

Table G.2.8 Task Sharing in Household (1/2)

Repartition of farms tasks in traditional rice cultivation (by ethnic group)

| Ethnic group | Sénoufo | | | Yacouba | | | Wobé | | | Baoulé | | | Kourmèr | | | Dioula | | | Mossi | | | |
|--------------|---------|----|---|---------|---|---|------|---|---|--------|---|---|---------|---|---|--------|---|---|-------|---|---|---|
| | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | |
| Tasks | | | | | | | | | | | | | | | | | | | | | | |
| Clearing | X | | | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Plowing | X | | | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Sowing | | X* | Δ | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Weeding | X | | | X | | Δ | X | | | X | | Δ | X | | | X | | | X | | | X |
| Treatment** | X | | | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Harvesting | X | | Δ | X | | | X | | Δ | X | | Δ | X | | Δ | X | | Δ | X | | | X |
| Threshing | - | | | - | | | X | | Δ | X | | | X | | | X | | | X | | | X |
| Winnowing | X | | | - | | | - | | | - | | | - | | | X | | | X | | | X |
| Selling | X | | | X | | | X | | | X | | | X | | | X | | | X | | | X |

Notes: * Transplanting is done by women's group** in modern cultivation *** Each one has its own plot

M: man, W: women, C: children X: Responsible

Who keeps income from these agricultural products in family? (according to ethnic group)

| Products | Sénoufo | | | Yacouba | | | Wobé | | | Baoulé | | | Kourmèr | | | Dioula | | | Mossi | | | |
|---------------|---------|---|---|-------------|---|---|--------|---|---|--------|---|---|---------|---|---|--------|---|---|--------|---|---|--------|
| | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | M | W | C | |
| Coffee, Cocoa | - | | | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Paddy | X | | | X | | | X | | | X | | | X | | | X | | | X | | | X |
| Maize | X | | | X* | | | X | | | X | | | X | | | X | | | X | | | X |
| Cassava | | | | consumption | | | Family | | | Family | | | Family | | | Family | | | Family | | | Family |
| Yam | | | | Family | | | Family | | | Family | | | Family | | | Family | | | Family | | | Family |

Notes: Staple food

* Each one having its own plot can manage income from it.

** Precocious variety of yam is considered as sacred.

Table G.2.8 Task Sharing in Household (1/2)

Repartition of farms tasks in traditional rice cultivation (by ethnic group)

| Tasks | Sereque | | Sancoulo | | Yacouba | | Wobe | | Baoué | | Kourmen | | Djoula | | Mossi | |
|-------------|---------|---|----------|---|---------|---|------|---|-------|---|---------|---|--------|---|-------|---|
| | M | W | M | W | M | W | M | W | M | W | M | W | M | W | M | W |
| Clearing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Plowing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Sowing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Weeding | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Treatment** | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Harvesting | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Threshing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Winnowing | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Selling | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |

Notes: * Transplanting is done by women's group** in modern cultivation. *** Each one has its own plot.
M: man, W: woman, C: children, N: Responsible

Who keeps income from these agricultural products in family? (according to ethnic group)

| Products | Sereque | | Yacouba | | Wobe | | Baoué | | Kourmen | | Djoula | | Mossi | |
|----------------|---------|---|---------|---|------|---|-------|---|---------|---|--------|---|-------|---|
| | M | W | M | W | M | W | M | W | M | W | M | W | M | W |
| Coffee, Coccol | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Paddy | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Maize | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Cassava | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| Yam | N | N | N | N | N | N | N | N | N | N | N | N | N | N |

Notes: Staple food.
* Each one has its own plot, can afford income from it.
** Previous variety of year is considered as stored.

Table G.2.8 Task Sharing in Household (2/2)

Task sharing according to crop and sex

| Ethnic Group Crops & Task | | Kroumen | | Dioula | | Mossi | | Baoulé | |
|------------------------------|------------------------|------------|---|--------|---|------------|---|--------|---|
| | | M | W | M | W | M | W | M | W |
| Rice | Clearing | X | | X | | X | | X | |
| | Plowing | | X | | X | | X | | |
| | Sowing | | X | X | X | X | X | | |
| | Weeding | | X | X | X | X | X | X | |
| | Treatment | | X | X | | | | X | |
| | Harvesting | | X | X | | X | X | X | X |
| | Threshing | | X | X | | | | | X |
| | Winnowing | | X | X | | | | | X |
| | Selling | | X | X | X | | X | X | |
| Coffee and Cacao | Clearing | | | X | | X | | X | |
| | Control | | | X | | X | | X | |
| | Harvest (coffee) | | | | X | X | X | X | X |
| | Harvest (cacao) | | | X | | X | | X | |
| | Gathering | | | X | X | | X | | X |
| | Cabossage (pour cacao) | | | X | | X | | X | |
| | Selling | | | X | | X | | X | |
| Vegetable | Clearing | Contractor | | X | | Contractor | | | |
| | Nursery | | X | | X | | X | | |
| | Watering e | | X | | X | | X | | |
| | Transplantation | | X | | X | | X | | |
| | Preparation de compost | | X | | X | | X | | |
| | Control | | X | X | X | | X | | |
| | Weeding | | X | | X | | X | | |
| | Selling | | X | | X | | X | | |

Note: X: responsible

Table G.2.9 Classification of Farmers in Cité Agricole

| Group | Arrival | Training | | Educational level | Nationality or Ethnic group | principal GVC | No. of farmers |
|-----------------------------------|-----------------------|-----------------|----------------------|--------------------------------------|---|--|----------------|
| | | place | term by whom | | | | |
| ARSO | 1972-73 | Project site | 3 years Taiwanese | illiterate in french | Kroumen and other Ivoiriens, Maliens and other foreigners | ① Popo (1976) | 8 |
| Applicants to SODERIZ on the spot | 1975-79 | Project site | 0.5-1.5 year SODERIZ | Various (illiterate to junior high) | Various | ② Sabougnouma ① Bangadi. ② Progres ③ Entenic | 22 |
| Ex-extension workers SODERIZ | 1976-77 | Training center | 1-3 years | Primary to junior high school | Ivoiriens | ① Colline. ③ Liberté, ③ Alliance | 8 |
| Volunteers for development | 1977-80 | Training center | 0.5-2 years | Primary to junior high school | Senoufo, (Ivoiriens) Yacouba, Baoule | ④ Allakabo ④ Segahi, ④ Renaissance, ④ Assabo. | 14 |
| Applicants to GVC | 1979-89 | OJT | - GVC | Various (illiterate to junior high) | Ivoiriens, Maliens | ⑤ Lokité (1981) Divers | 15 |
| Other senior farmers* | 1972-92 | - | - | - | - | Divers | 9 |
| Independent or second generation | varied | OJT | Father and brothers | Various (illiterate to junior high) | various | Divers | 17 |
| OCTID | 1990-95 (acquisition) | No training | - | Junior high to High school | Ivoiriens | No GVC member | 2 |
| New comers | 1993-1998 | No training | - | Various | Ivoiriens | No GVC member | 14 |
| Other farmers | | No training | - | Various | Ivoiriens, Burkinaabe | No GVC member | 6 |
| GVC Lycée Prof.** | 1990-98 | No training | - | Various | Various, Moslem | ⑥ GVC Lycée Prof. | 22 |
| Total | | | | | | | 137 |

* Farmers who participated in the past irrigated paddy project but their detailed background is not clear. ①-⑥ : Order of creation of GVC (year of creation)

** GVC Lycée Professional was formed in 1985 by farmers who left the project, in low land across the road from paddy project site. Though in this area too, joint marketing has not been carried out since the ceasing of the operation of water pumps, members are carrying out rain-fed paddy cultivating with their own planting schedule, using jointly owned tractor

Table G 2.10 Farmers in Cite Agricole

as of March 8

Residents in Cité Agricole (Campus 1,2)

In San-Pédro city

| code | Farmer's Name |
|------|----------------------|
| 1 | NASSOUO Jean Batiste |
| 2 | KONE Seidou Dodérimé |
| 3 | SYLLA Mamadou |
| 4 | ADAMA Coulibaly |
| 5 | KONE Pothélétia |
| 6 | DAME Zibo Paul |
| 7 | TAHET Sondé |
| 8 | Kpan Jean |
| 9 | AMIDOU Sambou |
| 10 | Blé Adama |
| 11 | YE Gaston |
| 12 | PENAHOUÉ Henri |
| 13 | COULIBALY Kagnidia |
| 14 | SILUE Koléhe |
| 15 | SORO Zana Sounkalo |
| 16 | SORO Madou |
| 17 | SORO Ali |
| 18 | KRA Konan (I) |
| 19 | ZADY Désiré |
| 20 | BAMORY Ouatar |
| 21 | METOUÉU Paul |
| 22 | DOLE Joseph |
| 23 | NAHOOU Coulibaly |
| 24 | GBOGBO Emmanuel |
| 25 | GONSAN Gueu Etienne |
| 26 | TOURE Mamadou |
| 27 | SORO Zié |
| 28 | SORO Zana |
| 29 | Kouakou Désiré |
| 30 | MAHAN N'gada Gilbert |
| 31 | KOUAKOU Konan (I) |
| 32 | KOUAKOU N'zué (I) |
| 33 | SEOULOU Atanase |
| 34 | SORO Lelourou Blas |
| 35 | DIE Richepin |
| 36 | KONAN Brunot (I) |
| 37 | Soro Logonan |
| 38 | Kassogné Antiné |
| 39 | Ohy Bamba |
| 40 | Lah Bbasson Ludovic |
| 41 | Blé Raphaël |
| 42 | Tiéhi Anicet |
| 43 | Gueu Albert |
| 44 | Koffi kan Martin |
| 45 | Gbé Manto Léonard |
| 46 | Jean Bamba |

Notes:

(I) : inhabitants of Campus 1

GVC Members who passed away

| |
|------------------------------|
| Kouassi N'zian Fils (vacant) |
| Sia Mamadou (to his wife) |
| Tahé Iné (vacant) |
| Sékou Kéita (?) |
| N'gbani Kouakou Luc (vacant) |

| | Farmer's Name |
|-----|---------------------|
| 47 | Mabéa Zoueu Lambert |
| 48 | Guehi Charles |
| 49 | Touré Brahim (I) |
| 50 | Koffi Silvanus (I) |
| 51 | Koffi Bertrand |
| 52 | Ouattara Karamoko |
| 53 | Doman Prosper |
| 54 | Soro Allassane |
| 55 | Secongo Yaya |
| 56 | Péhé Jean |
| 57 | Blé Kouassi (Waté) |
| 58 | Saye Abraham |
| 59 | Guei Gaston |
| 122 | Bako Fabezoun |
| 123 | Koné Adama |
| 124 | Osuman Mohamed |
| 125 | Kobena Etienne |
| 127 | Brahima Ganama |
| 128 | Mory Konaté |
| 129 | Ouedraogo Salif |

66 families

GVC Lycée Professionnel

| | |
|-----|--------------------|
| 120 | Koné Fonguola |
| 121 | Kéléfili Youssouf |
| 98 | Blor-Eleine |
| 99 | Womdorogo Boukary |
| 100 | Ouedrago Noaga |
| 101 | Boga Améli |
| 102 | Savadogo Mamade |
| 103 | Diomandé Mariama |
| 104 | Waongo Ganda |
| 105 | Poly Victor |
| 106 | Sissaogo Bouréma |
| 107 | Zambsonré Lassina |
| 108 | Anmadou Talssolo |
| 109 | Sékongo Ferla |
| 110 | Momaolou Dagnogo |
| 111 | Toily Fuzone |
| 112 | Goubo Douhouré |
| 113 | Sékongo Bitou |
| 114 | Koné Adama |
| 115 | Savadogo Seydou |
| 116 | Yamba Lokré |
| 117 | Djionmandé Mohamed |
| 118 | Kassogue Amadou |
| 119 | Garibou Gindo |

