 130 and 150 at the farm gate. Among the prices of agricultural machinery and inputs even the price of certified seeds are being decontrolled. Nor agriculture sector has any privilege of asking special discount rate in using fuel comparing to other sectors, as the price itself is being liberalized.

Rice imported through San-Pédro port is mostly from Thailand and Vietnam. A small amount of rice from USA is also imported for quality market. It is usually sold in 50kg bag at wholesale market. As of July 1998, the cheapest broken rice is sold at the rate of F.CFA 225 /kg, which becomes F.CFA 275/kg in retail shops. The standard quality rice is sold at F.CFA 300 /kg, and the superior quality American rice is sold at F.CFA 1,000 /kg in super markets. The local rice is usually sold in 25 kg bag at wholesale market. Local rice of better quality is sold at the rate of between F.CFA 260 /kg and 280 /kg, which becomes F.CFA 285 /kg and 305 /kg in retail shops. They are sold out quickly. There are two types of special local rice, which gets higher prices in



the market. One type is distinguished by the sake of variety, the other type is due to processing. Swamp rice of 180 days and Parboiled rice could fetch up to F.CFA 350 /kg in the retail shop.

### 3.4.7 Agricultural Supporting

#### (1) Agricultural Extension

ANADER has its office under the head of the zone (CZ) at the departmental level. In the physio-social environment of the field, the ideas and techniques which are brought by extension workers (CA) supported by the products of R&D and education interact with the ambivalent thought of individual agriculturists of all age. Its organization chart is given in Fig. 3.4.1. CZ coordinates and controls several supervisors who subsequently assist and supervise CAs under them. CZ is assisted by several numbers of specialized technicians (TS) and specialists of the 'Organisation Professionnelle Agricole' (OPA) in his/her decision making process. CAs work with about 15 contact groups, each consists of 15 to 20 members. TS are responsible for maintaining the technical standard of CAs in the specific fields, and for finding the ways of adapting certain technique to the specific field condition. SOPs' principal concern is development of the OPAs by bringing up their members, leaders and staff. ANADER works in the field in cooperation with various organizations such as:

- a) The government organizations such as regional offices (RO) of the administration, RO of MINAGRA, *direction de l'organisation professionnelle et du crédit*, and OCPV;
- b) The chambers of agriculture;
- c) The Federations of OPA such as UNECA-CI, URECOS-CI, COOPAG-CI, CEACI, IPRAVI and UACI;
- d) Government agencies such as CIDT and SODEFOR;
- e) NGOs;
- f) Financial organizations such as CREP/ COOPEC, commercial banks, social funds and guarantee funds; and
- g) The development projects.

The new technologies and varieties developed by institutes/organizations are handed over to ANADER zone offices after adaptability tests which are carried out by the joint works between the institute and the regional ANADER offices at their observation fields. After the tests, the extension workers diffuse the technologies to the farmers. Prior to the diffusion of the technologies, the extension workers undergo training about the new technologies from the staff of the institute, the regional ANADER and the specialists of ANADER zone offices.

At present, nine (9) extension workers and one supervisor have been assigned in the San-Pédro zone unit in which the Study Area is included. In the zone unit, 67 villages with 2,470 farmers are located. So that, each extension worker takes care of 274 farmers on average. It is scheduled that the extension workers undergo training from the specialists of ANADER zone office on the 1<sup>st</sup> Friday and have meeting on the 2<sup>nd</sup> Friday in every month, and visit the same farmers' group at least twice a month to spread recommended technologies and to meet the farmers' technical problems. About the problems, which can not be settled at the site level, the problems are sent to the specialists of ANADER zone office. If the solution is difficult at ANADER zone office, the problems are sent to the regional office or to the institute concerned. The urgent and biggest problem in the extension activities is the insufficient fuel budget for visiting farmers.

## (2) Rural Finance

For the building of rural social infrastructures such as school buildings, rural roads and other agricultural production facilities, *Fonds Regionaux d'Aménagement Rural* (FRAR) has been allocated in the national development budget. As of the end of 1996, a sum of F.CFA 85.9 billion was invested to 9,127 projects out of 15,648 proposed plans (9.4 million on average, ratio of realization: 58.3 %). 83 % went to school buildings, 11 % were invested to rural roads and the rest went to various types of agricultural production facilities. The money allocated by FRAR covers between 75 and 78 % of the total project costs and the rest are shouldered by the concerned federation of communes.

On the other hand, for the individual farmers and OPAs, after *Banque Nationale pour le Développement Agricole* (BNDA) was liquidated, only two savings and credit cooperatives have been available nationwide. One is the *Caisse Rurals d'Epargne et de Prêts* (CREP) and the other is *Coopérative d'Epargne et de Crédit* (COOPEC). In general, as the name suggests, CREP's market is rural area and COOPEC for the urban and suburban area. But as is the case with San-Pédro city, where there is no branch office of CREP in its neighborhood, COOPEC welcomes the rural residents to join. As of Jan.1996, CREP consisted of 56,000 members with savings of F.CFA 4 billion; and as of June 1998, COOPEC had 34,000 members with savings of F.CFA 2 billion. As of the same date, San-Pédro branch of COOPEC had 700 members with savings of F.CFA 43 million. The savings do not bear interest.

After the 1994's denomination, four funds related to agriculture have been created by the Government. They are:

- a) Supporting fund for facilities and activities for young agriculturists;
- b) Fund to develop animal production (for animal husbandry and fishery);
- c) Fund for crop diversification and export promotion (for producers and exporters of newly introduced crop, and for producers and processors of newly introduced food crop); and
- d) Fund for rebuilding of coffee production.

Among them the most related fund to the Study is supporting fund for facilities and activities for young agriculturists. Part of San-Pédro Paddy Project, which founded Cité Agricole Village, were realized by mobilizing the young modern farmers. The fund, however, has no basic reserved fund. It relies on the promoter of a development project for the principal. ANADER organizes the recruit and education of the young farmers to see to it that they will establish themselves as a member of healthy OPA, for which finance is another important factor along with the human resources.

A few tiny scale mutual financing association (local name: *tonchin*) of around 20 members are founded among women's organization in the Study Area. A Catholic NGO in San-Pédro city runs a public safe which opens seven days a week for the convenience of the farmers in the Study Area. There are a few NGOs, which have been running small-scale credit operation among the farmers in the Study Area.

### 3.4.8 Farmers' Organization

#### (1) General

'*Organisation Professionnelle Agricole*' (OPA) is a term to represent any rural farmers' organizations, and used to express as a concept to counterbalance of the private enterprises in agricultural sector. The most active and significant organization among them is the '*Groupements à Vocation Coopérative*' (GVC). The socio-economic aspects of rural development in Côte d'Ivoire have been revolved around GVC. It is a form of organization defined by the Cooperative Law promulgated in 1977, the statute of which is allowed to include relaxed condition in some aspects of the accounting procedures in order to facilitate the formation of GVC by the farmers.

Therefore, people have begun to feel that the old cooperative law, which had been valid for 20 years, was due for revision, and it was abrogated by the new cooperative law promulgated on 23rd December 1997 in order to fill some loopholes and to adjust itself to the socio-economic change of the business world in Côte d'Ivoire. With this change, all the so far registered GVC shall have been re-registered under the new law by 23rd December, 1999 with possible extension of another year. This change implies the necessary upgrade of accounting standard and usage on the part of GVC.

In the Study Area, there are 24 officially recognized GVCs 18 GVCs of which are for tree crop marketing<sup>1)</sup> and 6 for food crop production & marketing<sup>2)</sup>. These types of GVCs have different characters or functions as shown in the table below:

	GVC for tree crops (coffee/cacao : C/C GVCs)	GVC for food crops* (irrigated paddy : I/R GVCs)
Funds raising/ Input supply	Loans for purchase of trucks for GVCs from processing or exportation companies / Loans for individual inputs not available from GVCs	All inputs provided free or on credit for GVCs by GOCI or private companies / Members are obliged to repay GVC the amount of debt according to individual planted acreage
Production	Individual / There cases to borrow implements from GVCs	In Group / Planned cropping
Marketing	In group	In group / Obligated to deliver the whole harvest
Communication /Training	Lack of communication and exchange of information among members due to their scattered plots / no training by GVCs	Easy communication and exchange of information and skills among members due to contiguous plots / training given by GVCs
Other activity	Mutual aid system	Maintenance of joint production facilities / Mutual aid system
Other outlet	To traders or middlemen in cash payment on the spot	Home consumption or to local market
Merits for members	To withstand unfair trade by middlemen / to ensure transportation of products by GVCs	Full support and control in whole process by GVCs / Indispensable to join GVCs in the case of irrigated paddy cultivation
Size of GVCs	12 -- 189 members	13- 24 members

\* The activities done by GVCs before ceasing irrigated paddy cultivation.

Naturally, I/R GVCs are required to have greater management skills and organizing abilities, since these organizations take part in all over the activities that include supply of inputs, cultivation techniques and marketing of products. Each member is also equally required to assimilate with and practice new ideas which are not seen in the traditional agricultural practice

<sup>1)</sup> 17 GVCs for coffee/cacao and 1 for rubber in detail.

<sup>2)</sup> including one women's' GVC and 5 GVCs for irrigated paddy production / marketing which are not active now.

e.g. conversion of shifting cultivation to intensive farming, fair distribution of resources such as land and water. among members and planned cropping pattern in cooperation with others.

The problems common to both types of GVCs are as follows:

- 1) Unfair money management by administrative committees of GVCs attributes to lack of their abilities in financial affairs.
- 2) GVCs cannot immediately pay their members for their delivered products due to lack of liquid funds in GVCs.

1) above is considered as the principal reason for the disruption or breakdown of GVCs. Since farmers are in need of cash at harvesting time, they want to have cash from their products as soon as possible. Therefore, 2) above is one of the biggest weakness of c/c GVCs in competing with middlemen. This situation discourages farmers from joining GVCs, and this in turn decreases GVCs' abilities to deliver enough quantity of products, thus ultimately decreasing their abilities to obtain a loan from companies. On the other hand, 2) forces I/R GVCs to sell rice even when the price is low.

In addition to these two factors, there is another problem i.e. organizing of immigrant society. In the beginning, single multiethnic C/C GVC was established in each main village. But in many cases, at present, it has been divided into some smaller GVCs usually composed of same ethnic members. According to the members, the principal reason for the disruption is factor 1) "Money problem", but it is understood that, in the behind, the mutual distrust among members, in particular between different ethnic groups, makes the problems more serious ultimately bringing GVC to disrupt. Additionally, an organization can be hardly run in a democratic way with the reason given in 3.6.2 and maintaining the organization becomes also difficult when indigenous people join it. While waiting for the growing 2nd generation of immigrants who are more assimilated to the new society, organizing the people with similar ideas, in other words, in ethnic or religious groups seems more cohesive and practical for the time being.

## (2) Other OPAs

There are various kinds of OPAs as shown below and Table 5.2.3:

- a) Contact groups of CAs of ANADER are the unit of receivers at the time of technical transfer;
- b) Water committees for the management of semi-deep well for drinking water;
- c) Young farmers' organizations; and
- d) Other organizations such as for maintaining primary schools and religious services.

## (3) Women's Organization

One of the characteristics of women's organization in Africa is represented by a well-known term of Market Mama, which has a modern scent of commercial transactions. In some places of the rural West Africa, a reminiscent of women's secret society, which maintains traditional values, adds another flavor. Its range of activity not only covers marketing but also extends itself to vegetable growing. The individual member's wish underlying any organization's activities is the will of protecting and safeguarding her household by all means from the severe economic world at large, and of covering the shortcomings of its male head.

### 3.5 Irrigation and Drainage

#### 3.5.1 Irrigation and Rainfed Cultivation

##### (1) Rainfed Cultivation

More than 70 % of the agricultural land are covered by tree crops. They are seldom irrigated except for planting period. Food crops such as upland and lowland paddy, maize, cassava are produced in and near the lowland (bas-fonds) without any artificial irrigation. They are cultivated depend on the flooding conditions during the wet season with minimum input considering weather risks. Small-scale vegetable cultivation is practiced under the irrigation by water drawn from shallow wells dug using the water pots.

##### (2) Small-scale Irrigation

In 1970's, several irrigation development activities especially paddy irrigation were started by ARSO, under the Government's subsidy. They were irrigated by the water pumped up from the San-Pédro river. And they were implemented under the Taiwanese technical assistance. After fading out of ARSO and Taiwanese from the area in 1986/1987, most of them stopped the pump operation. The San-Pédro Paddy Project Area continued its pump operation up to 1988, and it was reinforced by the renovation of pumps by the Canadian assistance in 1992. But they stopped the paddy cultivation in 1992, and the last irrigated paddy cultivation field was taken over by a private farmer. At present, two irrigation pumps are operated in the southern end of the San-Pédro Paddy Project Area by a private farmer, covering about 20 and 8ha of paddy cultivation lands, respectively.

#### 3.5.2 San-Pédro Paddy Project Area

##### (1) Purpose of the Project

Based on the ARSO's master plan of San-Pédro development, the San-Pédro Paddy Project was implemented. The purpose of the project is to supply rice to San-Pédro city by the labor force of youth volunteer from various areas of Côte d'Ivoire.

##### (2) Progress of the Development

The construction of the project was started by ARSO/SODERIZ in 1973. The first 50 farmers with their families and Taiwanese engineers were settled in the area having 80 ha paddy field. In 1977, the planned 650ha of paddy field were developed and they were cultivated by 200 farmers. The executing agency of the project was changed from SDERIZ to SODEPALM in 1979. In 1989, the farmers in the project area reduced to 114 from 200 families and the cultivation area also reduced to 330ha from 650ha. Even the reinforcement of the agricultural infrastructures like renewal of the irrigation pumps were made, cultivation area has never been recovered up to now. The details are shown in Table 3.5.1.

##### (3) Pumping Station

Pumping station of the project is located on the left bank of the San-Pédro river about 21 km from the river mouth. Pumping station and 3 units of pump with 2 units of diesel generator were installed in 1975. Pumps and generators were renewed with the Canadian assistance in 1991. Present dimensions of the pumping station are summarized as follows:

1) Pumping Station

House area	7.4 X 6.8m
House floor elevation	9.80m
River bed elevation	1.75m
River design water level	3.0m
River design flood level	8.0m
Pump chamber floor elevation	0.50m
Minimum pumping water level	1.87m
Attachment	cranes

2) Pumps

Name of manufacturer	IIT Fluid Technology Corporation
Model of pump	PL 7050.760 – submergible motor pump
Specification	380 V /3HP /50Hz /75kw
Pump head	7.6m
Pump suction diameter	530mm
Design discharge	700 lit/sec

3) Generator

Name of manufacturer	Onan Corporation
Model of generator	DFBD
Model of diesel engine	NT855-G4

(4) Irrigation Canal and Related Structures

The project area is divided into 4 blocks irrigated by 4 main canals. Most of the irrigation canal is non-lined earth canal. In the irrigation canal many structures are installed such as diversions and turnouts. Also the canal related structures are installed such as bridge and drainage culvert. They are summarized as follows:

Name of Block	Name of canal	Area (ha)	Highest EL	Irrigation facilities			
				Main canal length (m)	Secondary canal length (m)	Irrigation Structures (no.)	Related structures (no.)
West	A	173	7.20	3,300	1,240	7	5
Central	B	108	7.10	5,400	2,150	18	4
South-east	C	122	6.90	7,790	3,580	35	3
North	D	33	5.35	4,050	2,620	12	5
Total		306		20,540	9,590	90	17

(5) Drainage System

The project area is protected by flood dykes from the San-Pédro and Gonou rivers. Northern extension is protected by dykes at Grand Gabo paddy project in the west, by Grand Gabo flood dyke in the north and the road connecting Grand Gabo and Cite Agricole villages in the east. West block is protected by the high flood dyke along the San-Pédro river. The area is protected by flood dykes and elevated hills. Internal drainage treatment is most important. There are many drains in the area with gentle slope without any dykes. Installed drainage culverts have small capacity together with water head. Therefore, the large area becomes the retarding basin, and drainage canal areas occupy large portion of the cultivable area.

## (6) Operation and Maintenance of Project

The operation and maintenance of the irrigation system was carried out by GVCs formulated by beneficiary farmers. At the initial stage of project under SODERIZ, Taiwanese irrigation engineers assisted the irrigation water management between 1973 and 1980. According to the farmers, even during this period, there were many water troubles/conflicts among the farmers. Throughout the period of the project operation, the pump O&M was conducted by Governmental organization, SODERIZ, SODEPALM and CIDV. Even these technical and financial supports were made, O&M of the irrigation system could not be performed by the farmers. The causes for the failure of the project are discussed in section 3.7.

### 3.5.3 Small Scale Irrigation Areas

#### (1) Grand Gabo Paddy Irrigation Project Area

About 10 ha of paddy area, irrigated by pump (one unit 300mm dia.) was developed in the same period as the development of the San-Pédro Paddy Project by ARSO/SODERIZ in 1973. 200m long flood protection dyke against the San-Pédro river was constructed. It is located in the north of the San-Pédro Paddy Project Area. It was operated up to 1980 by SODERIZ. OCTIDE, private company, continued the cultivation and they employed more than 20 workers at the peak. Because of inefficiency of pump and difficulty of extension of cultivation land, they stopped its operation.

#### (2) Right Bank Paddy Irrigation Areas

There were two pump irrigated paddy areas on the right bank of the San-Pédro river adjacent to SODECI Pumping Station. Both of them were constructed by ARSO/SODERIZ. The same scale pumping stations (150 mm dia. pump) were designed and their construction was made at the same period as the San-Pédro Paddy Project. They were operated by the agricultural labors lived in San-Pédro city under the technical guidance of Taiwanese engineers. Their pumps were moved out and no detailed data are available at present. The upstream scheme area of about 10ha is cultivated for paddy by the farmers in the area and the downstream scheme area of about 5ha is remained as a cultivable waste at present.

#### (3) Cpt. Bernard ARSO Pond Area

A small-scale pond for irrigation was constructed by ARSO/SODERIZ near the Ganou river after crossing the National Highway at Cpt. Bernard. The pond is surrounded by about 2 m high banks, and have a stop log controlled intake/spillway. The control structure is not functioning at present. No technical details are available. Presently in the lower area of the pond, vegetables are cultivated by women's groups.

#### (4) Northern Lycée Professionnel Valley

About 15 farmers, led by a farmer ousted from the GVC of San-Pédro paddy project area, are cultivating paddy by taking water from one of the internal drains of the San-Pédro Paddy Project Area during the wet season in the northern valley of *Lycée Professionnel*.

### 3.5.4 Drainage Conditions

#### (1) Flooding of San-Pédro River

Every year flooding of the San-Pédro river occurs in the low plain of the Study Area. The flow capacity of the San-Pédro river channel is estimated at around 150m<sup>3</sup>/sec and its annual flood is also estimated to be more than 200m<sup>3</sup>/sec in the Study Area.

#### (2) Tributaries

Tributaries in the northern part of the Study Area, such as the Niré and Kpohou, formulate the marshy area in the San-Pédro river flood plain, retarding their floodwater during the flood of San-Pédro river. Tributaries in the southern part of the Study Area run through the flat area. They have no outlet to the San-Pédro river. Many seasonal ponds are found along the San-Pédro river in the southern part of the Study Area during the wet season, such area as near the San-Pédro bridge and SODECI Pumping Station.

#### (3) Road Crossings

Drainage culverts crossing the road are installed. Drainage culverts under the highway are constructed by steel corrugated pipes. Some of them are deteriorated and partially cropped and upstream areas becomes swampy areas. On the other hand, traffic is stopped for several days at the crossing of tributaries during the wet season because of low capacity of the drainage culverts and embankment of road at low level.

## 3.6 Rural Society and Household Economy

The rural society and household survey was conducted by the JICA Study Team in collaboration with the Ivorian counterparts. The survey results are presented in the Supporting Report in detail and their summary is given below:

### 3.6.1 Village and its Members

#### (1) Village

The "administration" of a village consists of one main village together with some adjacent hamlets with a chief recognized by the government. Main villages are usually developed villages located along the paved road and/or with a residential earth-chief. Inhabitants of hamlets go to main villages for marketing, meeting and religious gathering. Though village boundary can be roughly estimated with the site of each hamlet, they are not clearly fixed.

In the Study Area, most of the villages are composed of several ethnic groups and each of them has its own residential area. Solid ethnic communities based on the same languages and cultures are spreading over villages, while "villages" may be regarded as mere administrative or geographical units.

#### (2) Key Members

**Village chief:** Official representative of village recognized by authority.

**Secretary:** Assistant of the village chief who is an intermediary between the authority and the village due to his high literacy and can be viewed as virtual leader in village.



Earth-chief: Traditional leader of indigenous people's communities, usually the oldest *doyen* and responsible for the management of land of the communities.

*Doyen*: Old man with knowledge and wisdom who plays the role of judge, conciliator or mediator to settle the dispute among the members of his communities.

Ethnic community chief: Generally the first comer to the village of immigrant ethnic group, considered as a coordinator among the members or with other groups.

Religious chief: Spiritual leader in his religious community who organizes the cult in the village and has the same role as *doyen* for the faithful.

Additionally, the villagers' committee members and representatives of the other official groups mentioned below can be also considered as notables of the village.

### (3) Villagers' Groups

#### 1) Traditional Groups

In general, there are some social groups based upon ethnicity, nationality or religion in a village. They have functions of mutual aid and developed networks on departmental, regional and national levels. Some traditional working groups by gender and by generation exist also in the same ethnic group. It can be said that, in reflecting the difference in political, social or economic standpoint and the access to the resources, the immigrants are stronger than indigenous people, the foreigners than Ivoiriens and the women than the men in the solidarity. Some unique cases such as a friendly society formed by Gouro women of several villages and three women's food production groups with different characteristics in Cpt. Bernard, which are helpful at the time of the inhabitants' formal organization, are observed.

#### 2) Official Groups

Existing so-called villagers' committee is a rather political organization, since it is often mixed up with basic supporting organization to the leading party. Therefore, foreign immigrants without voting right don't take part in it. The committee coordinates problems and needs expressed by villagers to submit to the authority.

Besides these groups, there is a water committee in villages equipped with a/some tube well(s) and a parent association as well as a school body, if the village has a school. The representatives of these groups are usually selected in "democratic" way.

### 3.6.2 Classification of Villages

Eight (8) villages defined as the main villages<sup>1)</sup> are classified as below, according to the relationship among ethnic groups in the village.

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<sup>1)</sup> The villages, which meet the following conditions: 1) Relatively large population (more than 40 households listed during the preliminary survey), 2) Independent village (which is not attached to others), 3) Recorded in the list presented by the concerned authorities (town council, office of sub-prefecture), 4) (part of) Inhabitants who have agricultural activities in the Study Area.

Dominant Cultivation	Tree Crops	Food Crops
Cité Agricole		Type2
Cpt. Bernard		Type1
Blahou		Type1
Pont Bascule	Type2	Type1
Petit Pédro	Type2	Type2
Grand Gabo	Type1	
Scaf	Type2	
Fahe	Type1	

In the type-1 villages, an earth-chief with his descent group and some immigrant ethnic groups, that form a numerical majority, coexist. The former group assumes a dominant position due to its absolute power on the distribution of land to the latter. In this type of villages, therefore, the numerical minority holds a superior status, while the numerical majority has the subordinate status.

Meanwhile, the type-2 villages consist of only immigrant ethnic groups and usually there is no superordinate-subordinate type of relationship among them. The village chief himself is an alien and very often the first settler in the place. He might not have an absolute influence over the villagers since he acts just as an intermediary between newcomers and the earth-chief living outside the village.

In short, it is important to identify the village type (1 or 2) in order to understand the village organization especially the decision-making process on the village matters. In the type-1 village, it happens that the earth-chief's decent group makes decisions exclusively. On the other hand, in the type-2 village, even the village chief can't always manage whole the village and decisions are made democratically or sometimes without order.

It should be noted that Cité Agricole is rather particular among the villages. It was created with the initiative of the Government by gathering young volunteers aiming at the same goal of "irrigated rice cultivation", while the other villages are expanded by the inflow of immigrants hoping to exploit virgin forests or to be engaged by ARSO.

### 3.6.3 Rural Society

#### (1) Family

Concept and size of a family differ with ethnic groups. For example, Baoulé has traditionally a extended family of matrilineal descent as a basic production unit, while Kroumen has a patrilineal nuclear family. However in any case, there is no doubt of family and kindred forming the basic and important groups of the society. Each type-1 village consists of a core group of indigenous families who belong to the same descent group and immigrant families dwelling around the core and the cores of different villages are tied with marital relations. Marital relations are expanded through different ethnic groups e.g. close indigenous networks are established through many marital relations between Kroumen of Cpt. Bernard and Bakoué of Fahé.

The results of the survey indicate that a family is composed of 8.6 members on average, in which 6.4 members live together in the same house. Among them, the economically active population is estimated at 3.6 persons (2.3 men) with an average of 2.2 farmers (1.5 men). The average age of the household head is 42.1 years old and his spouse 31.7 years old. 65 % of the heads have no educational background.

## (2) Social Stratification

Generally speaking, when a society is comprised of several ethnic groups, the social stratification that emerges is relatively complex. The Study Area also shows typical complexity. Farming especially coffee-cacao plantation is the main occupation as well as the main income source for the people in the Study Area. Indigenous families have more land-area available for cultivation than immigrants (11 ha for Kroumen families and 8 ha for Burkinabé immigrant families). The accessibility to land, however, does not reflect the economic standing of the families in the society. In reality, the Burkinabé immigrants dominate the others in regards to the income size (F.CFA 1,619,000 for Burkinabé and F.CFA 1,162,000 for Ivoirien). As for the plantation, the income size does not appear to depend on the size of planted area but to the degree of its intensiveness as well as farmers' ability.

During the village survey, the following characteristics were cited by the villagers as the scale by which they measure "rich or poor".

- The rich family has a well-built house with cement floor and zinc roof, equipped with a latrine, and possesses one or some motor bike(s), a television set, an individually owned well, etc. It can lend money to neighbors and the wife always dresses well.
- The poor family asks help from neighbors for food and its children don't go to school.

However, these scales can not be applied to the foreign immigrants. They invest their money in farming but not in their day-to-day life, while remitting the rest of money to their own country. As shown, the social stratification in the Study Area is very complex and reveals the peculiar fact that those who are weak from the social and political standpoints are strong from economic viewpoints.

## (3) Daily Life of Villagers

According to the survey, the life in the Study Area is summarized as follows:

- About 90% of the households own a house.
- The Fahé village only is electrified in the Study Area. However, only 3 % of households benefit from grid there because of its expensive installation cost. Nearly 90 % of the households use firewood as the principal fuel, generally collected by women.
- About 70 % of the households depend on individually owned or community wells. These wells are likely to dry up in the dry season (especially from January to May), which is one of the most serious problems for villagers. The average distance to the water points is 40 - 60 m and women and their daughters take responsibility for collecting water.
- More than half of the households chose rice as the most favorite basic food, which is followed by yam and maize (15 % and 15 %). All the interviewed households cultivate rice for home consumption besides other staple food. But most of them feel the shortage of food from January or February until the moment of harvest (July-August).