24 families

No intention of participating

| | Farmer's Name |
|-----|---|
| 60 | TAHE Elise |
| 61 | ATAHER Inamoudou |
| 62 | AMAN Atino |
| 63 | NOUHOOU Moussa |
| 64 | CAMARA Aboulaye |
| 65 | SILUE Nawala |
| 66 | KONE Yacouba (No.1) |
| 67 | KEITA Madi |
| 68 | BASSABATE Berthé |
| 69 | VAKIA Touré |
| 70 | LACINA Sanogo |
| 71 | MAIGA Djibrilla |
| 72 | BAHA Keita |
| 73 | BI Irié Christophe |
| 74 | BRAHIMA Moussa |
| 75 | Dekoué Jacque |
| 76 | N'guetta Mathieu |
| 77 | Daouda Hamidi |
| 78 | Youssouf Bamba |
| 79 | Minkaila Barazi |
| 80 | KONE Yacouba (No.2) |
| 81 | Maïga Zakaria (interviewing his mother) |
| 82 | Coulibaly Kalina |
| 83 | Gnagna Alphonse |
| 84 | Boukary Taranda |
| 85 | Touré Alpha |
| 86 | Sahi Boni |
| 87 | Bamba Brahim |
| 88 | MADJOU Kourouma |
| 97 | Beh Soro |
| 130 | Moussa Traoré |
| 131 | Kané Sébé |
| 133 | Gouanou Paulette |
| 134 | Albachar Abdoulaye |
| 135 | Doué Bar Charles |
| 136 | Tia Etienne |

36 families

Autres / Other place

| In the Priority Area | |
|----------------------|-------------------------------------|
| 90 | Kouamé Badiou Benjan (chekin farm) |
| 91 | Savadogo Salifou (Garage) |
| 92 | Zokoya Laurant (Pump Station) |
| 96 | François Wampau (his campement) |
| 126 | Abdoulaye Dion (Small pump station) |
| Other | |
| 89 | Saye Isac (Grand Bérébi) |
| 93 | Kobany André (Blhaou) |
| 94 | Bekou Antoine (his Campement) |
| 95 | Moussa Hamadou (Sabo) |
| 132 | Albachar Abdoulaye (au Mali) |
| 137 | Daouda Sideye (au Mali) |

11 families

Total 137 families

Table G.2.11 New Settlers and Youth living in the Project Area

as of Feb. 8

New Farmers (without experience in irrigated paddy cultivation)

| code | Farmer's Name |
|------|---------------------|
| 29 | Kouakou Désiré |
| 38 | Kassogné Antiné |
| 40 | Lah Bbasson Ludovic |
| 42 | Tiéhi Anicet |
| 43 | Gueu Albert |
| 46 | Jean Bamba |
| 53 | Doman Prosper |
| 54 | Soro Alassane |
| 55 | Secongo Yaya |
| 56 | Péhé Jean |
| 57 | Blé Kouassi (Waté) |
| 59 | Guei Gaston |

No intention of participating

| code | Farmer's Name |
|------|-------------------------------------|
| 122 | Bako Fabezoun |
| 123 | Koné Adama |
| 124 | Osuman Mohamed |
| 125 | Kobena Etienne |
| 127 | Brahima Ganame |
| 128 | Mory Konaté |
| 129 | Ouedraogo Salif |
| 90 | Kouamé Badiou Benjan (chekin farm) |
| 91 | Sawadogo Salifou (Garage) |
| 92 | Zokoya Laurant (Pump Station) |
| 96 | François Wampau (his campement) |
| 126 | Abdoulaye Dion (Small pump station) |

24 families

Youth having the intention of becoming independent of his family
(participating independently in the Project)

| No. | Young Farmer's Name | age | with* | married |
|-----|------------------------|-----|-------|---------|
| 1 | Meussoleu Aimé | 21 | 1 | |
| 2 | Soro Méléh | 21 | 13 | |
| 3 | Yéo Dougnon | 29 | 13 | x |
| 4 | Secongo Chiélé | 29 | 37 | |
| 5 | Kouamé Henri Jacques | 26 | 44 | |
| 6 | Soro Madou | 22 | 37 | x |
| 7 | Coulibaly Bakari | 27 | 4 | |
| 8 | Soro Fournigué | 21 | 27 | |
| 9 | Kassogué Amalé Jean | 22 | 38 | |
| 10 | Kassogué Sékou | 23 | 38 | |
| 11 | Sila Mamoudou | 18 | 3 | |
| 12 | Dolé Firmin | 25 | 22 | x |
| 13 | Soro blos Kassoum | 19 | 34 | |
| 14 | Modan Félix | 55 | 11 | |
| 15 | Tiéoule Oulaye Léonard | 30 | 48 | |
| 16 | Soro Soigon Salif | 37 | 14 | x |

* Now, he is living with the family of the code number

Table G.5.1 Results of SWAP Workshop

| | SUCCESS | FAILURE | POTENTIALITIES | OBJECTIVES |
|--------------------------------------|---|---|--|---|
| Natural, Politic and Human Condition | A lot of rain | Lack of rain San-Pédro river drying-up for second cropping Land problem Landownership was not ensured Policy of mono-culture Government subsidies stopped | Existence of San-Pédro river The irrigated rice cultivating farmers are available in the area Expanding family | To take a census of existing farmers To settle new young farmers |
| Initial State | | Bad developments Not well-leveled lands Not concreted main canal | Area of 330 ha (irrigable); 650ha (developed) Fields of cassava and vegetable | To develop again the lowlands To concrete the canals To improve the land development by leveling |
| Factors of Production | The irrigation water was ensured | Lack of water | | To have enough water |
| | Newly developed plots | Degradation of plots Irrigation canals becoming too old for work Motopump becoming too old for work Irrigation by motopump was very expensive Lack of fuel Bad coordination between water users Negligence of water distributors' duty Departure of the Taiwanese experts Bad organization of farmers for water management Stealing water Impossible Irrigation | | To develop again the existing lands To concrete the irrigation canals To use dam instead of pump |
| | Plots in the proximity of pumping station | | | To create water management and maintenance committee To realize good water management To establish rules for water management |
| | Irrigation was suitable | | | |
| | Credit for getting a power tiller Obtaining a power tiller Combine-Harvester was available | Break down of farming material No means for plowing No means for quickly harvesting Problem of harvest planning and utilization of harvester | | To mechanize agriculture To have individual power tiller |
| Human Resources | Enough input to make good use of plot Variety 184 of short growing period | Lack of input Appearance of weeds Crop affected by diseases | Proximity to the market for input Existing some varieties Variety of short growing period | To supply chemical products To train farmers |
| | Experience in agriculture with 2 harvests / year | Not enough training The training was not followed up Knowledge acquired from the training was not put into practice | Experience in paddy culture Knowledge of agricultural techniques Sénoufo women know well how to do transplanting Women trained by their husbands know irrigated paddy | To train farmers for cooperative & water management To be well trained To visit the other farmers |
| | Training of farmers for cooperative | Undisciplined farmers in GVCs The rules were not applied | Training for cooperative Constructive / Cooperative idea Existing GVCs | To reorganize existing GVCs To create cooperative with independent manager |
| | Always in the plot | Ethnic groups Dishonesty of farmers Lack of understanding of farmers Indifference toward the other farmers | Two women's GVCs One Young farmers' GVC Many friends working in group Courageous people who like working | To organize a well established cooperative To creation small work groups To reach mutual understanding |
| | Supporting System | Bad system of supervision No participative management Supervisors were ignorant of the reality of plots Lack of transparency in supervisory organism Confusion of roles: both financial management and technical support were done by the same supervisory organism No evaluation system on the Project Lack of accommodation near the plots | | To have good supporting system To establish communication between supervisory organism and farmers |
| Direct Results | Abundant harvest with enough money 18 to 20 tons of paddy on 4 ha 2 tons of paddy per season 3,5 t/ha (average) | Bad production Ceasing completely farm activities | | To construct farmers' houses To resume the work To realize double rice cropping To produce a lot of rice |
| Indirect Results | Construction of houses Marriage after harvesting Purchase of a motorbike Honda 100, a television and many cloths Creation of Plantation coffee-cocoa | Too much debts Bad payers of credits Credit to farmers was not well managed by the supervisory organism No transparency in financial management No receipt for delivered paddy from the supervisory organism Lack of financial autonomy No financial means | Village exists Semi-modern village Village of reception 45 houses Water tour | To organize the paddy marketing To have milling machine, storage & transport of products To diversify crops To create tree crop plantation To have drinking water To have wide stable road to the city To electrify the village |
| | Contribution to build a three-rooms school | | School | To take good care of children To dress children well |
| | Schooling our children | Unschooling children | | |
| | Taking good care of my family | Break-up of families | | To ensure food self-sufficiency to the family |
| | Stabilization of farmers Creation of new communities by the farmers themselves Dynamism of farmers' community life | No infirmary service Heath problem Death of farmers | Building of infirmary | To have an infirmary service To be happy farmers in future |

Table G.5.2 Potential Participants to the Project

| DEVELOPMENT ORGANIZATION | MINAGRA | FARMERS | ECONOMICAL OPERATORS |
|------------------------------|---|-----------------------------------|------------------------------------|
| ANADER | MINAGRA / DAR | FARMERS' GVC | PADDY WHOLESALERS |
| RESEARCH INSTITUTES | MINAGRA - DOPAC (COOPERATIVES) | FARMERS OF THE DEVELOPED AREA | PRIVATE OWNERS OF MILLING MACHINES |
| ANADER ZONE S/P | DR MINAGRA | FARMERS IN THE STUDY AREA | CONSUMER |
| SODEFOR | MINAGRA - RURAL LANDS AFFAIRS | INHABITANTS AROUND DEVELOPED AREA | PADDY RETAILERS |
| OCPV | OTHERS MINISTRIES | POPULATIONS | AGRICULTURAL INPUTS SUPPLIERS |
| PROVISION OF SERVICES | MINISTRY OF FINANCES | INDIGENOUS POPULATIONS | RICE PURCHASERS |
| SODECI | MINISTRY OF HEALTH | FARMERS' CHILDREN | PRIVATE ENTERPRISERS |
| CIE | MINISTRY OF ECONOMICAL INFRASTRUCTURES (DEPARTMENTAL DIRECTION) | VILLAGE AUTHORITIES | SELLERS OF FARMING MACHINES |
| LOCAL AUTHORITIES | MINISTRY OF PLAN | INHABITANTS OF SAN PEDRO CITY | PURCHASERS OF PRODUCTS |
| MUNICIPALITY | HIGH COMMISSIONER OF HYDRAULIC | FARMERS OF CLASSIFIED FORESTS | TRADERS EXPLOITING SAND |
| CENTRAL ADMINISTRATION | MINISTRY OF NATIONAL EDUCATION | SCHOOL COOPERATIVES | FINANCIAL INSTITUTIONS |
| POLITIC AUTHORITIES | SO.DE.MI | | CREP-COOPEC |
| | | | BANKS |
| | | | INTERNATIONAL COOPERATION |
| | | | DONOR COUNTRIES |
| | | | JICA |
| | | Selection of Target Group | |