- As the individual transportation means, the bicycle is widely used by the villagers (half of the households have one) for the transport of both men and crops. In addition, they use shuttle "minicars" between San-Pédro City and the villages along the asphalt road in daily life.
- The funeral is considered as the most significant ceremony in the society and it often obliges villagers not only to leave their farmland for a couple days but also to run into debt due to its expensive costs.

#### (4) Information Dissipation and Communication

Common languages used among different ethnic groups are firstly French and secondary Dioula, which is widely used as a trade language. Communication networks are developed in a way despite the absence of telephone or postal services. Villagers make the best use of mouth-to-mouth communication within the ethnic or religious communities covering whole village, region and all over the country. But information is not conveyed easily among different ethnic communities even in the same village. It is partially due to language barriers, but seems often due to lack of will to communicate with the people belong to other ethnic groups.

The official information is usually transmitted to villagers by the chief or secretary through chiefs of each ethnic community or by organizing villagers' meeting. But in many cases, a multiethnic village does not function well as a unit of communication owing to reality described above. Therefore, it is sometimes more fair and sure to utilize teachers or extension workers living in the village to notify all villagers of the information concerning the whole village.

#### (5) Situation of Women

##### 1) Family

46 % of women consider housework as their principal job and 44 % believe that they are rather farmers than housewives. In any case, they take charge of whole domestic work, sometimes with their daughters. In 88 % of the households surveyed (94 % of the total households), the family money is mainly managed by the husband and a quarter of the wives take part in the decision-making on how to use their money. The decision on farming is also made by men. Women can, however, decide how and what to do in her plot.

##### 2) Agriculture

Generally speaking, as the tree crop production is regarded as the field of men, women concentrate their efforts on the production of food crops such as rice, maize, cassava, yam and vegetables. The objective differs from one ethnic group to another. For example, the food crop production carried out by Kourmen women aims to nourish all their family, whereas Dioula or Mossi women intend to sell them, since their husbands cultivate food crops for the family.

The market gardening is also developed among women. They grow eggplant, okra, chilli, tomatoe, etc. They consume a part of them in the family as condiments of their daily source and they sell the remaining part. In the village society, women, in general, have no property. Thus, they undertake their agricultural activities just in the corner of their husband's plantation or sometimes in the land leased from the earth-chief for the immigrant women.

### 3) Income Source

Women have usually the right to sell their own products that constitute the sources of their income and the income from tree crops production belongs to the men. Besides the sales of their own harvest, women have other income sources from their daily small trade.

The women's incomes and men's contributing to the family economy in a different way. For men, as the most of incomes are obtained from the harvest of coffee or cacao, they gain relatively big amount of money, but only two or three times a year. The men's income is, therefore, rather intended for the large expenses such as purchase of non-consumable products, children's education and travels. On the other hand, although the women's incomes are very small, they earn daily or weekly money, which allows them to purchase the necessities for daily life. These two types of income from different sources and natures are compensated each other to support the family life. Especially for the poor family, the revenue earned by women ensures the daily supply.

#### 3.6.4 Household Economy

The survey result using the questionnaire indicates that the crop production is the most important income source for more than 70 % of the interviewed households and that 47 % out of them depend on this activity entirely without any other income source. The following tables show the total annual average income by category. The average annual income by village ranges between F.CFA 1 and 1.5 million except Scaf, Pont Bascul and Cité Agricole. Cité Agricole records a relatively or absolutely very small annual income, which represents less than 30 % of the average income of the Study Area. This village is heavily depend on food crop production in lowland as shown in the following sections and few households have second income sources. On the other hand, two other villages have higher average income, one being consist mainly of Burkinabé immigrants who perform dynamic activities in industrial crop production, and the other is the village where all the interviewed households have their incomes from more than one source. The diversification of agricultural or economic activities could be, therefore, one of the factors which determine income sizes, although the abnormal precipitation in 1977 that devastated the food production in the lowland and the food crops consumed first in farmhouses had no direct limits to the low cash income.

Income source	Annual income (F.CFA 1,000) per related household	Village	Annual average income (F.CFA 1,000)	Household having second income source (%)
Crop Production	913 (983)	Cité Agricole	355	17
		Grand Gabo	1,080	57
		Camp. Bernard	1,347	72
Agriculture*	990 (1,021)	Pont Bascule	2,055	100
		Petit Pédro	1,593	61
Non-agriculture	302 728	Blahou	1,113	20
		Fahe	1,168	50
Total	1,290	Scaf	2,121	33
		San-Pédro	1,430	88
		Zone	1,290	52

\* Agriculture: Crop production +  
Livestock + Fishing (1997)

Source: JICA Study Team

Nearly 40 % of the current expenses are for the purchase of foods, of which 28 % and 25 % are spent for the purchase of rice and other staple foods, respectively. In fact, 71 % of the sampled households answered that they could not achieve self-sufficiency in food production, and 61 %

of them experienced the shortage of food during the certain period of a year. The reasons are presumed to be due to;

- Mainly, predominance of the industrial crop production in the Area on which the farmers focus their efforts; and
- Unfavorable conditions of related factors such as recently hit inadequate rainfall distribution, the increasing population pressure and so on.

In addition to high ratio of Engel's coefficient, the distribution of expenses also indicates the considerable portion on clothing (19 % of total expenses) due to "the compulsory purchase of women's clothes". Moreover, the large portion of expenses on social activities (14 %) is also affecting households showing the importance of various ceremonies in the society.

Throughout a year, farmers have to prepare the cash for three major occasions i.e. 1) school fees in October, 2) land preparation for their farming between February to April and 3) new year and religious festivals including Ramadan for Muslims. Especially school expenses as well as the case of illness often become the reasons for serious debts.

For the year 1997, 32% of the sampled households declared a financial deficit, which could be compensated by debt. In addition, the deficit often observed at farmers' household could suggested that whole expenses and incomes were not quantified during the interview. Especially, the income from "small trade of all kinds by women" regarded, as barter (sale and purchase on the spot) was impossible to be counted.

### 3.6.5 Problems and Solutions Proposed by Farmers

#### (1) Daily Life

The problems expressed by villagers vary according to the villagers as presented in Table 3.3.1. The common problems to all the villages relate to the basic human needs such as drinking water, health and children's education. The problem concerning the road and transportation means counts more naturally for the hamlets wedged and dispersed in the area, and it is strongly related to other problems such as the access to the basic social facilities (school and medical facilities) or to the markets. Some villages give priority to electrification. It must be the subject of prudent consideration, taking into account the expensive costs (installation cost and electric charge), a real burden for users.

As for the family level, one third of the households declare "insufficiency of food" as one of major concerns in addition to health and financial problems. Both husbands and wives (42 % and 26 %, respectively) think the agriculture to be their main problems. Women deplore also lack of funds necessary to launch a small business and the adverse condition of marketing of their own agricultural products.

#### (2) Agriculture

The land use shows that the agriculture in the area rests on two principal productions: cacao and coffee. During the interview, almost all the farmers insist on the considerable fall in cacao output. The majority of farmers in the Study Area depend more or less upon this type of cultivation. Therefore, their primary concern is to solve the "relative problems". With regard to the rubber cultivation, since it was recently introduced into the area by SAPH (1989) and just

started the production, the problems are not quoted for the moment. This new trend interests the farmers more, because coffee and cacao cultivation has the following merits:

- Technical and financial supports given by SAPII
- Monthly remuneration, different payment system from that of coffee and cacao

In comparison with the cultivation of crops for export, the food production remains always minor, but it seems to take more and more importance from the viewpoint of food security as well as creation of new income sources. The market gardening, which allows women to obtain daily income shows more and more its potential, and not only women but also young people are interested in it (because they can't find the forest for their own plantation).

The problems on each type of cultivation presented by farmers are summarized in Table 3.6.1, which explains also the countermeasures taken by the farmers to overcome the obstacles and constraints they met on their way to solution. It is noteworthy that farmers form groups generally in ethnic line by themselves or under the guidance of ANADER in order to solve problems: working groups to weed the plantations, and women's groups to lease land, to bore wells and to realize market gardening. Except for coffee and cacao, the commercialization of products is not organized.

### 3.7 Failure of the San-Pédro Paddy Project

#### 3.7.1 General

ARSO's San-Pédro Paddy Project was started in 1973. In 1977, the irrigated area was expanded upto 650 ha. Then, there was a gradual decrease in the irrigated area. Even though the renovation of the irrigation pump was completed in 1991 under the Canadian assistance, the last pump operation was made by OCTIDES, a private enterprise, in 1993, irrigating an area of 40 ha. Since then, no pumped water runs into the developed area. Hence, it is important to analyze the reasons of failure and possibility of re-introduction of rice cultivation in the Study Area, with countermeasures for regional development. The causes of failure of the former paddy project are studied on technical and social viewpoints, having several discussions with the farmers and government officers concerned.

#### 3.7.2 Agriculture during the Former Project

The irrigated rice double cropping culture was initially introduced in the Project Area in 1977 by the cooperation of Chinese team. In the same year, GOCI established SODERIZ in MINAGRA as the responsible organization for this project. In 1988, with privatization, the SODERIZ was reorganized to SODEPALM-RIZ. The SODEPALM-RIZ was also reorganized to CIDV in 1992 and the CIDV again was reorganized to ANADER in 1994.

There is no complete data on the agricultural production in the Project Area. Through ANADER San-Pédro, GVC based paddy yield and production data have become available for the main seasons in 1988 and 1989. They are summarized as follows:

Year	1988	1989
Average yield (kg/ha)	2,763	2,805
Maximum yield (kg/ha)	4,198	3,815
Min. yield (kg/ha)	792	2,044
Total Production (kg)	830,347	837,902
Production per farmer (kg)	7,037	8,638

Source: SODIPALM kept by ANADER San-Pedro

In the early stage of the project, the rice double cropping was carried out comparatively smoothly with the government subsidies and Taiwanese experts under their strong leadership. In 1990, the government subsidies for agricultural input materials were stopped in order to urge the farmers to establish self-supporting agriculture. In 1992, the government stopped all the subsidies and gave necessary input materials for the next coming season only, that is, 25,000 liters of fuel for operation of water pumps. However, the farmers wasted these input materials and could not make effective use of farming funds in the next season. Since 1993, CIDV and ANADER have supplied the farmers with input materials by credits.

According to the record of credits, the farmer's total gross income and debts per farmer in 1989 were F.CFA 462,511 and 454,930 (including 32,786 in 1988), respectively. Therefore, the farmer's net income was only F.CFA 7,581. In these conditions, rice double cropping was carried out only once in 1989, and the debt condition remained unchanged. Under such farming situations, the number of farmers cultivating paddy in the area rapidly decreased from 138 in 1988 to 62 in 1991. Similarly, the rice cultivated areas also decreased from 394 ha in 1988 to 187 ha in 1991.

### 3.7.3 Engineering Aspects

In connection with the engineering aspects of the project, the following matters have come up as the causes of its failure; 1) insufficiency of irrigation water, 2) unequal water ponding and 3) poor drainage. These are interpreted to 1) poor water management, 2) incomplete land leveling and 3) poor drainage facilities.

#### (1) Insufficiency of Water

Three units of pumps (one unit was standby) and two sets of generator were installed. After initial installation of them in 1973, because of their deterioration, they were replaced in 1991. The pump operation record of second crop season (September to February) in 1981 shows as follows;

a. Total pump operation:	2,511 hours
b. Estimated pumped water amount (700 lit/sec/pump):	6,327,000 m <sup>3</sup>
c. Total fuel consumption:	42,800 lit
d. Irrigated area:	219.53 ha
e. Unit irrigation water:	28,820m <sup>3</sup> /ha = 2,882mm
f. Estimated irrigation water requirement:	1,122mm
g. Fuel cost per ha at present fuel cost(=c x 235 / d):	F.CFA 45,816/ha-crop

From the above, irrigation efficiency is estimated as 39%. As the standard efficiency is around 65%, this low irrigation efficiency might be caused by 1) conveyance losses through the unlined sandy-soil irrigation canals and 2) improper water management in the field.



## (2) Poor Land Leveling

Based on the existing data, land levels of some typical plot area are examined as shown below:

Plot No.	Area (ha)	Maximum El.	Minimum El.	Mean El.	(Unit: m)
					Difference
50-1	4.0	11.10	10.22	10.88	± 0.41
14	4.0	10.16	9.76	9.94	0.20
82	2.2	8.91	8.51	8.73	0.20
82-1		8.91	8.75	8.80	0.08
82-2		8.80	8.59	8.67	0.11

Note: Elevations shown above are about 4 m higher than project datum.

Plot 50-1 shows the difference of the land level at  $\pm 44$ cm and Plot 14 and 82 shows  $\pm 20$ cm of undulation. Under these conditions, the water management in each plot could not be implemented and it might require excess irrigation water. If Plot 82 were divided into 2 sub-plots, the undulation could be reduced half of the undivided plot.

Undulation limit of within  $\pm 5$ cm is usually considered and targeted for paddy field plots in Asian countries. This might allow easy weed control during the paddy-growing period. Land leveling in large cultivation plot requires high technical accuracy, but land leveling in small area within  $\pm 5$ cm undulation is comparatively easy to maintain. Considering the mechanized farming, the favorable scale of cultivation plot is 0.25 ha.

## (3) Poor Drainage

In the project, the paddy field was developed in the flat area protected by the artificial flood protection dyke, where the direction of the Ganou river flow was changed to southwards from westwards. Therefore, internal drainage of the project area was very important. But not so much attention on the drainage was paid in the project. Wide and uncontrolled drains or artificial swamps are observed at present. It might have reduced the irrigable area of the project.

### 3.7.4 Social Aspects

#### (1) Social Background of the Project

##### 1) Starting From Zero

There was no participation of existing inhabitants from the onset of the project, because project site was located where population density was low and within the dwelling area of ethnic groups who had been practicing perennial-crop based agriculture. All the participants were immigrants, thus they could not form organizations based on the existing communities and/or traditional groups. Therefore, it took longer time and the process became laborious for the participants to establish villages and organizations starting from zero.

##### 2) Diversity in Participants

Diversity in nationalities, ethnic groups, social background (educational, occupational etc.), dwelling sites (Cité Agricole or San Pédro city) and other differences caused inefficiency in communication among participants which consecutively became the disturbing factors for the mutual trust. This situation hindered the farmers from assuming the responsibility and performing their organizational duties. In short, the diversity placed many obstacles on the road to "organizing".

### 3) Youth Participants

For youth participants, who lacked experiences in agriculture, double cropping in irrigated paddy cultivation was a heavy work with a lot of restrictions. Therefore, there was a tendency for them to run into easier ways such as stealing water and neglecting their water control duties in their own plot and/or in the joint management of facilities and machinery.

### 4) Intervention and Assistance of Government / Land Problems

Though the mono-culture of rice, which was rather imposed by the government, showed the vulnerability to disasters such as flood or drought, the farmers had to depend on it for both their income and self consumption. Some farmers tried to minimize risks by diversifying crops, but faced difficulties in cultivating other crops since they were involved in land troubles with neighboring indigenous people on the uplands in and around their site. In addition, the government supported and subsidized irrigated paddy cultivation throughout the project period so that farmers' reliance upon "others" increased. Consequently, they never learned to plan an investment in agriculture or to manage farming by themselves.

## (2) Farmers Organization for Operation and Maintenance of the Former Project

### 1) History of GVC and its Organization

In the project area, 13 GVCs were created one after another from 1976 to 1981, as new farmers came in to settle with the expansion of project area. In 1980s, the debt of each GVC continuously increased since production remained low against inputs due to frequently occurred natural disasters such as flood and to difficulty in getting adequate quantity of water in plots which was caused by both superannuated facilities and inapt water management. In 1985, the Central Committee for Management and Restoration (CCGR), higher organization of GVCs, was established in an effort to raise fund for the rehabilitation of the project and finally to be transformed into officially recognized cooperative. Within CCGR, the following three sub-committees were also formed in order to unify management function and strength coordination abilities among the GVCs.

- a. Technical sub-committee (to manage planned crop cultivation, water distribution and harvest / to maintain jointly utilized facilities and agricultural machinery)
- b. Discipline sub-committee (to lead the farmers to observe rules thoroughly/ to mediate disputes, judge as well as apply sanctions)
- c. Financial and marketing sub-committee (to raise funds and inputs / to sell the products / to manage account and debts)

The farmers had not managed the project independently yet at that time. While the government's assistance gradually shrunked, their intervention equally decreased. Eventually the farmers obtained their autonomy at the time of establishment of GVC union, which replaced CCGR in 1991. Then, 13 GVCs were also unified into 4 GVCs based on the irrigation blocks of main canals. In the meantime, production situation such as pumping operation and canal conditions were deteriorated and in the end, irrigation was ceased in 1992 with financial difficulties attributed immediately to the ceasing of subsidized fuel supply from the government. Ironically enough, these 4 GVCs were officially recognized by the government in 1995.

## 2) Activity

According to the available documents, in 1988 a single GVC consisted of 4 to 17 members and managed an area of about 8 to 54 ha, so they seemed rather small as organization. Nevertheless GVC was considered as the receiver of funds with joint liability system. Farmers were almost forced to receive loans by the government, which decided the amount of agricultural inputs. These inputs were calculated based on nominal plot area of each farmer, which was very often different from the real irrigated area. They were bound to repay the debt through the sales circuit established by the government. At the beginning, the work in paddy field, the management of machines and the sales of rice were conducted collectively, in other words, by GVC, but they were transformed into individual activities for the reasons mentioned below (for example, individual ownership of machines, individual payment of debt and sale of rice in the black market).

## 3) Problems and Lessons Learnt from the Project

To perform agricultural activities such as irrigated rice cultivation which require high organizational skills under difficult condition, "Resettlement of a diversity of persons to the new land", was not very easy work. However, there was no much trouble among the farmers because irrigated rice cultivation was going smoothly with economic success thanks to new facilities, government subsidy and water management carried out by Taiwanese experts. According to the farmers, once it became difficult to have enough water in the plots, disputes and jealousy started erupting among individual farmers and/or different social groups. Such troubles were possible to be solved within comparatively small single group, GVC. But in the cases of water troubles among GVCs, especially between upper stream ones and lower stream ones, scrambles for water frequently occurred, because hostility overpowering coordination function. The coordination system and sanctions did not work well on water troubles owing to the inequality in accessibility to water according to the locations of respective plots which had been existing since the onset of the project and in turn, justified the fights and the unfair practices.

In addition, to the farmers, joint liability system in loans seem to be also unfair since it was "giving merits to lazy ones while giving demerits to hard working ones". And then, more and more farmers began selling produced rice in the black market individually without handing it over to GVCs. These members' dishonest act contributed to the increase in debts of GVCs. In any case, the unfair practices such as stealing water or individual marketing were controlled by the farmers themselves but the control seemed to function ineffectively. And at last the rule of organizations became a dead letter. Then ultimately, joint operation became difficult and organizations finally came to collapse.

From above experiences, some lessons or recommendations can be drawn as follows and they may be helpful in organizing farmers in the future.

- a. First of all, economic success is the most effective factor for avoiding troubles, which occur due to various differences among the members.
- b. Coordination function and sanctions do not work well, if inequality among the members exists in the initial condition and/or the system set up in organization, which will ultimately lead the organization to collapse.
- c. Let farmers grasp whole view of the organization. Then the coordination among the members in the smallest unit such as working groups should be left to the farmers

themselves. For the coordination of more important matters between organizations (between units or irrigation blocks), common rules and neutral coordination organization should be established.

- d. While rules are established by the members, effective control and supervising systems should also be set up in order to apply the rules thoroughly.

Some farmers left the project or some others stopped agricultural activities with ceasing of the project. But most of them are still farming, either living in Cité Agricole or San-Pédro city. Additionally, there exist GVCs and other organizations in the site as shown in Table 5.2.3, even if they do not function any longer. According to the surviving farmers, after various failures, what they have gained is "skills of irrigated paddy cultivation" as well as "a new community".

### 3.7.5 Comprehensive Analysis of Failure

As discussed above, the failure caused by technical faults and social deficiencies are interlocked to each other and interrelated with other external situations. Their correlative effects on the project failure are summarized as shown in Fig. 3.7.1.

## 3.8 Environmental Conditions

### 3.8.1 Natural Environment

The Study Area is a patchwork of lands intensively used by the local people, with two (2) distinct sub-areas, which are the upland area on eastern side and the lowland area on the western side. The natural habitats in the Study Area can be characterized according to three (3) categories as follows:

- The lowland swampy forest has been generally replaced by rainfed rice when this is possible. Large pieces of swampy forest still remain in several places, mainly in the northern and central part of the Study Area. The swampy forest is generally dominated by the *Raphia* trees, in association with other species like *Mitragyna* trees.
- The upland forest is organized in a patchwork of woody hills. This forest is decimated by shifting cultivation and will be completely destroyed in the coming years. This forest is already degraded and cannot fulfill its original ecological function to sustain the fauna, with the exception of minor species or species that have easily adapted to the crop fields environment.
- The San-Pédro river and its banks constitute a specific habitat which is, however, largely dependent on development works and uses like hydropower, fishing and riverside cultivation. The right bank of the river in the classified forest is more intense than the left bank in the Study Area. This riverside forest, which generally remains in small isolated woods, is composed of the same species as those in the upland forest.

There is only one large area of natural upland forest in the central part of the Study Area. This forest is actually owned by the National Research Center for Agriculture (CNRA), and is known as the IDEFOR forest. This forest is a sanctuary for valuable species like chimpanzee and buffalo. However, the new policy under management of CNRA since 1998 is to replace the forest cover by cacao and coffee plantations for research purpose.

### 3.8.2 Rapide Grah Classified Forest

#### (1) Background

The Rapide Grah classified forest (315,000 ha) lies on the right side of the San-Pédro River, outside the Study Area. Half of the area are occupied by crop fields, and the total population reaches about 145,000 persons. The Rapide Grah forest is the largest classified forest of Côte d'Ivoire. It can be considered as a kind of buffer zone along the Taï national park. This park is the largest remaining natural forest of West Africa and has been declared as a world natural patrimony by UNESCO. Some details of classified forest in Côte d'Ivoire and specific case of Rapide Grah Classified Forest are presented in the Supporting Report.

#### (2) Development Plan

The development plan of the Rapid Grah forest was adopted in 1997 by order. This plan has defined the objectives according to a set of areas; the protection series (61,386 ha), the reforestation series (118,440 ha), the production series (86,675 ha) and the cultivated land series to be renamed as being the enclaves (48,500 ha). The development plan provides that SODEFOR will recover the area for its forestry purpose, which implies to relocate the existing population. Relocation is, however, a resettlement action from the series toward the enclaves.

#### (3) Protection Series

The protection series have been defined as follows:

- a buffer zone all along the National Park of Taï;
- a 300 m wide riverside zone along the San-Pédro River and the Nero River;
- a 200 m wide riverside zone along other rivers (Hana, Kré, Go rivers).

This protection objective raises jurisdictional problems. As regards to the protection of the riverbanks of the San-Pédro, SODEFOR has obviously no jurisdiction on this matter on the left bank, which belongs to the Study Area.

#### (4) Implementation of the Development Plan

Implementation of the development plan has started since 1997, but it has found so much opposition from the settlers that MINAGRA has decided to postpone its application after revising the plan. Actually, SODEFOR maintains the pressure upon the illegal settlers to prevent further extension into the remaining forest. Further implementation of the development plan is subject to the agreement of MINAGRA.

### 3.8.3 Environmental Resources

#### (1) Cynegetic Resources

In Côte d'Ivoire, the consumption of bush meat has been estimated to reach the equivalent economic value of about F.CFA 100 million. These estimates do not include birds, reptiles and more particularly snails, which are, however, important in the daily diet during the rainy season. The gathering of snails has been estimated around 8,000 tons per year. In the Study Area, hunting to get the bush meat is an important activity practiced by the cultivators, because:

- It is a component of the current subsistence economy;

- It is also a possible additional source of revenue;
- It is sometimes a necessary substitute for fishing, since most of the people living near the San-Pédro river have not got the necessary know-how for fishing.

The main species that are hunted and consumed by the villagers are the Cane Rat (locally called agouti), Squirrel, Hedgehog, Rat, Snail, Duiker, Varanus, Frog, Crawfish, Porcupine, Python, Crocodile and several common birds. Hunting activity seems to be more essential for daily life in the villages of the northern part of the Study Area, compared with those of the southern part. However, the place of hunting differs according to the villages, as have shown by the interviews made by the Study Team. Results of these interviews as well as the evaluation of importance of hunting in the Study Area are shown in the Supporting Report

## (2) Fishery Resources

Fishing is clearly divided into two (2) types of activities as follows:

- A poor fishing activity for subsistence with neither organization nor know-how, giving up the main water resources like the San-Pédro River and dam reservoir. Subsistence fishing is more dependents on the lowland swamps, the small rivers and also the old irrigation drains in the plain of San-Pédro than the San-Pédro River itself.
- A commercial and organized fishing is being done by experimented fishermen in the San-Pédro river and the dam reservoir. Data on annual catches are available for Fahé only.

The relative importance of fishing in the Study Area can be characterized as follows:

- It is a source of revenue for both permanent and temporary fishermen;
- It is a subsistence activity for the people who depend on it for their daily diet;
- It provides fresh fish on the local markets of isolated villages like Fahé for example;
- It is an activity that supplies people with continental water fishes that are apparently more appreciated than sea fishes. Crawfish are an appreciated dish in restaurants. This confers a specific value to continental fishing, although it is quantitatively negligible in comparison with sea fishing.

However, the practice of fishing raises also issues like the depletion of the fishery resources and the trends toward generation of social conflicts. Provided that in a context of depletion of the fishery resource, a lot of villagers have to buy the fish on the local markets, the overfishing practice made by the Malien fishermen is increasingly perceived as an unacceptable activity. Most of the Malien fishermen have a temporary activity, which strengthen the feeling of despoilment of the resource. The detailed fishing activities in the Study Area are shown in the Supporting Report.

## (3) Fuelwood Collection

Fuelwood is generally extracted from the remaining woody hills, but is increasingly shifting to the plantations like the hevea woods because of deforestation. The villagers are aware of the quick depletion of the fuelwood resources, but they are unable to stop it. Fuelwood is considered as a serious problem in Cpt. Bernard and Cité Agricole villages, for example.

#### (4) Plants

A lot of plants are collected around the villages for cooking and for medical treatment. Only a part of them are supplied by the woods. Most of the diseases are treated with plants, wherever the patient is treated by modern medicine or not. For the Buruli disease, people rely first on the treatment by plants, then on modern medicine. Other supplying functions of plants are the production of bangui drink from the palm trees, the supply of papo leaves by the raffia trees of the swamps for roofing and wood materials for housing.

#### 3.8.4 Biodiversity

Fauna and flora species are considered here from their ecological value. The project lies in an area that belongs to so-called Guinean phytogeographic domain of swampy forest, but has been deforested and used for cultures. Inherited elements of the original habitats like isolated trees, woody hills partially preserved and few forest swamps can be found in the Study Area. Present biodiversity is the result of the degradation of the natural environment, and is largely determined by the human selection of useful species.