Table G.5.3 Target Group and Core Problem

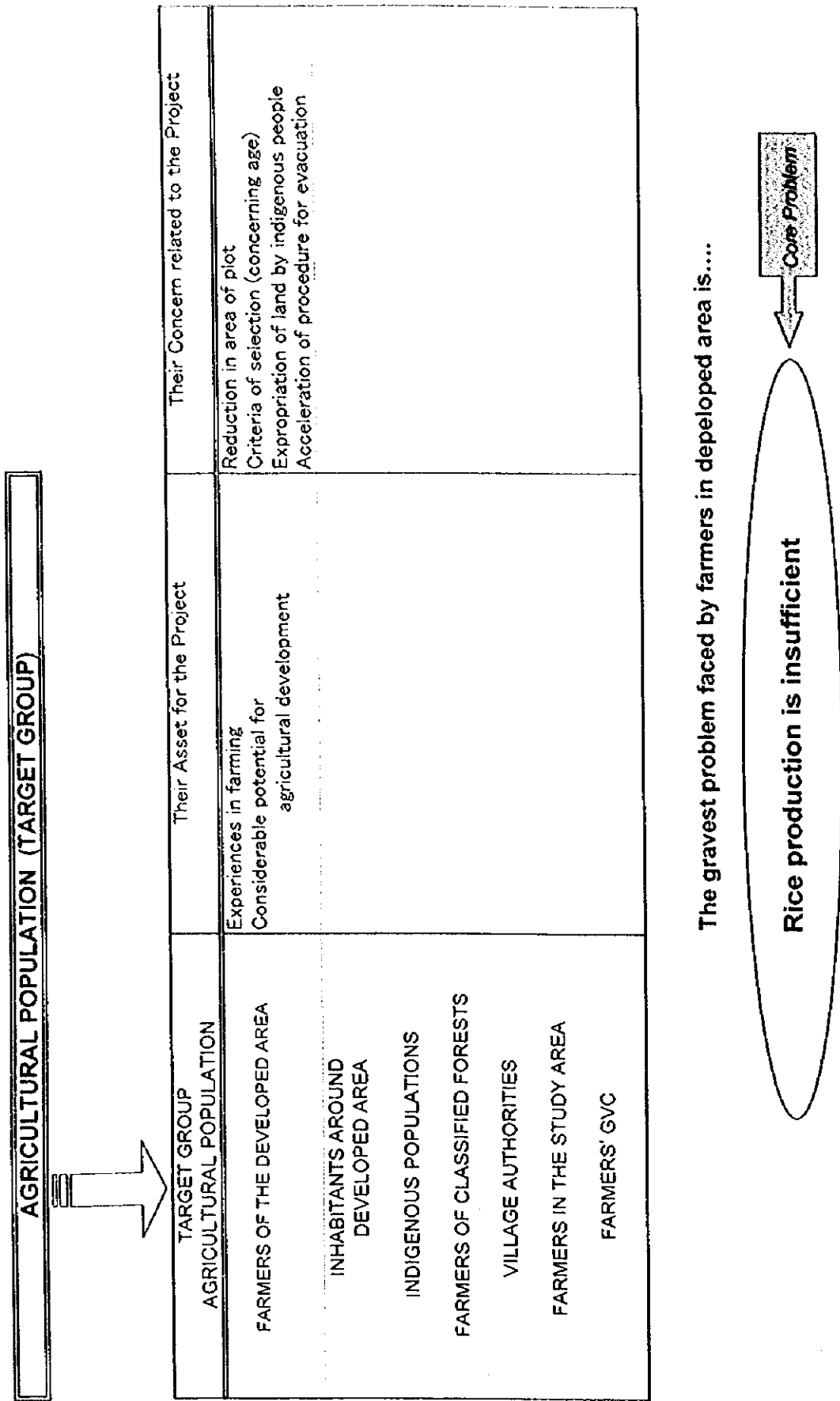


Table G.5.4 Result of PCM Workshop

| Narrative Summary | Responsible | Important Assumption |
|---|--|---|
| Overall Goal Increase of rice producing farmers' income | | |
| Project Purpose The rice production increased | | * The price of rice must be remunerative |
| Outputs 1) Agricultural techniques are applied 2) Good working of cooperative is ensured 3) Sufficient quantity of water in the plots 4) Access to inputs is guaranteed 5) Conditions for buying agricultural machines are improved | | * The settlement conditions for the new settlers are set up * Farmers and operators buy agricultural machines |
| Actions 1-1 To train the farmers regularly in agricultural technique 1-2 To make qualified agents available to the farmers 1-3 To evaluate regularly the technical level of the farmers 1-4 To adapt the working load to farmers' capacity 1-5 To execute the agricultural techniques 2-1 To train the farmers to manage the cooperative 2-2 To apply the management rules of cooperatives 2-3 To apply the operating rules of cooperatives 2-4 To apply the sanctions 2-5 To create the cooperative 2-6 To set up the cooperative management organs 3-1 To construct the Grand Canal 3-2 To establish the irrigation schedule 3-3 To make people respect the irrigation schedule 3-4 To maintain regularly the irrigation system 3-5 To develop the plots 3-6 To involve the canalside population in the canal water management 4-1 To supply inputs to the farmers 4-2 To train the farmers to the principles of cooperative 4-3 To create the cooperative 4-4 To institute a collective supplying system 4-5 To train members of the cooperative management organs in financial management 4-6 To create a credit system for the access to inputs 4-7 To establish a good information sharing system 4-8 To set up saving and credit funds | Government " " " Farmers Government Farmers " " " Government Farmers " " Government " Farmers Government Farmers " Government " Farmers " | * The trained farmers remain in the irrigation area * The water management rules of Fahe dam are respected |
| 5-1 To create the right conditions for buying machines 5-2 To train the mechanics 5-3 To train the farmers for using of machines 5-4 To create the right conditions for installing providers of service | Government " " " | Pre- condition * setting up the counterpart fund and staff of the Ivorien side * The canalside population accept construction of the canal |

Table G.5.5 Potential Participants in Study Area

| living place (village or Cpt.) | No. of households | having intention |
|--------------------------------|-------------------|------------------|
| Grand Gabo | 40 | 26 |
| Petit Pédro | 157 | 32 |
| Konankro | 34 | 19 |
| Cpt. Colonel | 66 | 5 |
| Zilédro | 17 | 15 |
| Pont Bascul | 46 | 22 |
| Kouassikro | 32 | 17 |
| Other in P.P. | - | 32 |
| Lassinakro | 36 | 16 |
| Petit Zuénula | 54 | 18 |
| Blahou | 486 | 11 |
| Cpt. Bernard | 133 | 90 |
| other in C.B | - | 7 |
| San Pédro | - | 4* |
| Total | | 310 |

| Nationality | intention | % |
|-------------|-----------|------|
| Ivoirien | 207 | 65.9 |
| Malian | 41 | 13.1 |
| Burkinabe | 50 | 15.9 |
| others | 16 | 5.1 |

| Ethnic groups | intention | % |
|---------------|-----------|------|
| Kroumen | 22 | 8.8 |
| Bakoué | 13 | 5.2 |
| Baoulé | 80 | 31.9 |
| Dioula | 13 | 5.2 |
| Mossi | 25 | 10 |
| Gouro | 43 | 17.1 |
| Sénoufo | 14 | 5.6 |
| others | 41 | 16.3 |

Indigenous ethnic group

| | |
|---------------------------------|-----------------------|
| Average Age of household's head | 38.7 years old |
| Average No. of Members * | 3.4 persons/household |

* Family members of more than 15 years old who have intention of participating to the Project

| Main activity * | intention | % |
|------------------|-----------|------|
| tree crops | 206 | 70.3 |
| food crops | 30 | 10.2 |
| market gardening | 11 | 3.8 |
| other activities | 1 | 0.3 |
| nothing | 45 | 15.4 |

* present economic activity done by the households who have intention of participating

Table G.5.6 Potential Population in Classified Forest by Sampling Survey as of Feb.6

| | Ethnic group or Hamlet | No. of households (a) | having intention of participating (b) | a/b (%) |
|-------------------|------------------------|-----------------------|---------------------------------------|-------------|
| Village Kourémoué | Kroumen | 5 | 5 | 100 |
| | Abron | 23 | 15 | 65.2 |
| | Tabana | 15 | 18 | 120.0 |
| | Baoulé | 52 | 8 | 15.4 |
| Hamlet | amoudoukr | 68 | 63 | 92.6 |
| | Danielkrö | 12 | 8 | 66.7 |
| | Total | 175 | 117 | 66.9 |

Number of farmers' households in classified forest (95, SODEFOR)

| | | |
|-----------------------|-------------------|--------------|
| Indigenous | (Bakoué/ Kourmen) | 524 |
| Immigrant (Ivoirien) | Baoulé | 4608 |
| | Abron | 297 |
| | Others | 1253 |
| Immigrant (Foreigner) | Bourkinabé | 9440 |
| | Maliens | 351 |
| | Others | 211 |
| Total | | 16684 |

Estimation: Total households X a/b = 16684 x 66.9/100 = 11161(households)