The fauna of the Guinean forest is remarkable. The degradation steps of this fauna diversity are reflected in the gradual quality decrease from the Taï forest at the west to the Rapide Grah forest, and finally the Study Area on the east. The species still observed in some parts of the Rapide Grah Forest like buffalo and chimpanzee were also living in the Study Area no more than 10 years ago.

Actually, the presence of buffalo is confirmed by villagers, especially in the northern part of the Study Area, but these animals are isolated and move within an area larger than the Study Area. Crocodiles are also frequently mentioned in swampy forest. It seems that they are very few and move between the San Pedro river and the swampy forest according to seasons.

It seems that aquatic biodiversity of the San Pédro river has been deeply affected by the land clearance at the riverside, by fishing and also probably hydropower. There could be 31 fish species in the river, but certain of these species have been proliferating, while other have reached extinction. According to ANADER, species like *Tilapia Nilotis*, *Labeo*, *Eutropius Mentalis*, all the *Mormyrops*, *Synodontis Occidentalis* and *Auchenoglanis Occidentalis* are no more present in the river. The population of crawfishes has considerably decreased according to the explanation of the villagers. Tortoises that were in high number 10 years ago in the San Pédro river cannot be observed now. Finally, crocodiles are apparently present but in small number, while they were common before the regional development.

Among the fauna species that are apparently present in the Study Area, it can be considered that Crocodile, Buffalo, few Duikers, maybe also the Diana Monkey and probably the Water Chevrotain are subject to integral protection (based on the species list of 1994). Animals partly protected and certainly present in the area include pythons, pangolin and possibly certain species of monkeys. A more detailed statement of the ecological value of the local fauna is not easy because, on the one hand, there is no actualized regulation of protection of species, and on the other hand, information about species present in the area is not accurate enough.

#### 3.8.5 Water and Soil

The main conditions observed in the field of water and soil are:

- Hydrology seems to be affected mainly by declining rainfall, and secondarily by the hydraulic works; deforestation of the Go watershed upstream is possibly an additional factor;
- It seems that the San-Pédro estuary has been strongly influenced by the development works; The silting of the estuary from the sea causes flooding in the plain, specially during the dry season.
- There are several erosion actions like river banks sapping which cause tree falls near Polo, gully erosion in upland villages which should cause increasing livelihood problems to maintain the settlements and certainly sheet erosion in the agricultural fields with loss of soil.

### 3.8.6 Environmental Diseases

The Sanitary District of San-Pédro has recorded water-born/water-related diseases, specially diarrhea, malaria, bilharziose and Guinean worm. These data show the large prominence of malaria with more than 17,000 cases in 1996/97 in the district, in which San-Pédro area represents 57 % of the cases. During the same period, more than 3,000 cases of diarrhea have been met with 50 % of the cases in San-Pédro only.

Malaria occurrence is endemic in the Study Area and shows trends toward an increase of serious malaria cases, according to the observations made in San-Pédro. There is no accurate information to follow the evolution of this disease in time. However, data registered at the service of pediatrics of the San-Pédro hospital can be used as an indicator of seriousness of the disease. In 1997, there were 477 cases of paludal malaria, which induced 60% of hospitalization in the pediatrics service. Serious malaria touched 199 cases, which represented 15 % of hospitalization and 35 death cases. For reference, the second case of death observed in this service is anemia (32 % of death cases).

Control of malaria disease has been given priority at national level through the National Program of Fight against Malaria. This program lies upon medical care and prevention, and is implemented at local level by the Sanitary Districts. The main measures for prevention are chemoprophylaxis, fight against vectors and information/education activities. The fight against vectors is largely based upon the use of impregnated nets, which are distributed at the cost of F.CFA 5,000 and need new impregnation each semester at a cost of F.CFA 500.

The other diseases related to water in the Study Area are the urinary schistosomiasis and diarrhea (see Volume II of the Report). There are also cases of intoxication due to accidental inhalation of pesticide products (8 cases of hospitalization in 1997 at the San-Pédro hospital and 12 cases in 1998), specially those used in cacao cultivation.

### 3.8.7 Cultural Patrimony

With present knowledge, there is no record on cultural patrimony in the Study Area.



### 3.9 Present Constraints and Development Opportunities for Rural Development

As discussed above, agricultural and rural development in Côte d'Ivoire in general and the Study Area in particular is moderate in the past few decades. In spite of continuous efforts by governmental agencies, expected targets could not be achieved instead often resulted in failure of some perspective projects. Present constraints that hinder the integrated agricultural and rural development in the Study Area along with available opportunities can be grouped under 1) agricultural management, 2) agricultural supporting (marketing, extension services, rural financing), 3) irrigation and drainage, 4) social development and 5) environment as listed in Table 3.9.1. A comprehensive analysis of these constraints will give way to a new paradigm of technical and social development.

Table 3.3.1 Available Infrastructures and Problems Met in Villages

Village	T/ W	Elec.	Road		School	Health		Major issues			Suggested solutions					
			G	P		F	NF	Nur	Pha.	1	2	3	1	2	3	
Cité Agricole				3.5	X			Health	Electricity	Drinkable water	Health	Electricity	Drinkable water	Dispersary in operation	Electrification	Water supply
Grande Gabo				2.4				Drinkable water	Dirt road Transport	Health	Health			Tube wells	Improvement of roads condition	Construction of a dispensary
Camp.Bernarad	X		X	-	X		X	Readjustment of village lots	Electricity					Contribution of 1/5 of the cost	Electrification	
Petit Gabo			X	-				Burili Uleer	Drinkable water	Children's education	Children's education			Effective remedy	Tube wells	Construction of a school
Pont Baseule			X	-				Drinkable water	Electricity	Children's education	Children's education			Tube wells	Electrification	Construction of a school
Camp.Colonel				4.9				Classified forests	Health	Children's education	Children's education			?	Construction of a dispensary	Construction of a school
Petit Pédro	X		X	-	X	X	X	Health	Drinkable water	Readjustment of village lots	Health			Construction of a dispensary	Multiplication of tube wells	Governmental assistance
Konan Kro	X			2				No church	Children's education	Health	Health			Villagers' contribution	Construction of a school	Construction of a dispensary
Kouassi Kro				3	X			Drinkable water	Health	Children's education	Children's education			Tube wells	Construction of a dispensary	Public school installation
Zilé Kro				6.9				Dirt road	Children's education	Drinkable water	Drinkable water			Improvement of roads condition	Construction of a school	Tube wells
Blahou			X	-	X	X	X	Drinkable water	Road	Electricity	Electricity			Tube wells	Improvement of roads condition	Electrification
Petit Zénoula	X			8.6	X			Children's education	Dirt road Transport	Health	Health			Public school installation	Improvement of roads condition	Construction of a dispensary
Lassina Kro				10.6				Drinkable water	Dirt road	Health	Health			Tube wells	Improvement of roads condition	Construction of a dispensary
Fahe	X	X		-	X	X	X	Dirt road	Drinkable water	Health	Health			Improvement of roads condition	Water supply	Construction of a dispensary
Scaf	X			-		X	X	Classified forests	School	Health	Health			?	Construction of a school	Construction of a dispensary

X : existing

T/W : tube wells Elec. : electricity G : situated on the paved road P : distance to the paved road

F : Public school NF : Private school(built by villagers)

Nurs. Private Nurse Pha. pharmacy

Principal concerned villages

Table 3.4.1 Crop Income by Farming Type in High Yield Year

Type of Farming	Crop	Area (ha)	Yield (kg/ha)	Production (kg)	Unit Price (FCFA/kg)	Gross Income (FCFA)	Production Cost		Net Income (FCFA)	Area per farmer	Net Income (FCFA)		
							(FCFA/ha)	(FCFA)			per ha	per farmer	
Lowland Farming	Lowland Paddy	53	3,478	185,377	159	29,475,007	163,661	8,723,131	20,751,875	1.3	389,341	518,797	
	Total	53	3,478	185,377	159	29,475,007	163,661	8,723,131	20,751,875	1.3	389,341	518,797	42%
Upland Farming	Upland Paddy	2	1,685	3,370	159	535,830	157,869	315,738	220,092	0.1	110,016	7,860	
	Maize	15	1,903	28,545	101	2,968,680	99,829	1,497,435	1,471,245	0.5	98,083	52,544	
	Yam	1	3,812	3,812	135	514,620	130,947	130,947	383,673	0.0	383,673	13,703	
	Cassava	6	4,502	27,012	53	1,431,636	130,947	785,682	645,954	0.2	107,659	23,070	
	Vegetables	15	-	-	-	-	-	-	-	0.5	-	-	
	Total/Average	24	2,614	62,759	87	5,450,766	113,742	2,729,802	2,720,964	0.9	113,374	97,177	8%
Tree Crop Farming	Coffee	133	776	103,208	520	53,668,160	86,854	11,551,582	42,116,578	0.9	316,666	296,596	
	Cacao	320	612	195,840	402	78,727,680	110,979	35,513,280	43,214,400	2.3	135,045	304,327	
	Rubber	53	1,600	84,800	172	14,585,600	165,750	8,784,750	5,800,850	0.4	109,450	40,851	
	Oil palm	3	15,000	45,000	32	1,440,000	165,750	497,250	942,750	0.0	314,250	6,639	
	Cola	4	5,000	20,000	150	3,000,000	165,750	663,000	2,337,000	0.0	584,250	16,458	
	Total/Average	513	875	448,848	337	151,421,440	111,130	57,009,862	94,411,578	3.6	184,038	664,870	54%
Lowland + Upland	Lowland Paddy	83	3,478	288,674	159	45,899,166	163,661	13,583,863	32,315,303	1.4	389,341	557,160	
	Maize	44	1,903	83,732	104	8,708,128	99,829	4,392,476	4,315,652	0.8	98,083	74,408	
	Yam	3	3,812	11,436	135	1,543,860	130,947	392,844	1,151,019	0.1	383,673	19,845	
	Cassava	21	4,502	94,542	53	5,010,726	130,947	2,749,887	2,260,839	0.4	107,659	38,980	
	Vegetables	9	-	-	-	-	-	-	-	0.2	-	-	
	Total/Average	151	3,168	478,384	128	61,161,880	139,861	21,119,067	40,042,813	2.6	265,184	690,393	56%
Lowland + Tree Crop	Lowland Paddy	127	3,478	441,706	159	70,231,254	163,661	20,784,917	49,446,337	1.1	389,341	419,037	
	Coffee	143	776	110,968	520	57,703,360	86,854	12,420,122	45,283,238	1.2	316,666	383,756	
	Cacao	278	612	170,136	402	68,394,672	110,979	30,852,162	37,542,510	2.4	135,045	318,157	
	Rubber	12	1,600	19,200	172	3,302,400	165,750	1,989,000	1,313,400	0.1	109,450	11,131	
	Cola	1	5,000	5,000	150	750,000	165,750	165,750	584,250	0.0	584,250	4,951	
	Banana	3	18,000	54,000	100	5,400,000	1,280,021	3,810,063	1,589,937	0.0	519,979	13,220	
Total/Average	564	1,420	801,010	257	205,781,686	124,206	70,052,044	135,729,642	4.8	240,655	1,150,251	93%	
Upland + Tree Crop	Upland Paddy	7	1,685	11,795	159	1,875,405	157,869	1,105,083	770,322	0.1	110,016	9,394	
	Maize	52	1,903	98,956	104	10,291,424	99,829	5,191,108	5,100,316	0.6	98,083	62,199	
	Yam	11	3,812	41,932	135	5,660,820	130,947	1,440,417	4,220,403	0.1	383,673	51,468	
	Cassava	23	4,502	103,546	53	5,487,938	130,947	3,011,781	2,476,157	0.3	107,659	30,197	
	Coffee	114	776	85,454	520	46,001,280	86,854	9,901,356	36,099,924	1.4	316,666	440,243	
	Cacao	221	612	135,252	402	54,371,304	110,979	24,526,359	29,844,945	2.7	135,045	363,963	
	Rubber	35	1,600	56,000	172	9,632,000	165,750	5,801,250	3,830,750	0.4	109,450	46,716	
	Banana	1	18,000	18,000	100	1,800,000	1,280,021	1,280,021	519,979	0.0	519,979	6,341	
	Vegetables	12	-	-	-	-	-	-	-	0.1	-	-	
	Total/Average	464	1,194	553,945	241	135,120,171	112,624	52,257,375	82,862,796	5.7	178,584	1,010,522	81%
Mixed Crop Farming	Lowland Paddy	508	3,478	1,766,824	159	280,925,016	163,661	83,139,788	197,785,228	1.1	389,341	445,462	
	Upland Paddy	3	1,685	5,055	159	803,745	157,869	473,607	330,138	0.0	110,016	741	
	Maize	278	1,903	529,034	104	55,019,536	99,829	27,752,462	27,267,074	0.6	98,083	61,412	
	Yam	69	3,812	263,028	135	35,508,780	130,947	9,035,343	26,473,437	0.2	383,673	59,625	
	Cassava	176	4,502	792,352	53	41,994,656	130,947	23,046,672	18,947,984	0.4	107,659	42,676	
	Coffee	687	776	533,112	520	277,218,240	86,854	59,668,698	217,549,542	1.5	316,666	489,976	
	Cacao	1,758	612	1,075,896	402	432,510,192	110,979	195,101,082	237,409,110	4.0	135,045	534,705	
	Rubber	61	1,600	97,600	172	16,787,200	165,750	10,110,750	6,676,450	0.1	109,450	15,037	
	Oil palm	14	15,000	210,000	32	6,720,000	165,750	2,320,500	4,399,500	0.0	314,250	9,909	
	Cola	26	5,000	130,000	150	19,500,000	165,750	4,309,500	15,190,500	0.1	584,250	34,213	
	Banana	5	18,000	90,000	100	9,000,000	1,280,021	6,400,105	2,599,895	0.0	519,979	5,856	
	Vegetables	110	-	-	-	-	-	-	-	0.2	-	-	
	Total/Average	3,585	1,532	5,492,901	214	1,175,987,365	117,534	421,358,507	754,628,858	8.1	210,496	1,699,615	137%
	Whole		5,354	1,498	8,023,204	220	1,764,398,315	118,269	633,249,788	1,131,148,526	5.9	211,260	1,240,291