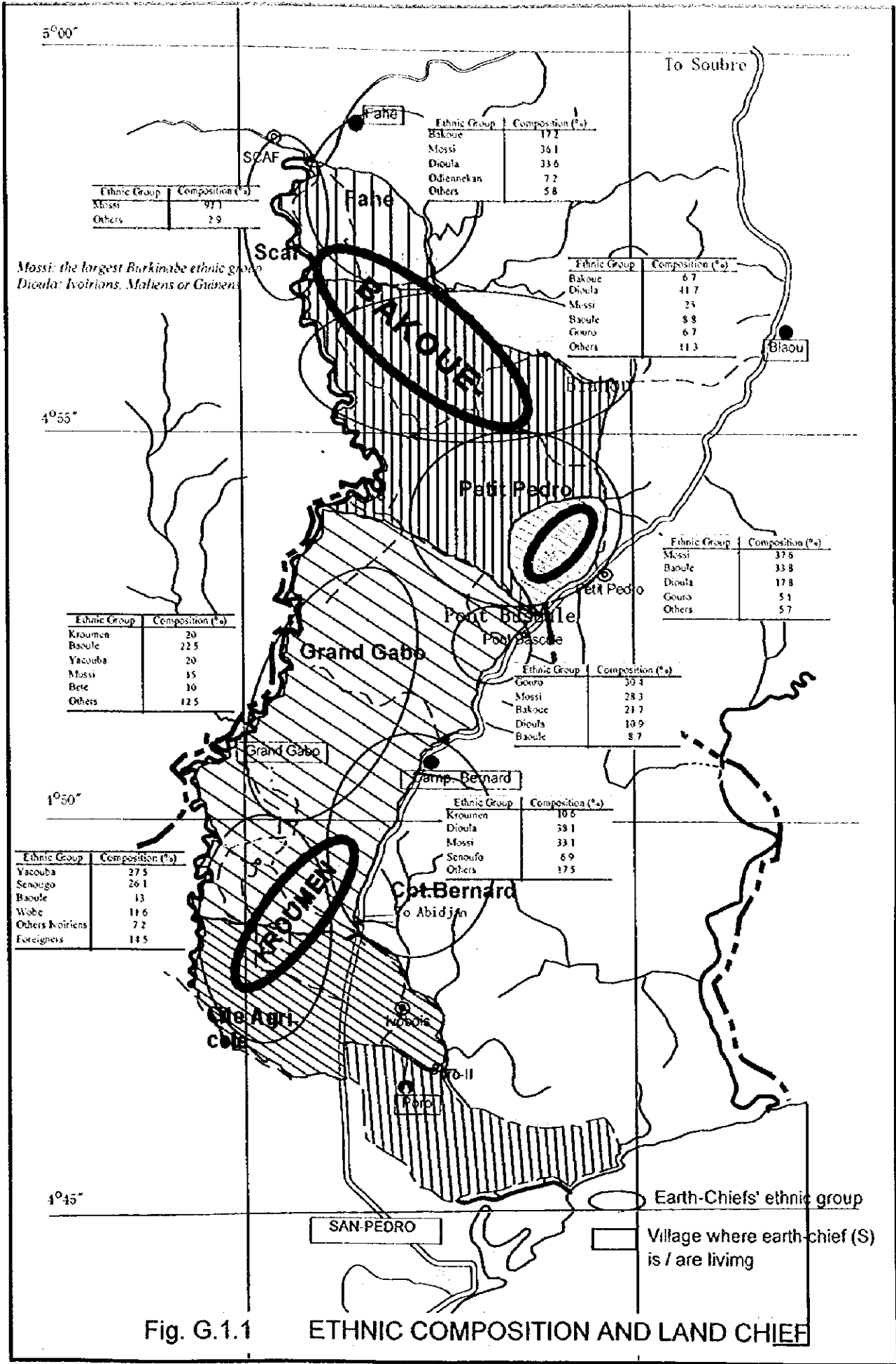


Fig. G.1.1

ETHNIC COMPOSITION AND LAND CHIEF

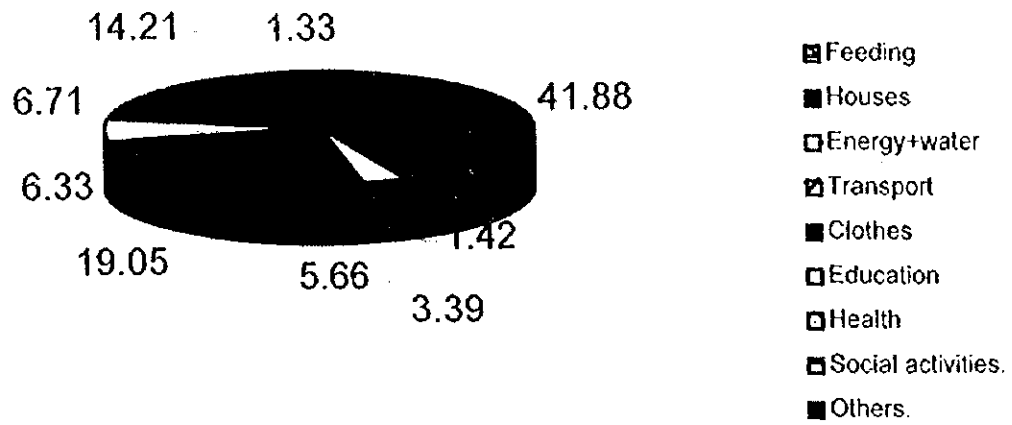


Fig. G.2.1 Expenditure of Household in the Study Area, 1997

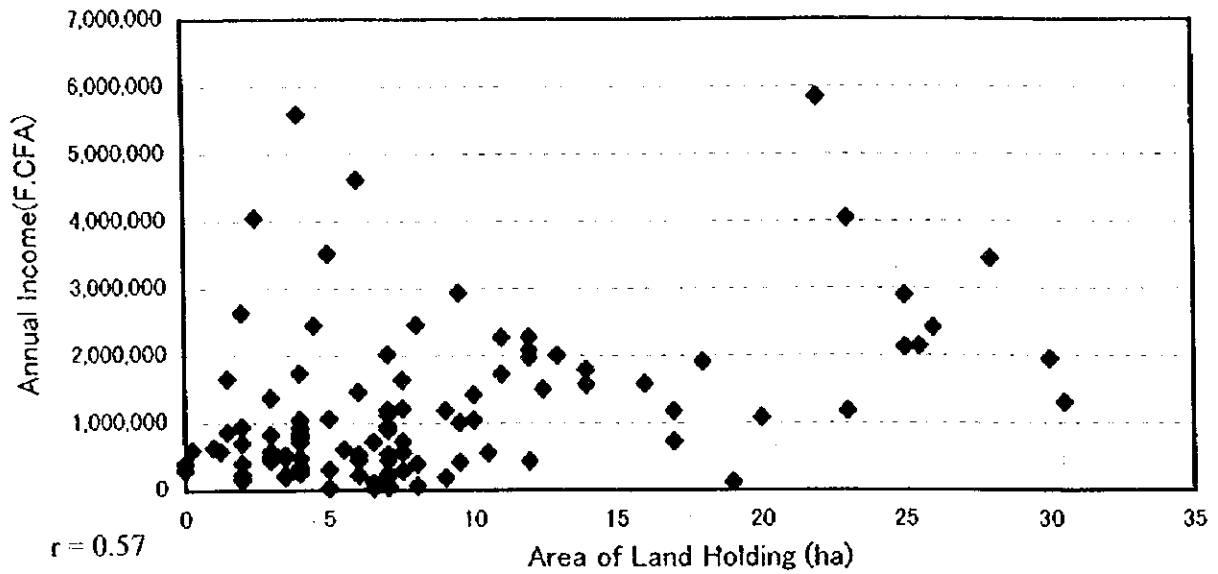


Fig. G.2.2 Correlation between Holding Area and Income

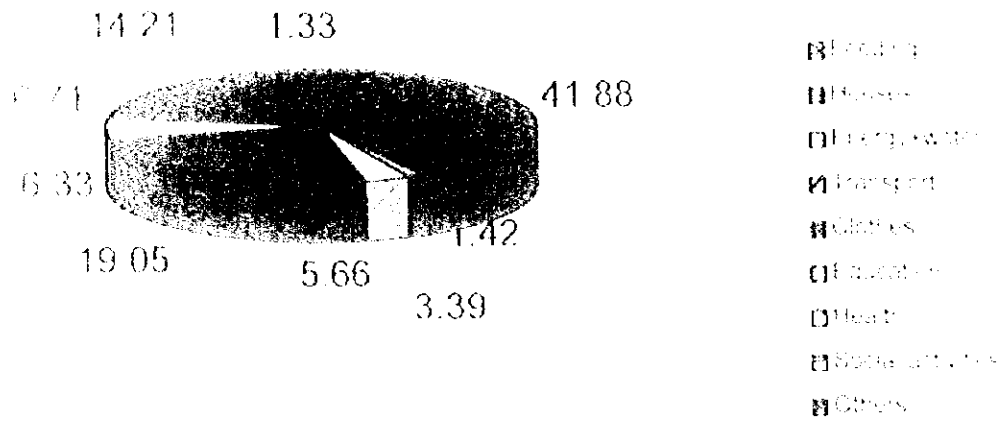


Fig. G.2.1 Expenditure of Household in the Study Area, 1997

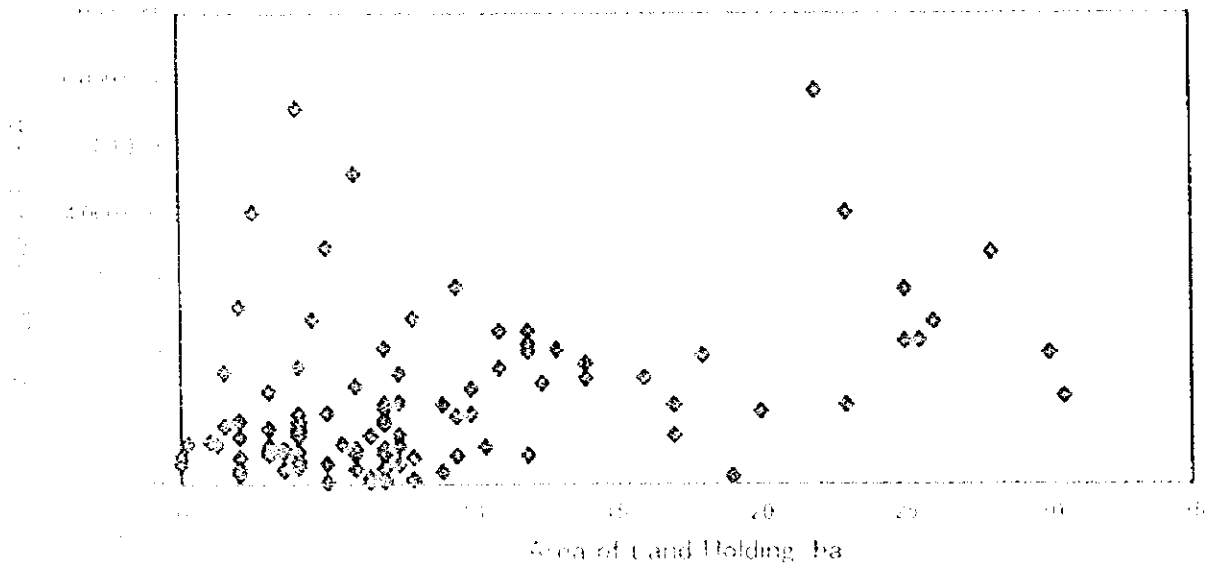


Fig. G.2.2 Correlation between Holding Area and Income

Fig. G.2.3 Histogram of Annual Incomes in the Study Area

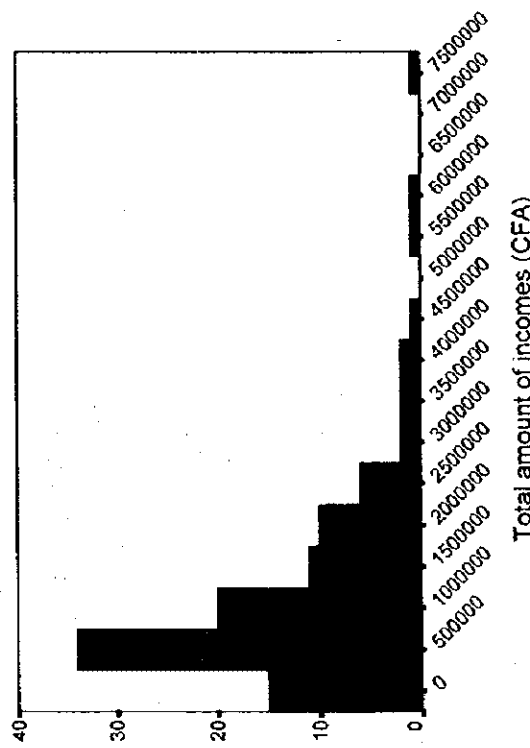


Fig. G.2.4 Outline Annual Income by Nationality

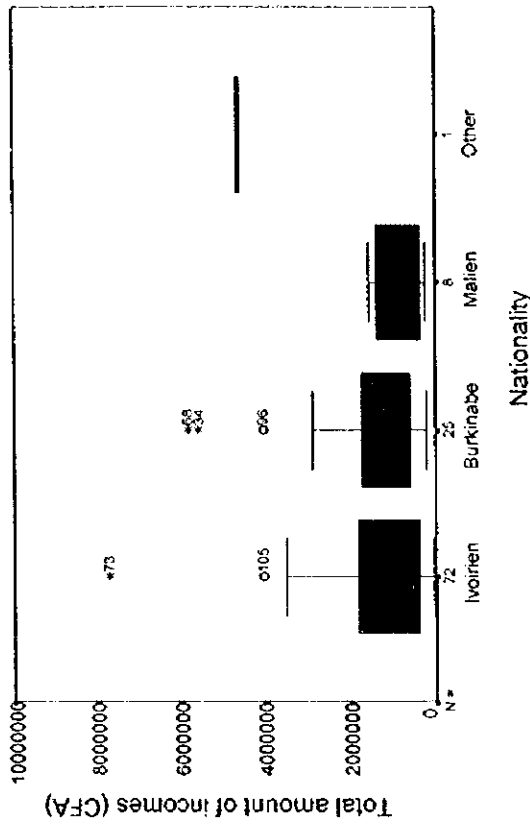


Fig. G.2.5 Outline of Annual Incomes by Village

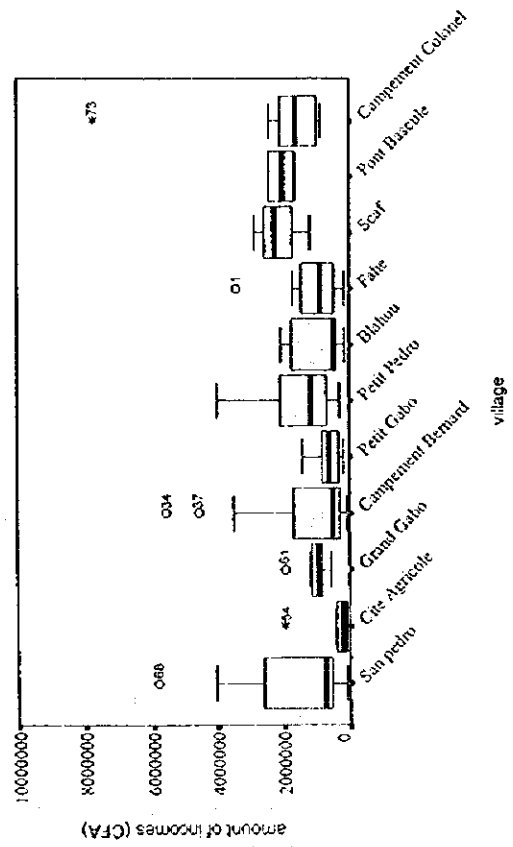


Fig. G.2.6 Outline of Annual Income by Source

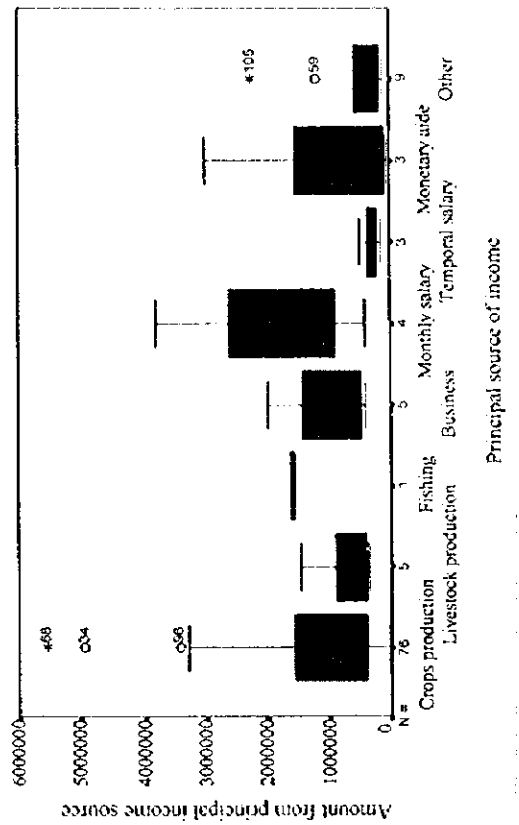


Fig. G.2.3 Histogram of Annual Incomes in the Study Area



Fig. G.2.4 Outline Annual Income by Nationality

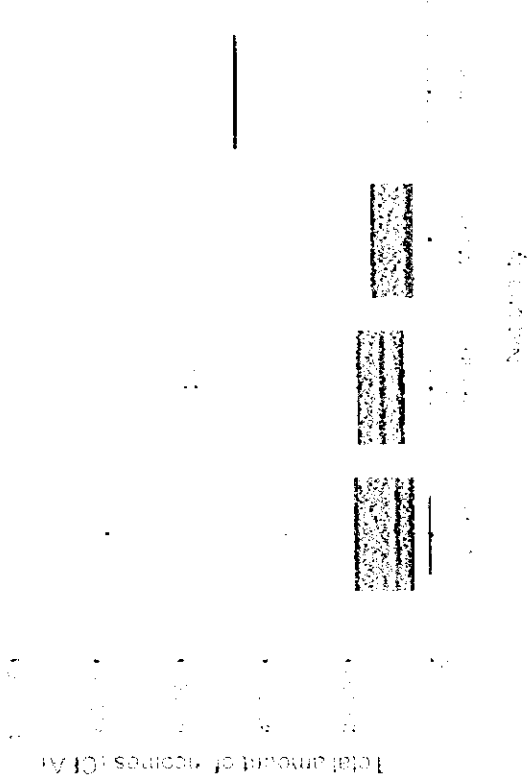


Fig. G.2.5 Outline of Annual Incomes by Village

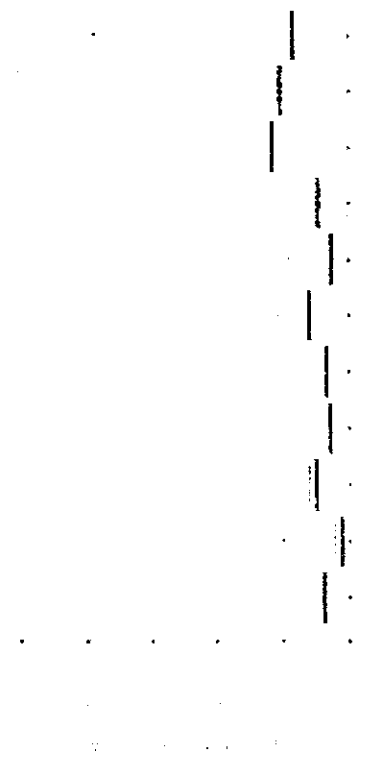
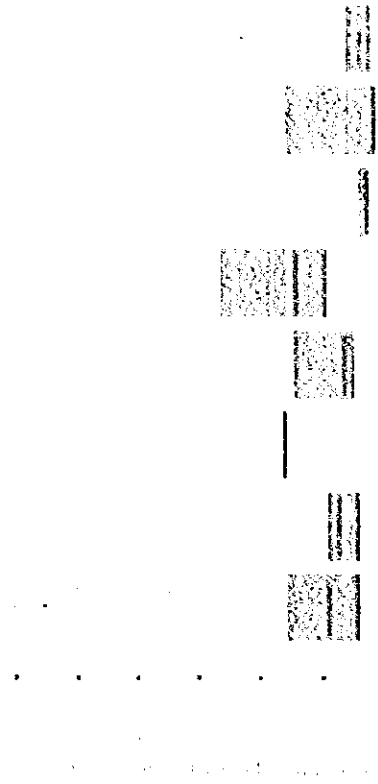