\* - Not available data

Source: JICA Study Team

Table 3.4.2 Yield Constraints of Crops in the Study Area

(No. of farmers answered)

Crop	Degree of Constraint	Water	Soil	Weed	Disease and Pest	Labor	Market
Paddy	Greatest	207	114	60	30	27	48
	2nd	30	62	101	36	38	16
	3rd	2	18	15	23	32	7
	Total	239	191	179	89	97	71
Maize	Greatest	120	54	24	3	0	30
	2nd	48	52	88	18	24	8
	3rd	12	25	25	20	34	6
	Total	180	131	137	41	58	44
Cassava	Greatest	63	96	24	12	3	30
	2nd	28	41	98	12	30	12
	3rd	37	23	26	15	37	5
	Total	128	163	148	39	70	47
Yam	Greatest	72	78	6	9	6	21
	2nd	44	22	66	4	8	6
	3rd	7	10	16	16	27	4
	Total	123	110	88	29	41	31
Vegetables	Greatest	18	12	9	24	0	3
	2nd	6	10	12	6	2	0
	3rd	0	1	4	1	9	4
	Total	24	23	25	31	11	7
Cacao	Greatest	108	132	3	138	30	144
	2nd	60	40	62	76	16	12
	3rd	10	10	36	2	33	5
	Total	178	182	101	216	79	161
Coffee	Greatest	75	90	36	21	39	102
	2nd	40	34	76	20	24	2
	3rd	6	9	8	14	23	3
	Total	121	133	120	55	86	107
Rubber	Greatest	3	15	0	12	6	21
	2nd	10	4	12	12	4	0
	3rd	1	0	1	0	5	0
	Total	14	19	13	24	15	21

Note: Degree of yield constraints is expressed by a score, which is given 3 points to the answer of greatest, 2 points to the 2nd, and 1 point to the 3rd.

Source: JICA Study Team

Table 3.4.3 Way to Increase in Farming Income

Farming Type	No. of Farmers	Expansion of land		Increase in yield Priority	Introduction of new crop		Improvement of market	
		Priority	Ideal area(ha)		Priority	Details	Priority	Details
Lowland(L)	4	3	3	1	3	Rubber	2	No suggestion
Upland(U)	1	1	10	2	1	Poultry	1	Construction of storage
Tree crop(T)	8	3	5	1	3	Rubber, Rice	2	Fixed place, Price up
(L)+(U)	5	1	8	1	1	Tree crops	1	Price up, Storage
(L)+(T)	14	2	6	1	2	Tree crops	2	Price up, Storage
(U)+(T)	9	2	6	1	2	Rice, Oil-palm	1	Organization of GVC, Price up
(L)+(U)+(T)	55	2	7	1	2	Rice, Tree crops	1	GVC, Storage, Fixed Price, PU
Total	96	2	7	1	2	-	1	-

Priority: 1: Highest, 2: 2nd, 3: 3rd.

Source: JICA Study Team

Table 3.4.4 Expectation to the Project

Farming Type	No. of Farmers	Irrigation facility	Drainage facility	Farm Road	Leveling of field	Technology support	Financial support	Social support	
								Priority	Details
Lowland(L)	4	2	2	5	5	3	5	7	No suggestion
Upland(U)	1	1	1	1	1	1	1	1	Water/Electricity
Tree crop(T)	8	2	3	3	3	2	5	3	Dispensary
(L)+(U)	5	1	1	2	2	1	2	3	Dispensary, Electricity
(L)+(T)	14	2	2	3	2	1	3	3	Dispensary, Electricity
(U)+(T)	9	1	2	2	2	1	3	1	Health center, School
(L)+(U)+(T)	55	1	2	2	2	1	2	2	School, Health center
Total	96	1	2	2	2	1	3	2	-

Note: 1: Highest priority, 2: 2nd priority, 3: 3rd priority

Source: JICA Study Team

Table 3.5.1 History of the San-Pédro Paddy Project

Year	Supervision	No. of Farmers	Exploited area	Inputs	Machinery	Pump	GVC	Events
1972		Around 50						Popo GVC area was developed by pump irrigation
1973						2 small pumps		Irrigated paddy cultivation starts with 3 Taiwanese experts.
1974	ARSO		80ha (1.5ha/ Farmer)	Credit	Manual (daba)			
1975					10 tractors to GVC	Creation of existing pump station	3 GVCs created	Training session of operation time by E.F.D. (1.5 years) Young volunteers have started to successively settle themselves. Campus I was created.
1976				Fertilizers Seeds Free?	2 Harvesters Tractors to GVC			
1977	SODERIZ		650ha (2 to 3 ha/Farmer)					
1978								
1979		Around 200	to 450ha					
1980		185					13 GVCs	Taiwanese expert left the Project. / First cocoa plantation started. Campus II was created with school, public wells, clinic, etc.
1981		130						
1982	SODEPALM	161						The boundary of activity area for C.A was staked off by MIN-AGRA.
1983	RIZ	160		credit				
1984		158	a)					Drop of paddy price and severe inundation.
1985		127						CCGR was established as coordination structure of GVCs
1986		146			Inventory 1986*			Earth chiefs started selling pieces of upland in / around the Project area.
1987		141						
1988		145						B.N.D.A was collapsed. The rehabilitation project started with land redistribution. (4ha to farmers with machine or 2ha to farmers without machine)
1989		114	330ha (2 or 4 ha/farmer)	Fertilizers seeds, free	38 tractors to the farmers			Governmental subsidies for irrigated paddy cultivation stopped.
1990		105				3 has been renewed**	4 GVCs	Union of GVCs replaced CCGR
1991		91				Operation stopped		The supply of subsidized fuel oil for irrigation pump ceased
1992	CIDV	96				Operated (40 ha/1 cycle)		Private company put commercial irrigated paddy production to trial.
1993		94				Small one set by OCTID		Discussion on land problems started (C.A. sub-prefecture, earth chief)
1994								CFA franc devaluation
1995								4 GVCs were officially recognized by the State.
1996	ANADER							
1997								
1998		69	About 110ha		12 tractors			

Notes : a) Reduction of the irrigated areas because of: the incomplete land leveling, poor drainage, poor water management, drop of the pump efficiency, etc.  
 \*Inventory 1986: 50 tractors are managed by GVC (farmers cooperative), 30 threshing machines belong to the farmers / 3 harvesters and threshers donated or lent.  
 \*\*Replaced by 3 set of pump/generator of 75kw and 70 lit/sec (Canadian grant)

Table 3.6.1 Problems Concerning Agriculture, Countermeasures and Constraints Given by the Farmers

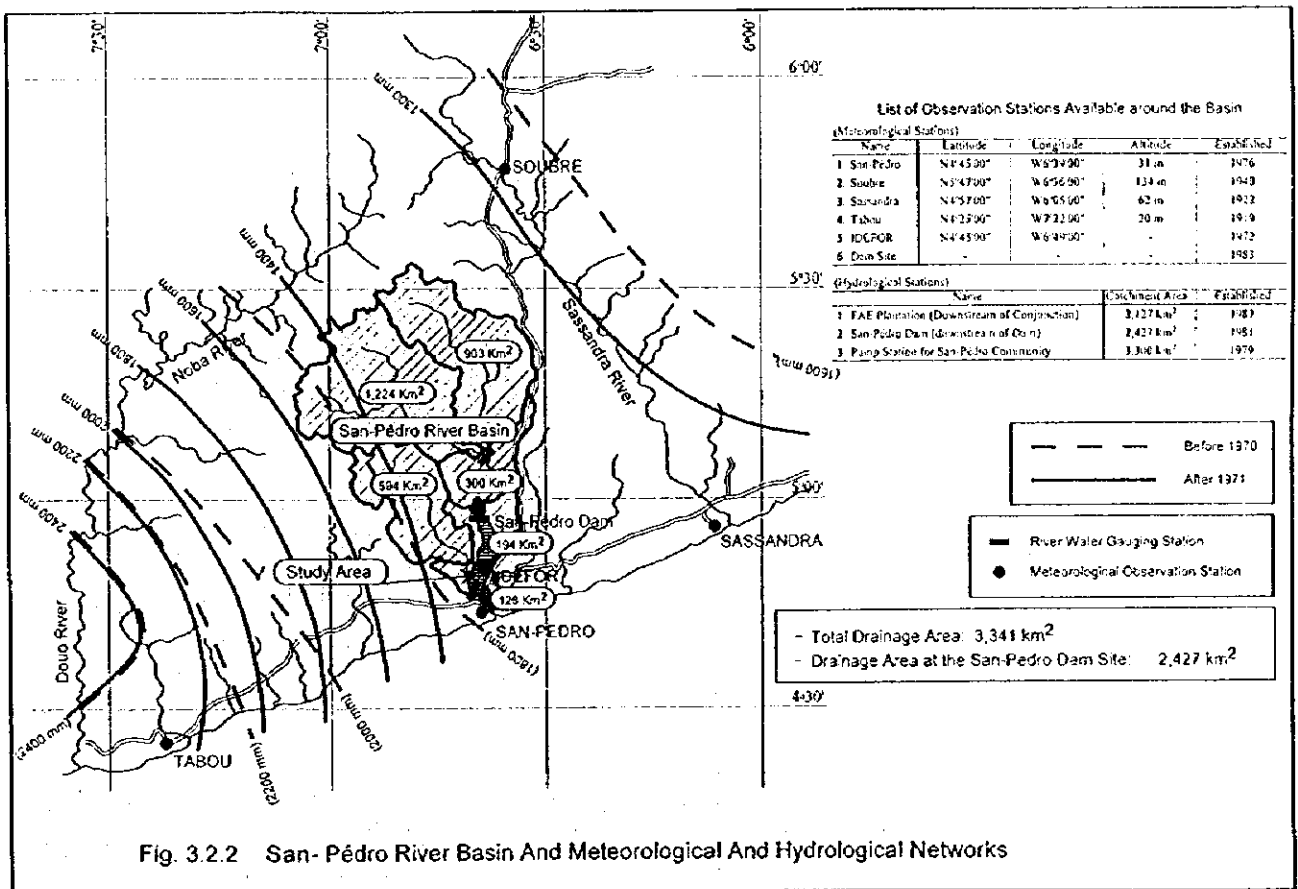
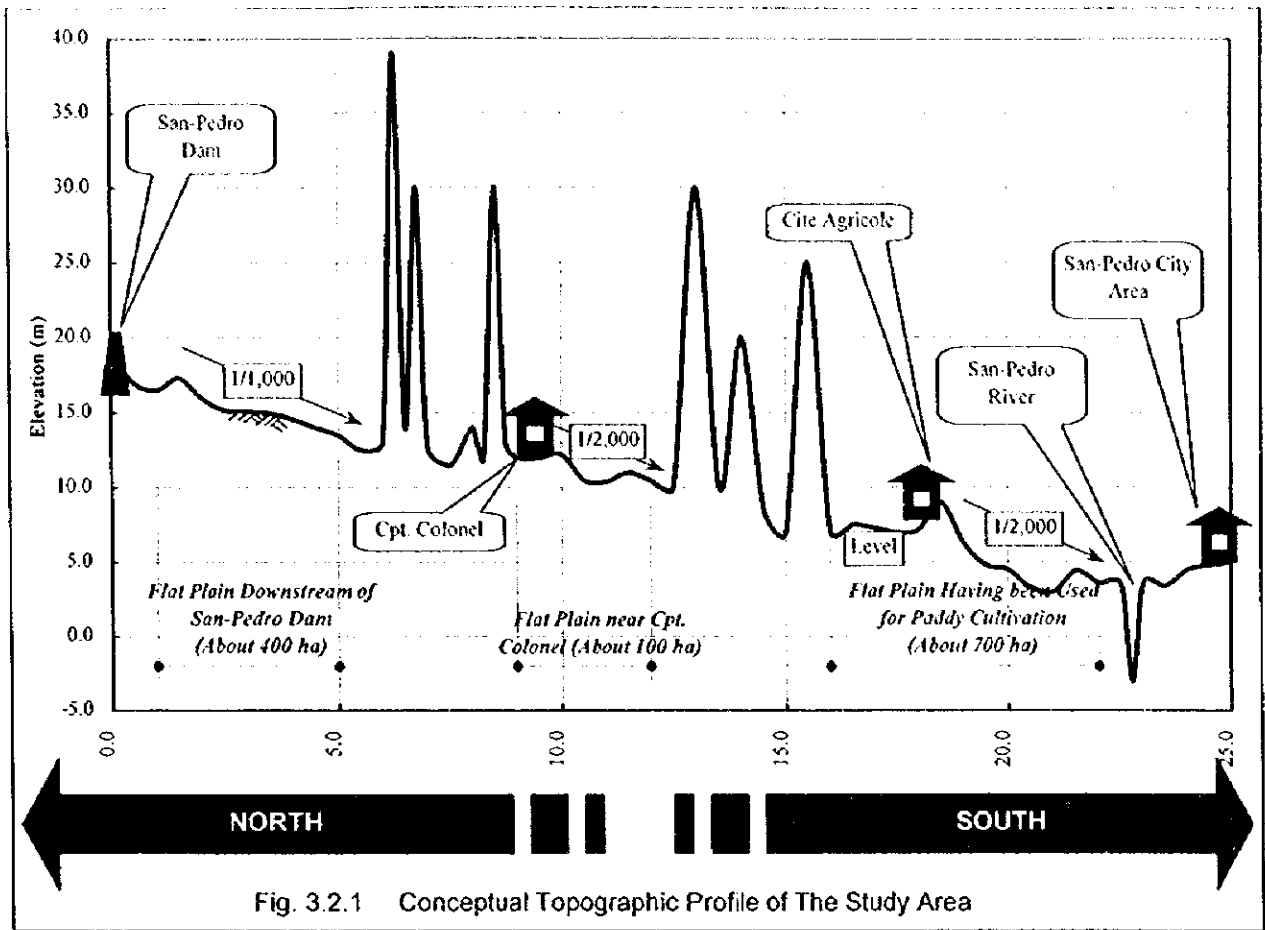
	Problems	Measures taken or proposed by Farmers	Constraints
Tree Crops	Damages caused by insects (termites, especially)	Control with insecticide	Lack of sprays or its expensive rent
	Degradation of the soil quality.	Application of fertilizer	(financial problems)
Food crops	Insufficient care of plantation	Employment of contractors	(the plantation is) Too spacious to maintain
	Unsuitability of cocoa to the soil quality of the region	Replacement of cacao by coffee or rubber	Lack of funds; SAPH suspended project
	Low official price of products	?	?
	Low purchase prices of products imposed by middle men	Organizing GVCs	Difficulties in putting all of the ethnic groups together in a group
	Bad qualities of products linked to drying	Construction of appropriate drying place	Lack of bamboo, too expensive cement
	GVC badly organized	Division of GVC according to ethnic groups	Insufficient quantity of products collected by GVC
	Difficulties in transporting or gathering products	1. Rent of trucks / 2. Fusion of GVCs to get credits	Limited availability of trucks
	Impossible water control (excess or lack)	Choice of more suitable place	Limited cultivable area
	Lack of means of plowing	Hiring contracted machine(tractor)	Cultivation calendar determined (or limited) by availability of machine
	Rainfall reducing or badly distributed	Changing the place to cultivate	Exaggerated dependence on rain
Market gardening*	Damages caused by insects, pest, and animal	Abandonment of the cultivation	Limited cultivable area
	Weed	Control with pest/insecticide or watch	(financial problems)
	Damages caused by insects, pest, and snails	Control with herbicide or manual weeding	(financial problems), lack of labor force
	Successive increase of rent (for immigrant women)	Control with pest/insecticide	Lack of sprays or its expensive rent
	Shortage of water in dry season	1. Lease by a group, 2. Lease of the land away from village	2. Difficulties in transporting the products and shutting long distance from house
	Flood in low land in rainy season	Digging wells near plots	Many wells drying up from January to May
	Difficult access to market (for the women living in villages remote from the main road)	Cultivation in upland during rainy season	Limited cultivable area
	Low price of products imposed by purchasers	Transport of products on their head as far as the main road	Limited Production
		1. Acquisition of fixed customers, 2. Trying production during dry season	2. Shortage of water