Fig. G.2.6 Outline of Annual Income by Source



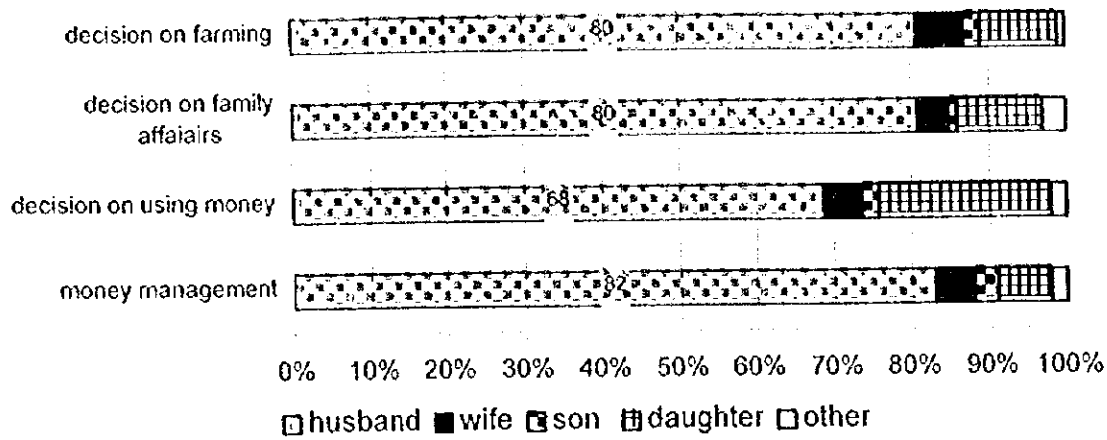


Fig. G.2.7 Decision-making in Family

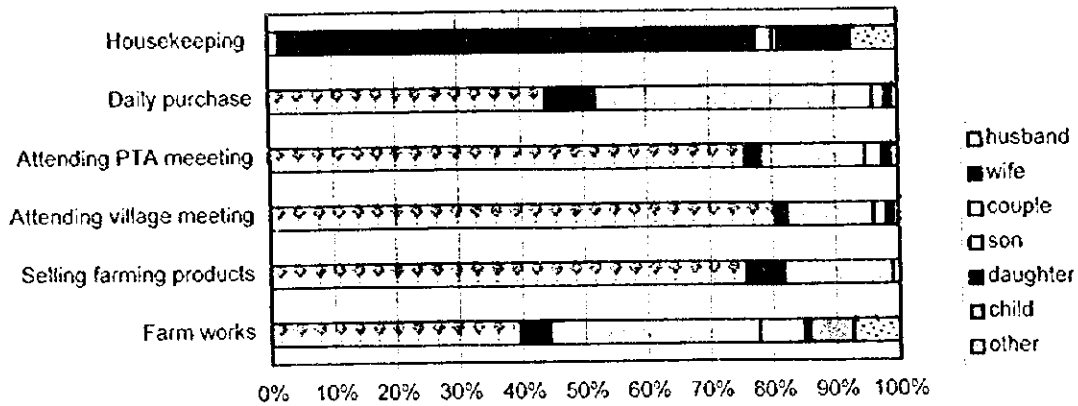


Fig. G.2.8 Tasks Sharing in Household

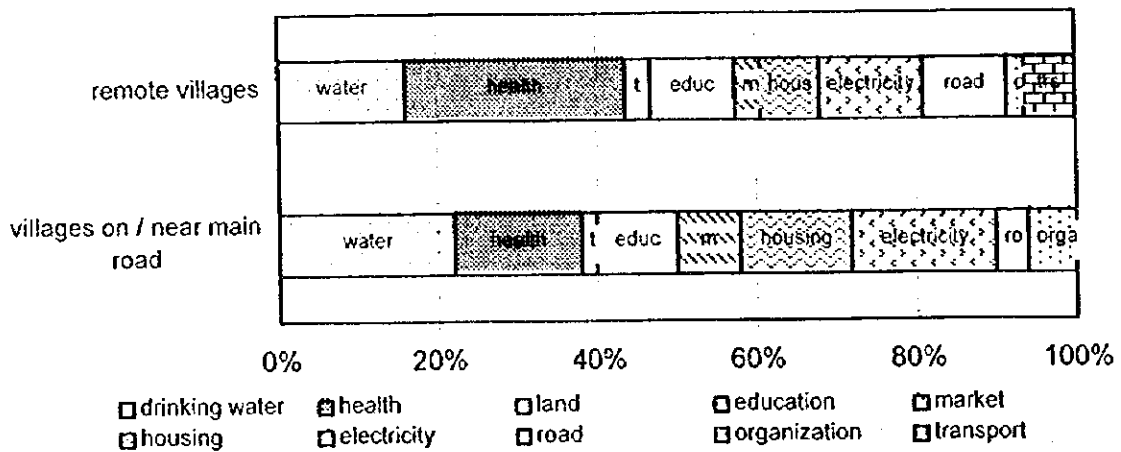


Fig. G.2.9 Problems by Types of Villages

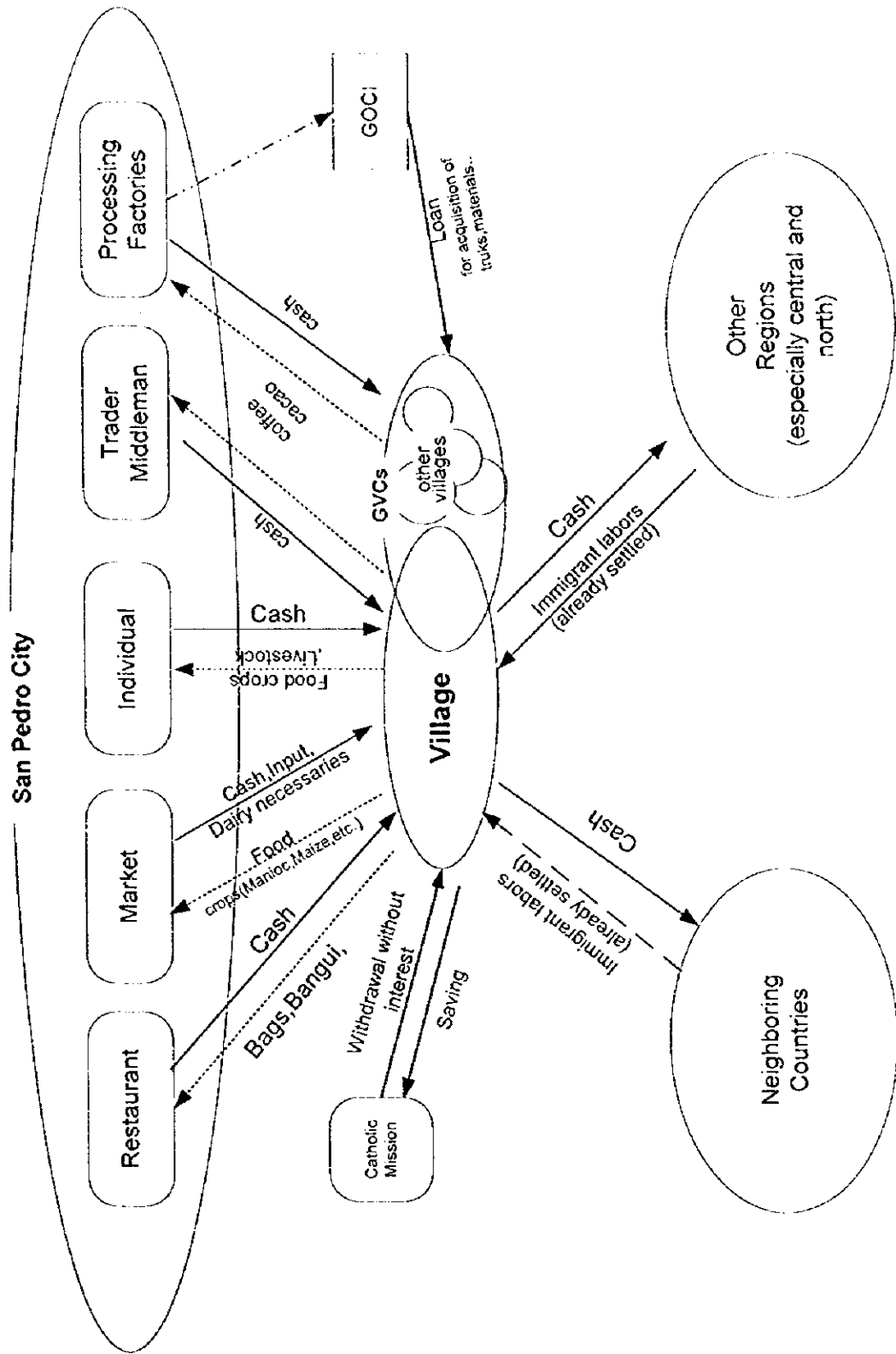


Fig. G.2.10 External Factors of Village Economy

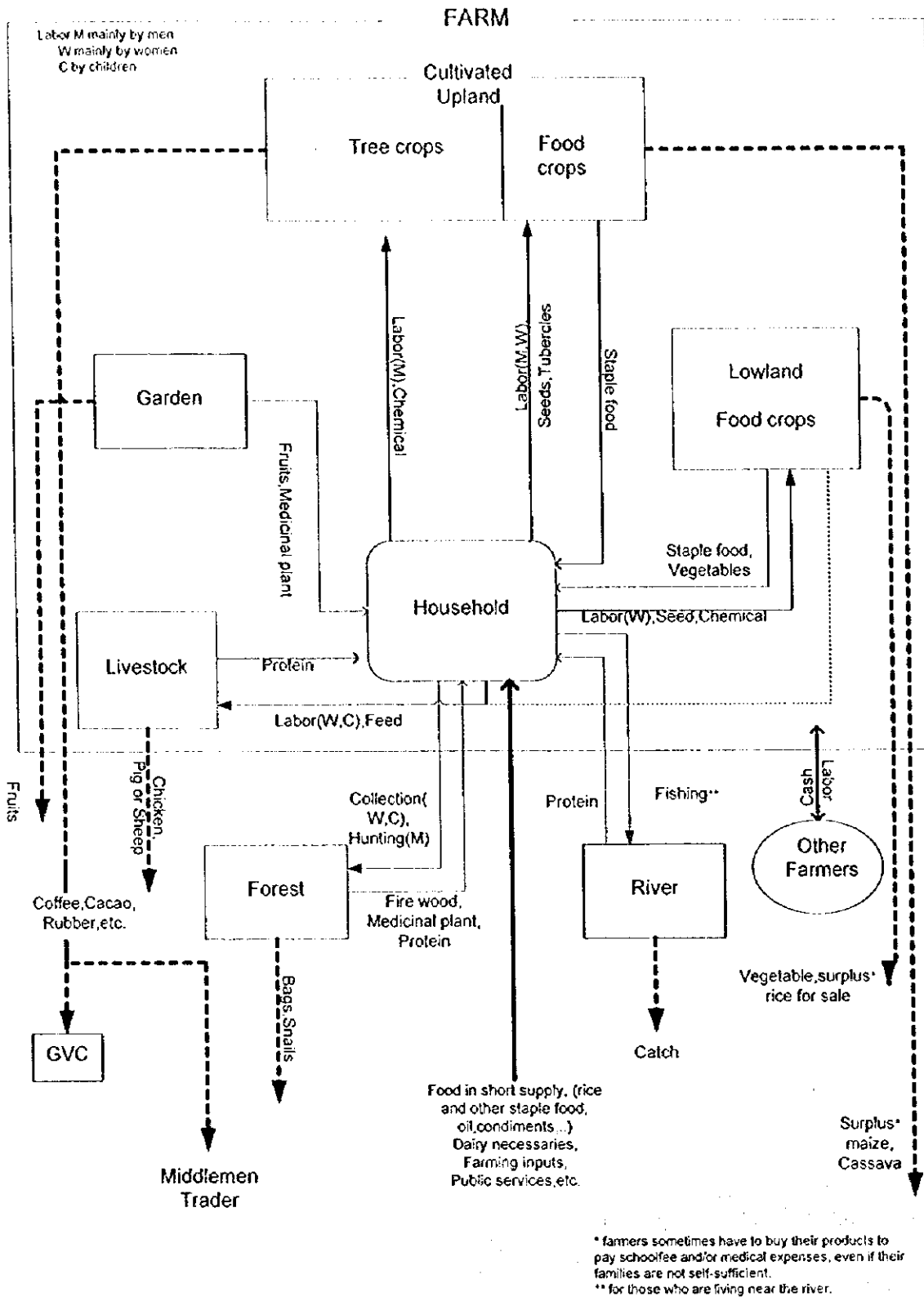


Fig.G.2.11 Concept of Farm Household Economy

Fig. G.2.12 Rice Calculation Calendar

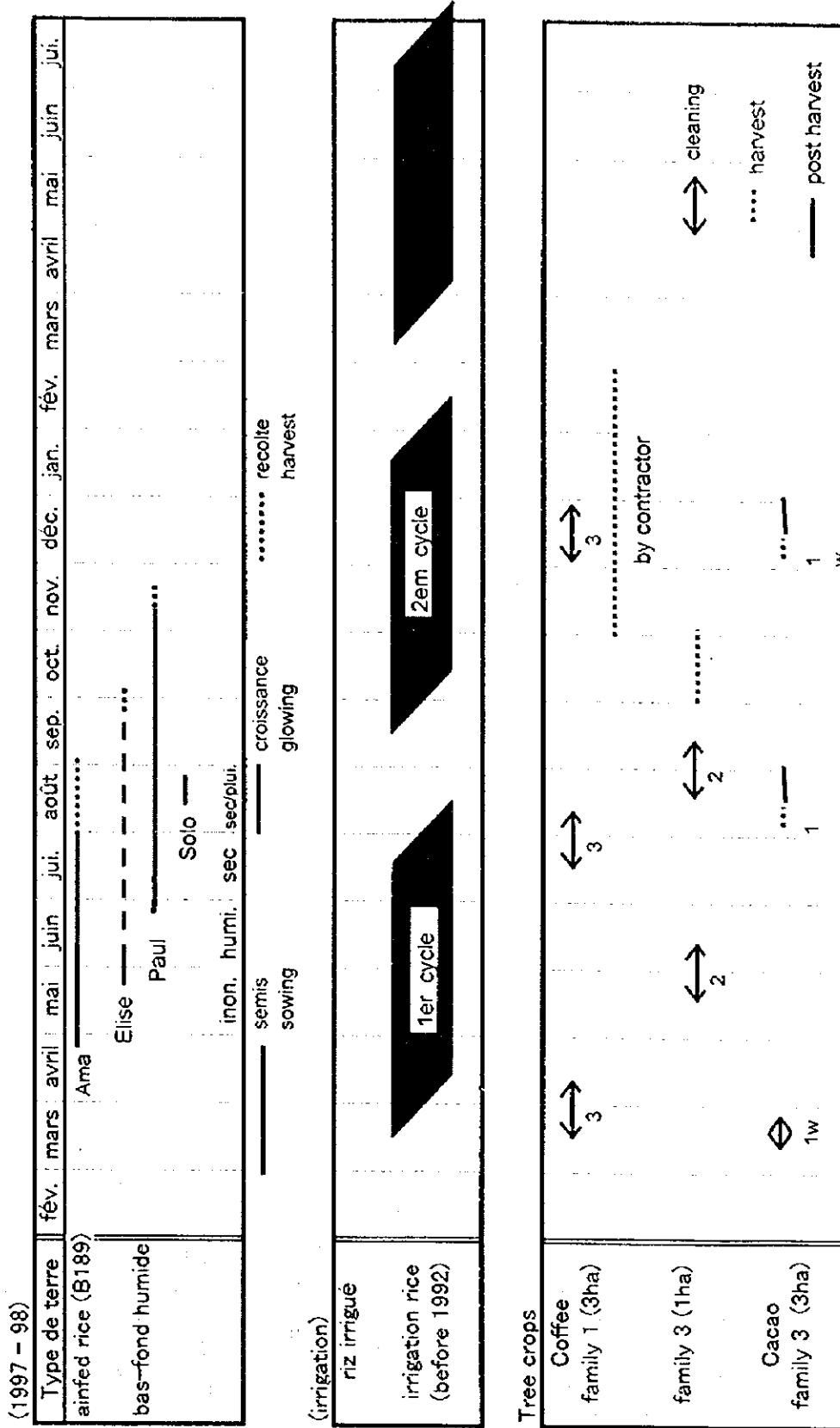
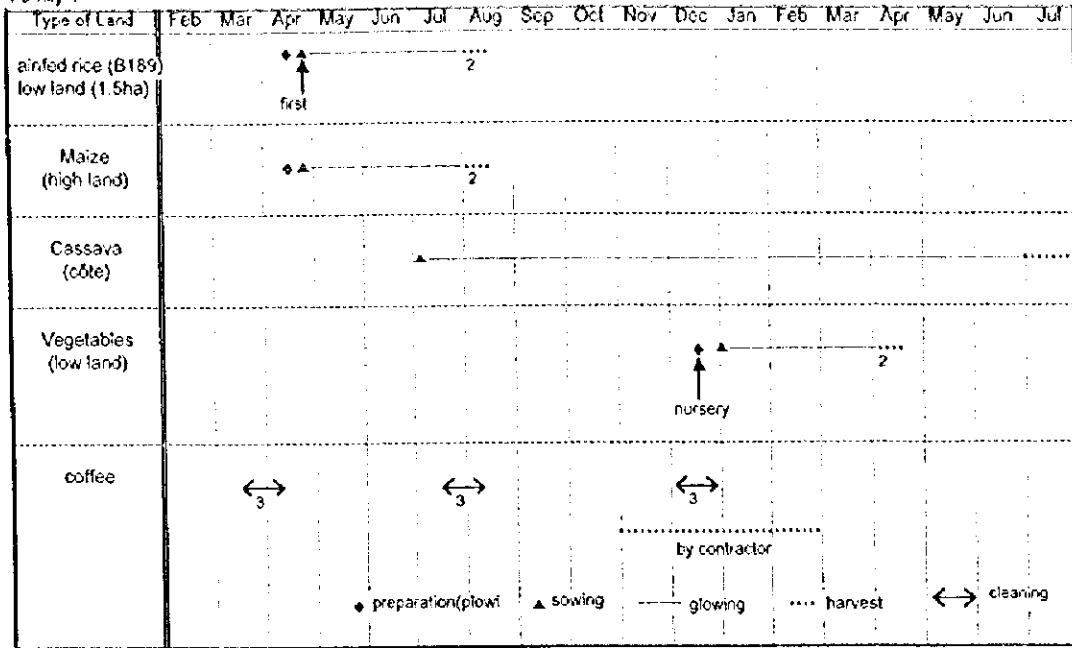
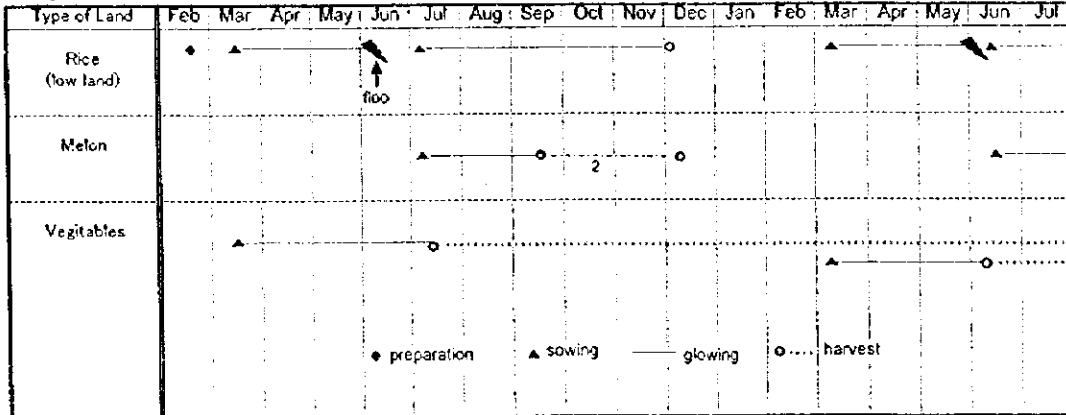


Fig. G.2.13 Crop Cultivation Calendar in 1996/97

Family 1



Family 2



Family 3

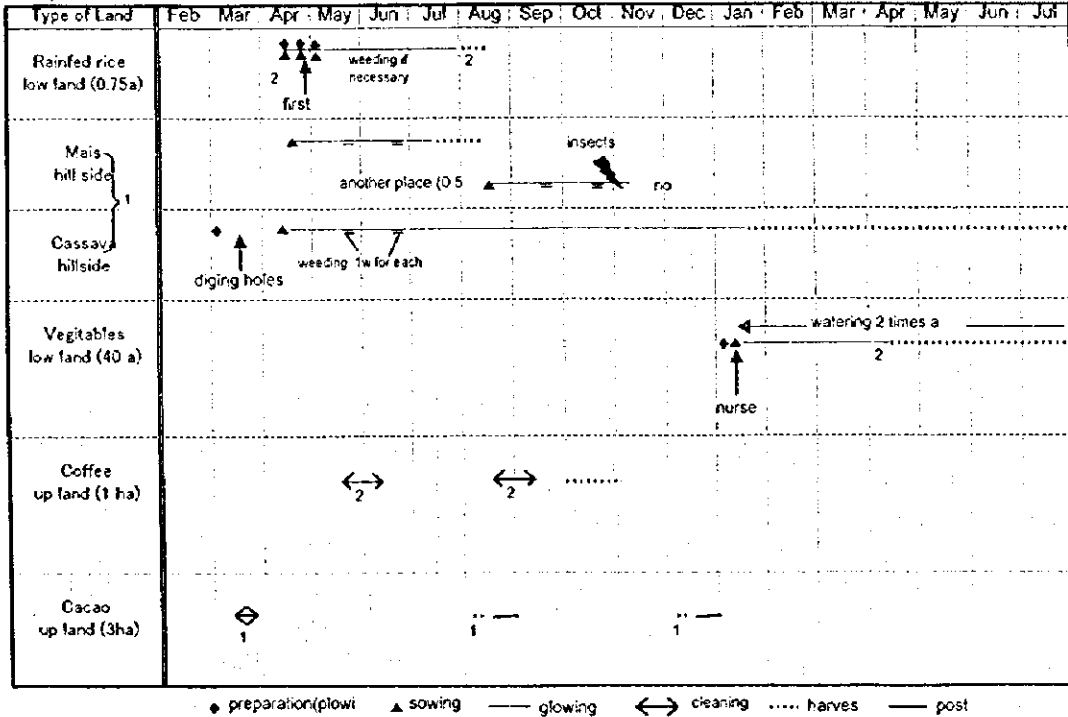


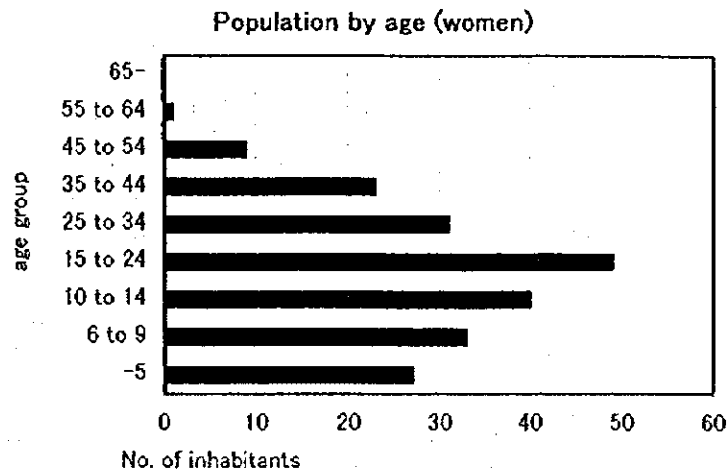
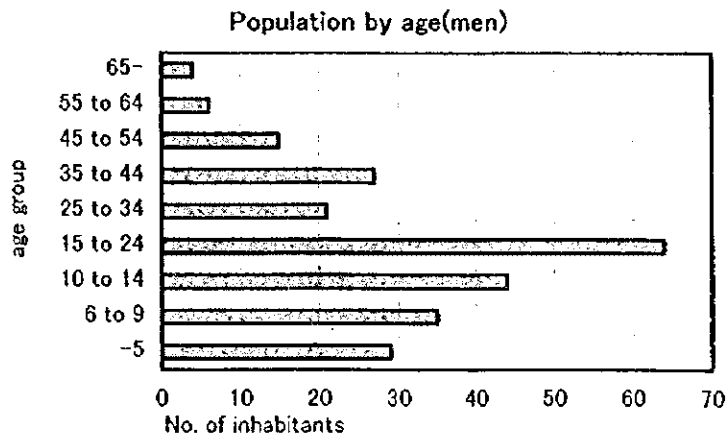
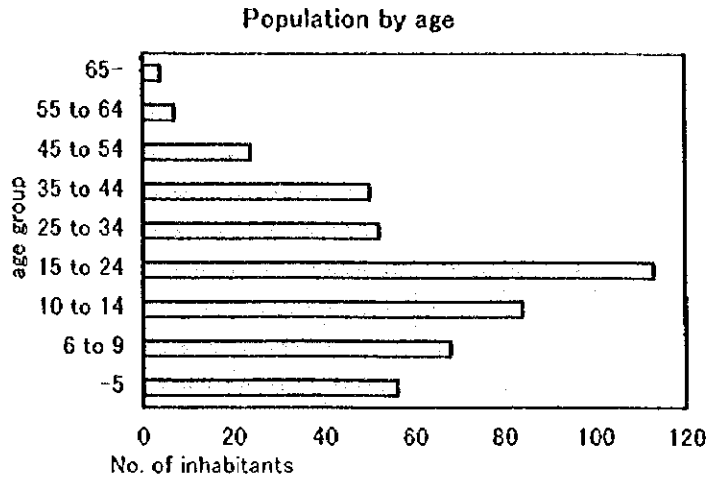
Fig. G.2.14 Farm Work Calendar

| Crops | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------------|-----|-----|-----|---|-----------------------------------|---------|-----|--------------------------|-----------------------------------|---|-----|------------------------|
| Rainfed rice | | | | land preparation (usually by contractor or direct sowing) | | | | | weeding and bird harvest and post | | | |
| Maize | | | | land | | weeding | | | harves | | | |
| Vegetables | | | | nursery, transplantation | weeding, watering, pest & disease | | | | } Dry season cycle | | | |
| | | | | | | | | nursery, transplantation | | weeding, watering, pest & disease | | harves |
| | | | | | | | | | | harvest and post | | |
| Coffee | | | | | | | | | | weeding, if necessary, pest & disease control | | |
| Cacao | | | | | | | | | | | | Grand harvest and post |