: Solutions give by the farmers, but not applicable due to lack of money

\* Proposed by women's groups who cultivate vegetables

Table 3.9.1 Present Constraints and Opportunities for Integrated Rural Development in the Study Area

Component	Present Constraints	Possible Countermeasures
Agricultural Crop Management	Low agricultural productivity in major crops	Use of high quality seeds and adoption appropriate cultivation techniques
	Less land utilization ratio in uplands	Crop diversification and field specific cropping pattern
	Rough land preparation and crop cultivation methods	Introduction of agricultural mechanization and advanced crop protection methods
	Labor intensive agricultural practices Widespread practice of traditional shifting cultivation	Mechanized farming and mutual exchange of farm labors Intensive farming
Agricultural Marketing	Limited surplus production of food crops	Crop diversification, increased and quality agricultural production
	Non-availability of post-harvest facilities	Installation of needed facilities such as drying yards, rice mills etc
	Lack of proper storage facilities Low selling price due to absence of proper marketing channels	Construction of community and individual storage houses Strengthening of efficient marketing network and improvement of information dissipation channels
Agricultural Extension	Incompetent extension activities on agricultural input delivery, crop management, marketing and fuel distribution	Increasing the technical level by training the extension workers through demonstration activities
	Shortage of trained personnel to offer quality extension service	
Rural Finance	Deficient micro-credit/ liquid funds to support crop production activities	Access to multiple financial sources and generation of new income sources
	Lack of communication or exchange of information on cooperative funds	Improvement of regular communication channels
	Unfair financial management by some administrative committees	Making the accounting system more transparent and sound
Farmers Organization	Lack of strong cohesiveness and cooperativeness among the members	Introduction of measures that facilitate community spirit among the members
	Poor management and organizing capabilities	Better training of members and executives on organization management
	Declining interest and willingness to continue farming	Making the farming more attractive
	Limited financial resources	Improvement of income sources
Livestock Production	Lack of awareness on profitability of commercial livestock production	Increasing the awareness on profitability of livestock financial sources through demonstration activities
	Insufficient animal feed/ fodder crops	Crop diversification
Aquaculture	Inadequate fresh water sources	Development of multi-purpose new water resources
	Shortage of efficient processing facilities and marketing channels	Establishment of required processing facilities and improvement of marketing channels
Irrigation Water Resources	Erratic rainfall, frequent droughts and flooding	Consolidation of water resources
	Conflicting interests for water use	Better coordination among water users
	Limited ground water sources	Rain water harvesting and ground water augmentation
	Absence of regulating structures in the tributaries	Planning and insulation of site-specific control structures
	Clogged of rivermouth and subsequent inundation	Periodical dredging
	Saline water intrusion and consequent water quality problems	Planning for best timing and proper location of water intake facilities
	Insufficient water supply and abandonment of previous irrigation schemes	Rehabilitation and modernization of previous schemes
	Inadequate Capacity of Drainage Works	Improvement of drainage network system
	Less efficient on-farm water management practices	Introduction of best water management practices
Inefficient Operation & Maintenance of irrigation Facilities	Encouragement of farmers participation in O& M	
Rural Infrastructure	Lack of enough rural road network; poor road condition	Improvement of rural road with public participation
	Low rate of electric supply	Rapid rural electrification
	Absence of piped water supply	Access to ongoing rural water supply projects
	Scarce communication facilities	Installation of postal and telephone services at nodal points
Land Property	Obscure land rights; coexistence of customary and modern land rights	Enactment of pertaining laws, strict enforcement of rules and regulations
	Unmarked farmland boundaries	Clear staking of boundaries and completion of legal formalities
Social Development	Ethnic diversity among the farming community and residents	Promoting activities that foster social harmony
	Presence of stratified layers within each ethnic community	Equal distribution of income
	Low literacy rate, poor enrollment in schools	Improvement of access to educational institutions
	Unfamiliarity with modern agricultural techniques	Intensive agricultural services through training & visiting
	Lack of efficient communication network among the communities	Improved human relationships as communication channel and information dissipation
Environment	Scarce opportunities for women to participate in development activities	Fostering economic activities by women
	Degradation of forest resources	Controlling the overexploitation through institutional improvement
	Depletion of flora and fauna, increased pressure on wildlife	Changing the consumption pattern and public mentality
Environment	Spread of water borne diseases	Implementation of preventive measures and creation of public health inspection units





San-Pédro Airport	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average/Total
Mean Temperature (°C)	1984-97	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
Humidity (%)	1984-97	81.0	81.9	81.8	83.1	85.3	87.2	85.6	87.7	87.6	86.4	85.7	83.3	84.7
Sunshine Hour/day	1984-97	4.9	5.5	5.3	6.1	5.2	3.3	3.5	3.1	3.7	5.9	6.3	4.9	4.8
Mean Wind Velocity (km/hr)	1984-97	8.9	9.9	9.8	9.2	8.7	9.4	10.1	10.3	10.9	10.0	8.7	7.5	9.4
Rainfall (mm)	1981-97	17.3	19.5	75.2	90.9	240.9	340.3	130.3	65.0	61.4	117.6	119.6	59.8	1,337.7
Rainy Days (day)	1981-97	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

Source: SODEXAM Jul.1998

IDEFOR San-Pédro	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average/Total
Mean Temperature (°C)	1972-97	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
Rainfall (mm)	1975-97	17.5	48.3	82.9	108.0	239.7	366.0	91.4	66.5	76.2	128.4	90.3	38.8	1,354.0

Source: IDEFOR San-Pédro

Sassandra	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average/Total
Mean Temperature (°C)	1984-97	26.6	27.2	27.4	27.4	26.8	25.8	24.9	24.6	25.1	25.9	26.5	26.4	26.2
Humidity (%)	1984-97	84.7	85.4	85.0	85.1	87.2	88.0	87.7	89.7	89.8	88.4	87.1	85.6	87.0
Sunshine Hour/day	1984-97	6.5	6.9	6.8	7.1	6.2	4.2	4.6	3.9	5.1	6.9	7.5	6.6	6.0
Mean Wind Velocity (km/hr)	1984-97	6.8	7.6	7.5	7.5	7.7	7.9	8.5	7.8	8.0	8.0	7.5	5.6	7.5
Rainfall (mm)	1981-97	34.9	18.5	47.8	135.1	284.0	254.8	113.4	45.9	21.3	110.5	102.9	55.2	1,224.4
Rainy Days (day)	1981-97	1.9	3.1	4.9	10.6	16.6	17.1	10.7	11.7	9.4	13.0	11.9	7.0	117.9

Source: SODEXAM Jul.1998

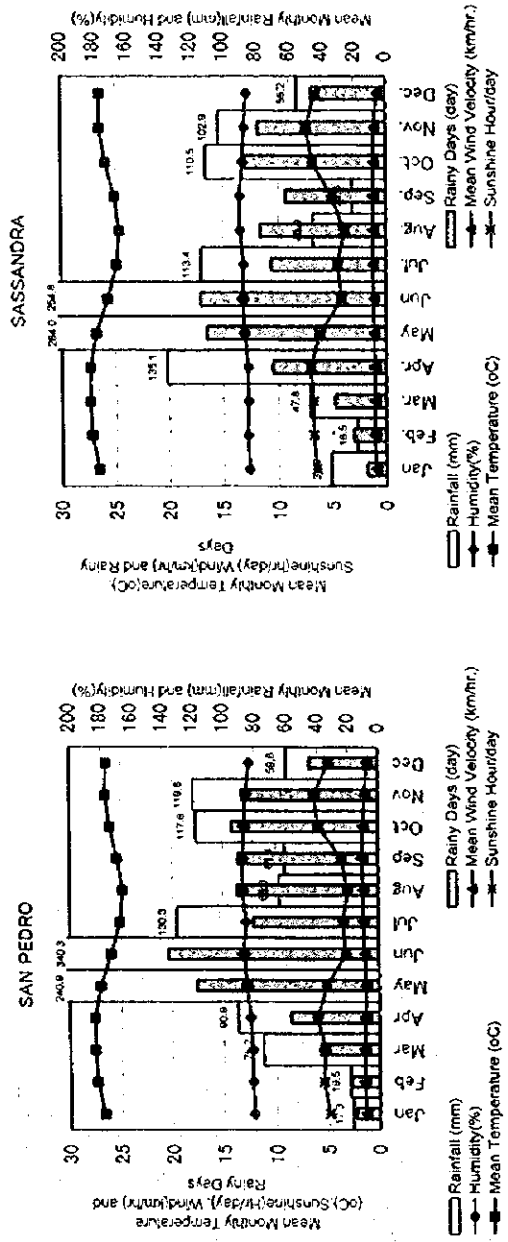


Fig 3.2.3 Climate Condition - San Pedro and Sassandra

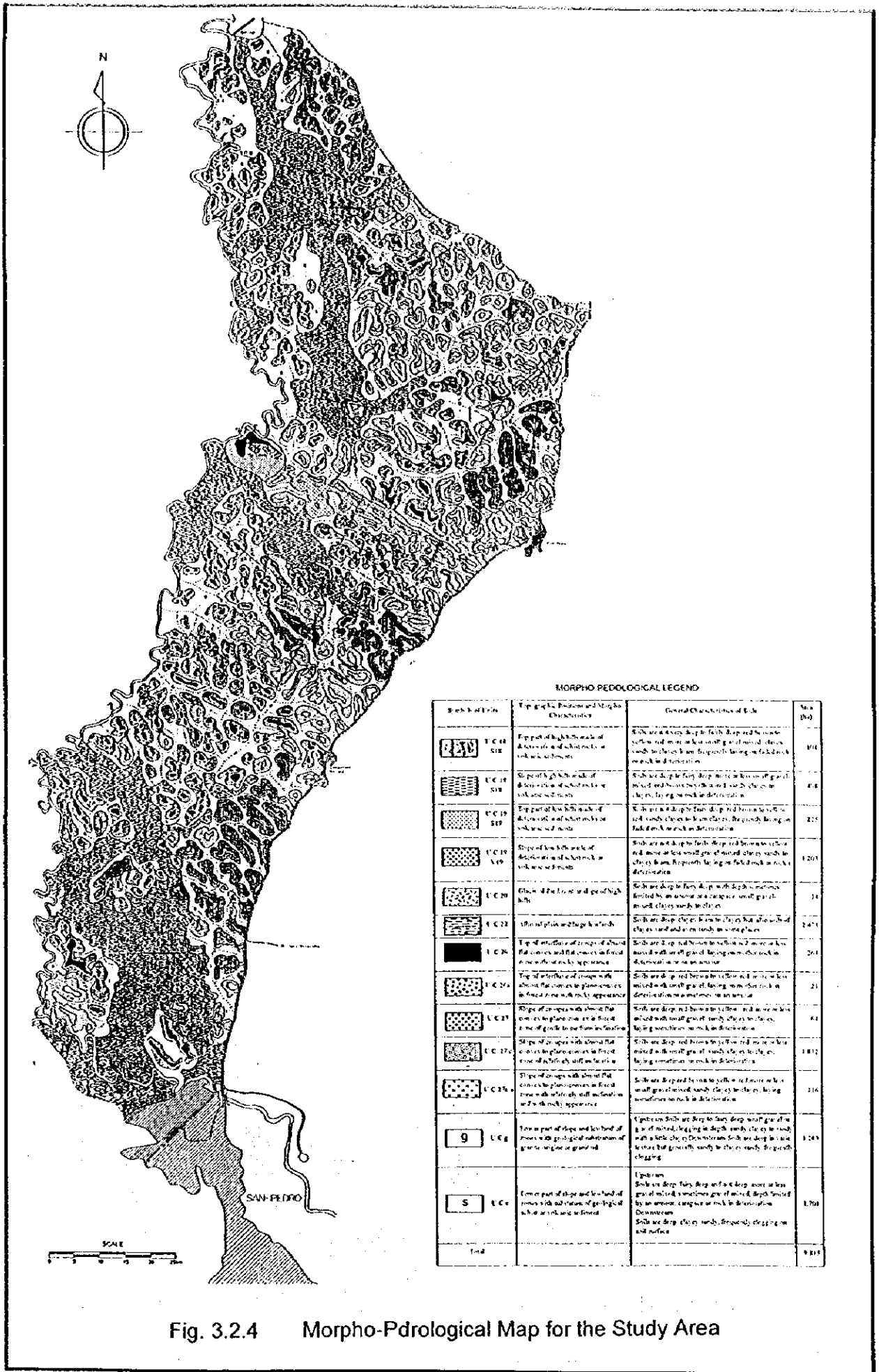


Fig. 3.2.4 Morpho-Pedological Map for the Study Area

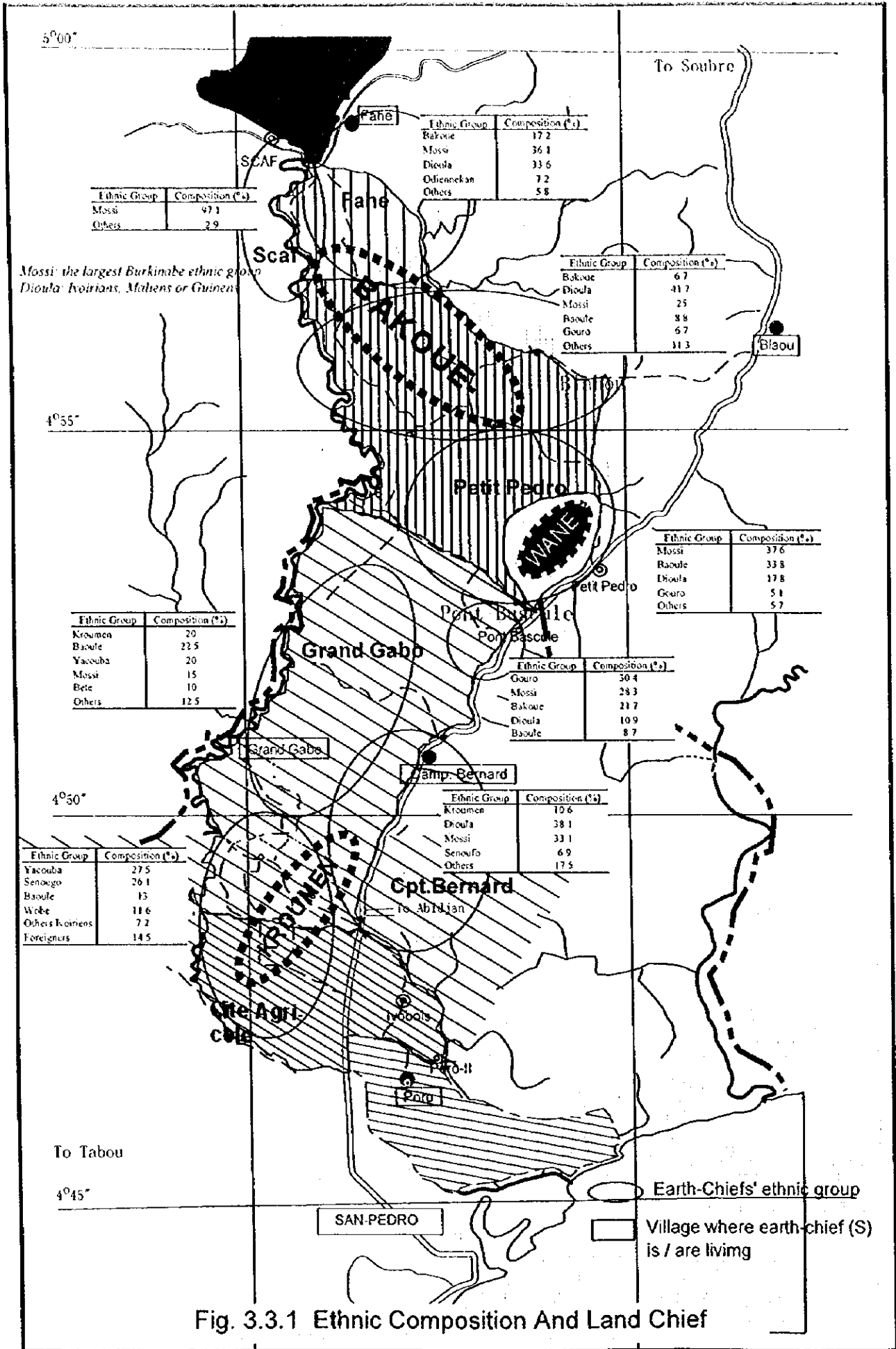


Fig. 3.3.1 Ethnic Composition And Land Chief

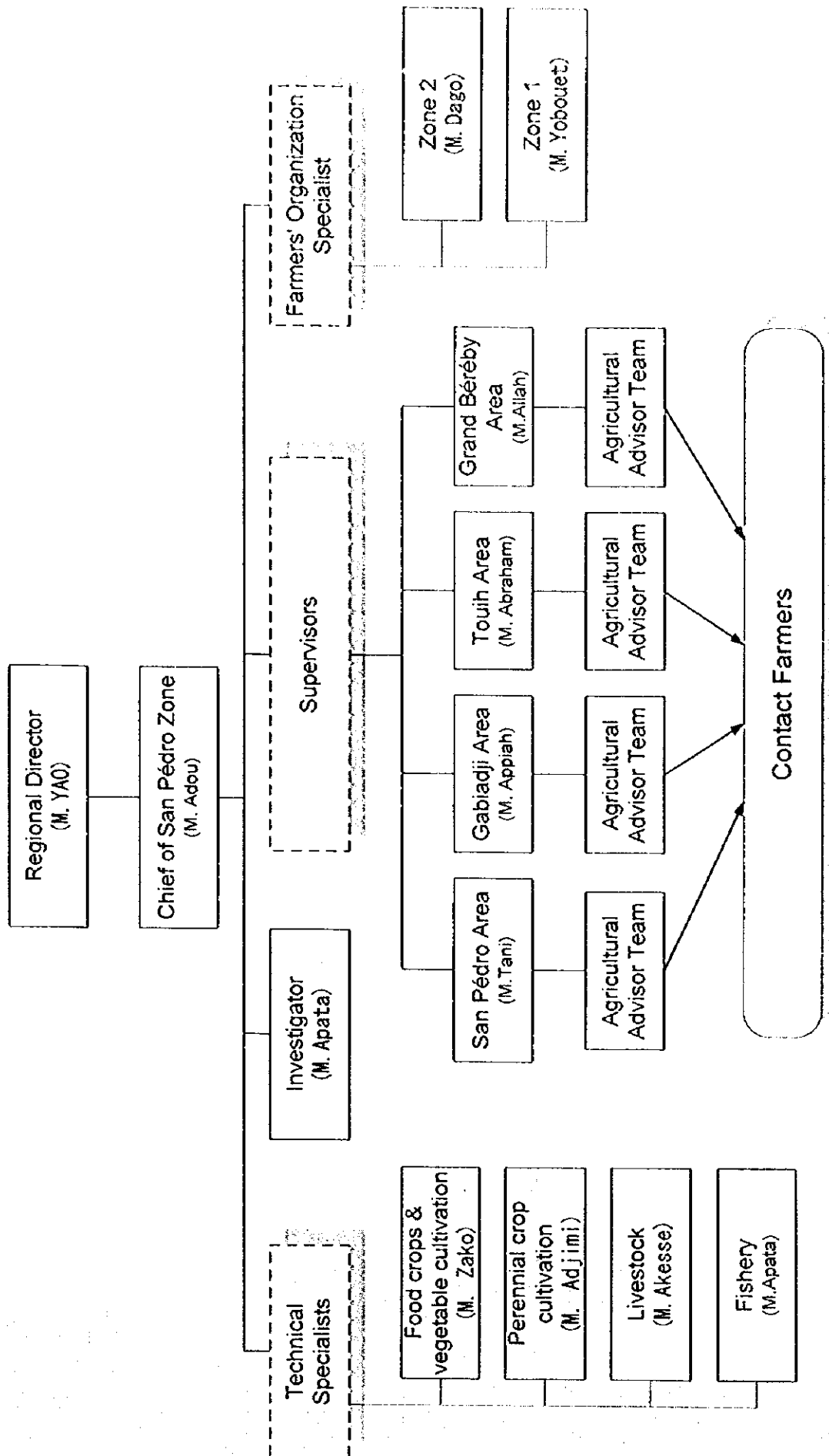
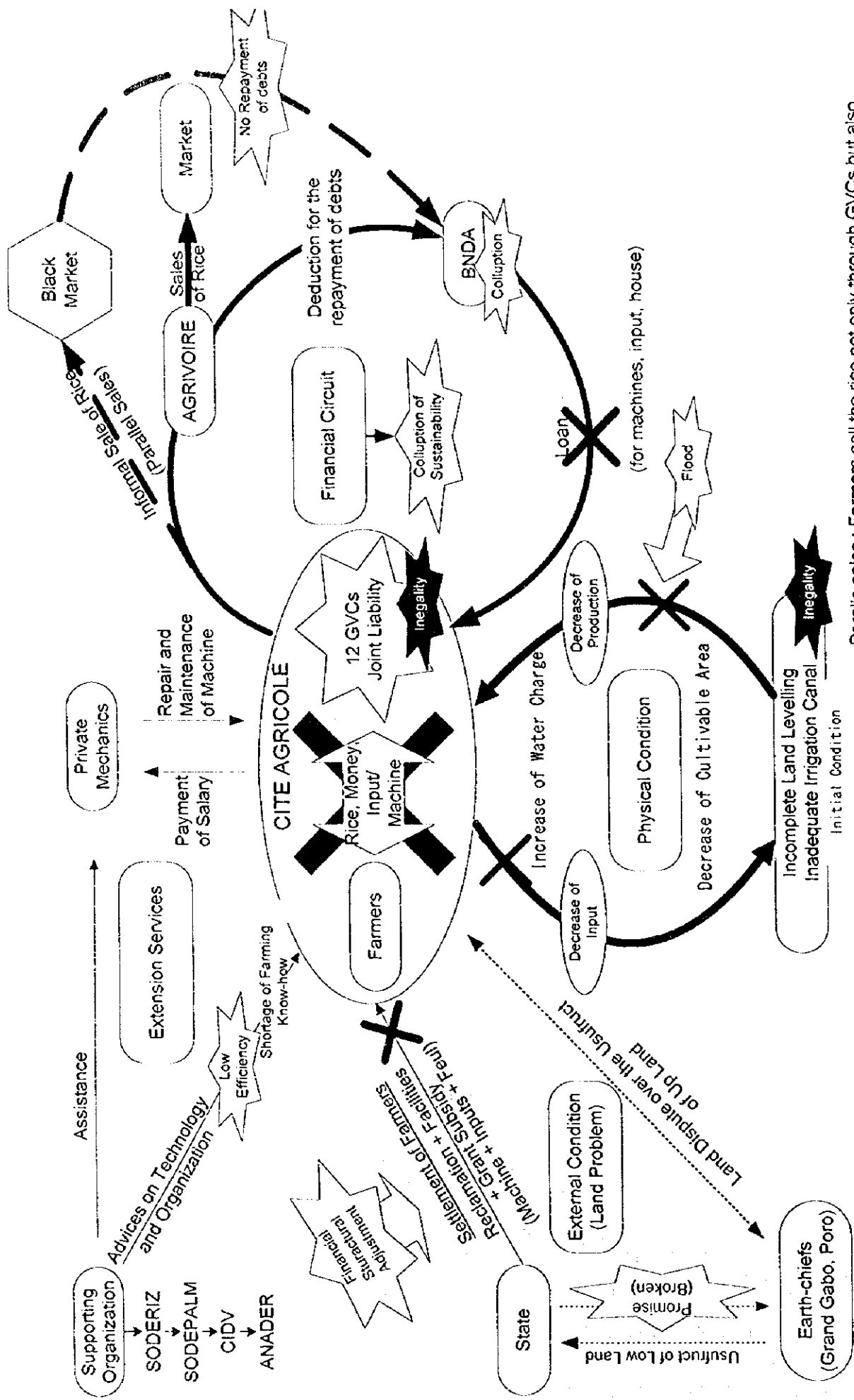


Fig. 3.4.1 Organization of ANADER San-Pédro Zone



Paralle sales : Farmers sell the rice not only through GVCs but also directly in the black market to avoid the deduction for the repayment of debts.

Fig. 3.7.1 Failure of San-Pédro Paddy Project