Preparation & sowing care harvest & post need much labor

Fig.G.2.17 Population in Cite Agricole

as of 1998. 5-7



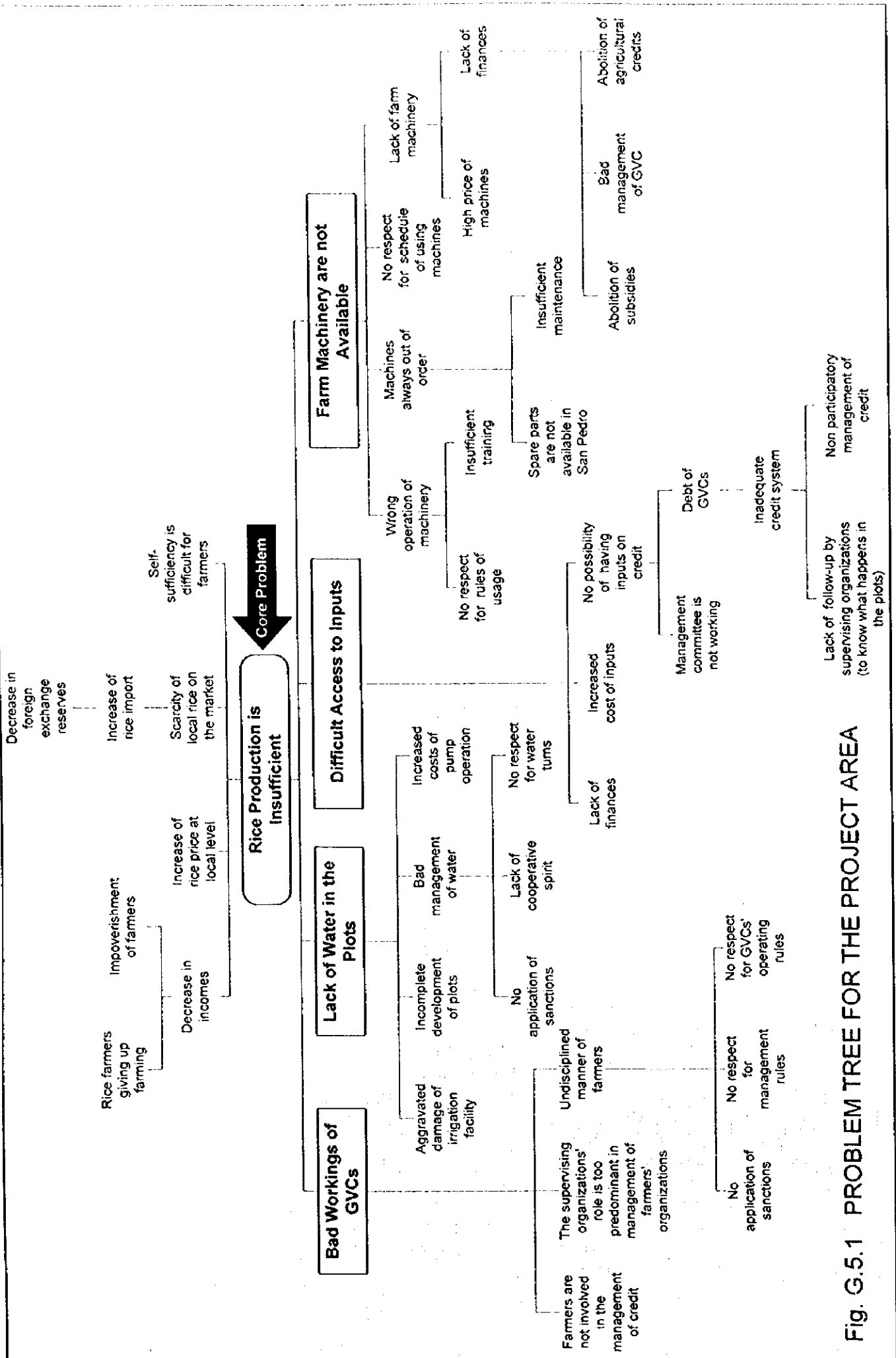


Fig. G.5.1 PROBLEM TREE FOR THE PROJECT AREA

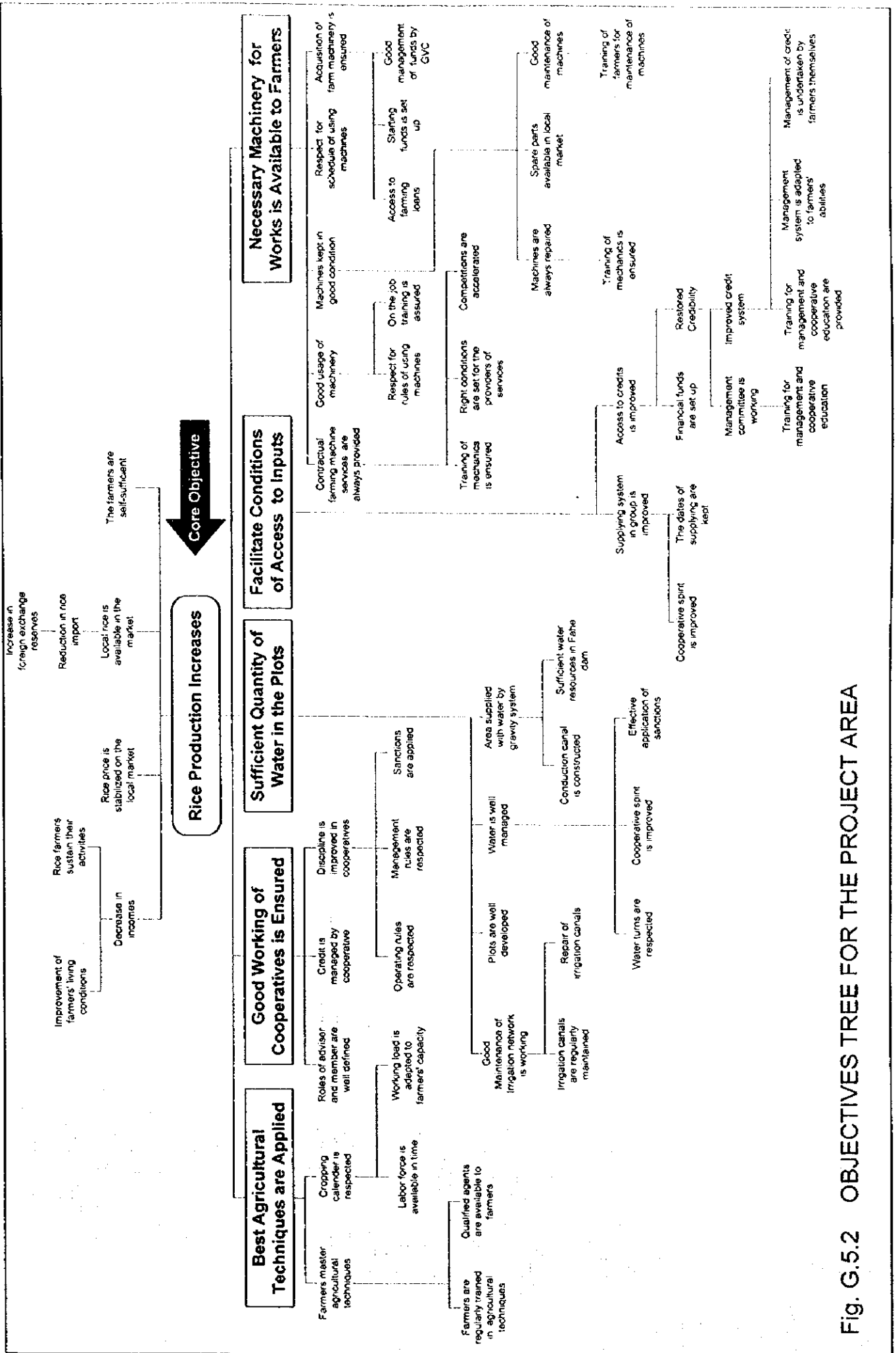


Fig. G.5.2 OBJECTIVES TREE FOR THE PROJECT AREA

H : RURAL INFRASTRUCTURE

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H : RURAL INFRASTRUCTURE

H.1 Existing Rural Infrastructure

H.1.1 Infrastructure in the Study Area

Founding of all the important new infrastructures in the region after 1968 was credited through ARSO. They are shown in Fig. II.1.1, and described as follows:

(1) Seaport

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

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

(2) Road

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

(3) Airport

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

(4) Electricity

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

of F.CFA 50 billion (US\$83 million of 1997 price), about US\$ 46 per capita.

In Côte d'Ivoire, *Energie Electrique du Côte d'Ivoire* (EECI) installs the facilities, and *Compagnie Ivoirienne d'Electricité* (CIE) maintains them and manages the business of selling electricity. The present users have been contributing about 2 % of their payment for future rural electrification. As it costs the consumers F.CFA 80/kwh, only 31.4 % of population of San-Pédro could enjoy the utility as of 1997. Also in Pahé, the village which enjoys the benefit of new electrification, some of its economically sensitive inhabitants see battery charged TVs under kerosene lamps.

A hydropower station of maximum 1,000 kw x 2 capacity was installed at San-Pédro dam and it is connected to the national grid. The station is affiliated to Buyo hydropower station.

(5) Water Supply and Sewage

La Société de Distribution d'Eau de Côte d'Ivoire (SODECI) is responsible for supplying potable water. Its San-Pédro branch extracts water from the San-Pédro River at the rate of 6,000 m³/day at the 15 km point from its river mouth, and supplies with it to 30 % of the residents of San-Pédro City in 1997[*: 90 lit. (30% leakage of 130 lit.)/capita/ day x 149,300 capita x 29.9%= 5800m³/day = 67 lit/sec]. The facilities were built by *Companie General d'Eau* (renamed to VIVENDI) which has built 35 water towers in Côte d'Ivoire since 1953. The customers experienced a supply restriction in certain period of February and March 1998, when a spell of exceptionally dry weather reduced the river flow in some parts to nearly zero. SODECI has a grand project of supplying potable water to 16 villages in the Montagnes Region, the northwestern neighbor of the Bas-Sassandra Region.

The sewage system originally planned by the ARSO is a simple one. Open channel which flows through the main street, collecting the sewage flow from the both side. In the rest of the area, it is individually treated.

(6) Communication

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

(7) Education

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

institutions than the level of *lycée* including teachers' college (EMI) are only found either in Abidjan or in Yamoussoukro.

(8) Public Health

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

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

H.1.2 Rural Road

Rural roads in the Study Area are gravel roads and basically they are maintained by farmers themselves. The Ministry of Economic Infrastructure maintains the road between Gabiadji and Tai, under the Tai National Park Project of GTZ. Other roads have never maintained these several years because of financial difficulties.

Most of road in the Study Area are poorly maintained and they are always submerged at the drainage crossing in lower areas during the rainy season. Their net works are tabulated as follows:

Rural Road Networks

| No. | Start | Via. | End | Distance (km) | Connecting |
|----------------------|--------------------|----------------|-----------------------|---------------|----------------------------------|
| National Highway A-5 | San-Pédro | | Pt. Pedro | 14.9 * | Soubre |
| Rural Roads | | | | | |
| 0 | Fahe | Dam | SCAF | | Gabiadji |
| 1-1 | Fahé Power station | GPS-6 | Cpt. Colonel | 10.95 | IDESA |
| 1-2 | Fahé | | GPS-6 | | Cpt. Colonel |
| 2-1 | Pt. Pedro | 14.5 km | (Blaou) | 13.3 * | National Highway A-5 |
| 2-2 | 14.5 km | | Lussinakro | 1.42 | No. 2 road |
| 3-1 | Pt. Pedro | | Cpt. Colonel | 5.5 | National Highway A-5 |
| 3-2 | Cpt. Bernard | | Jozenkro | 4.8 | National Highway A-5 |
| 3-3 | Pont Bascal | | IDEFOR center | 2.6 | No.3 road & National Highway A-5 |
| 4-1 | Cpt. Bernard | | SCAB | | |
| 4-2 | Jozenkro(2.5km) | | Gd. Gabo | 3.5 | No.5 road |
| 5-1 | Torratic Post | Campus I | Gd. Gabo | 3.5 | |
| 5-2 | 5-1(km) | | 5-6 (km) | 2.1 | No.5 road |
| 5-3 | 5-2(km) | | Northern Pump station | | |
| 5-4 | ANADER | Cite Agricole | Pumping St. | | |
| 5-5 | 5-1(km) | | Cite Agricole | | |
| 5-6 | 5-2(km) | Garage of C-II | 5-1(km) | | |

H.1.3 Community Water Supply

Most of households have their own wells, but they dry up during the dry season.

There exist 31 tubewells constructed in 23 villages scattered in and around the Study Area under the rural water supply schemes of the Ministry of Economic Infrastructure as shown in Fig. A.6.2 in this report. These wells are constructed to utilize the fissure water in the granite zone extending widely in the area, and their target fractures are suited from 20 to 40m deep. The depths of these wells vary from 36 to 88m with an average depth of about 59m.

H.2 Rural Infrastructure Improvement

H.2.1 Rural Road

The inspection road along the Grand Canal is considered as the main rural road penetrating the Study Area. Other O&M and farm roads along irrigation canals in the Project Area have functions as the rural and community roads. They need rehabilitation such as leveling the undulated road surface and gravel pavement. On the other hand, community and access roads in the settlement areas required to be constructed by the Project.

H.2.2 Community Water Supply

Existing villages in the Project Area have no rural water supply system. There is a tubewell and a water tank constructed by CIDV but not watered yet in Campus II of Cité Agricole. These facilities are to be developed by the villagers.

H.2.3 Community Infrastructure in the Settlement Area

(1) Selection of New Settlement Area

Area for the new settlers is proposed at the non-irrigable gentle hill areas adjacent to the paddy field as shown in Fig. 5.7.1. Based on the average area of 1,300 m² per house in Campus II of

Cite Agricole, including the community facilities such as school, new settlement area totaling 35 ha can absorb 292 householders and together with existing householders, in total 384 householders can live in the Project Area.

| Category | Village or Area | Area (m ²) | Average Area (m ² /house)* | No. of Householders | Remarks |
|--------------------------------|-----------------|------------------------|---------------------------------------|---------------------|-------------------------------------|
| Existing Villages | Grand Gabo | - | | 27 | |
| | Campus I | - | | 5 | |
| | Campus II | 79,000 | 1,300 | 61 | including the community facility |
| | Sub-total | | | 93 | |
| New Settlement Area (proposed) | Settlement (1) | 204,000 | 1,250 | 162 | |
| | Settlement (2) | 26,000 | 1,000 | 26 | Eastern extension of Campus II |
| | Settlement (3) | 40,000 | 1,000 | 40 | Southwestern extension of Campus II |
| | Settlement (4) | 80,000 | 1,250 | 64 | Southern out-skirt |
| | Total | 350,000 | | 292 | |
| Total | | | | 385 | |

(2) New Community Infrastructure and Facilities

1) Community roads

Community road with side ditches shall be of 3 m width, simple gravel paved, shall be constructed in new settlement area connecting with existing rural/farm roads.

2) Community water supply

Totally 4 tubewells for the rural water supply shall be provided in the settlement area at 500 persons/well. At the initial stage of the Project, the minimum 2 wells shall be constructed by the Project, and the remaining shall be installed by villagers applying the AfDB Rural Water Supply Project and FIAU.

3) Community center

In the new settlement areas where more than 50 households are expected, the site for community center will be reserved near the crossroads at the planing stage. The community center will be as simple as one in traditional village and built by the villagers.

I : Environment

I.1 Environmental Protection

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| I.1.3 | Water Policy Project of Côte d'Ivoire..... | I - 7 |
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I : Environment

1.1 Environmental Protection

1.1.1 Legislative and Regulatory Network for the Protection of the Environment in Côte d'Ivoire (1/2)

| Items | Laws, decrees, orders | Comments |
|--|---|---|
| Hunting rules and protection of fauna | Law 65-255 of 4/8/65 regulating the protection of fauna and practice of hunting | This law defines 5 classes for the protection status of fauna species and hunting rules. Hunting permits are divided into 4 categories. Traditional hunting outside protected areas and for non protected animals is permitted without hunting permit, but is submitted to the rule of opening / closing of hunting period; |
| | Order 1712 AGRI-EFC of 29/12/66 establishing the conditions of elimination or eradication of pest animals | Specific hunting authorization are issued in case of animals causing a serious degradation to crops; authorization is issued by the Minister of Agriculture for strictly protected animals, or by the prefect in case of urgency; |
| | Law 66-424 of 15/9/66 about rules of hunting permits and conditions of attribution | X |
| | Order 1068-AGRI of 22/9/67 regulating the commercial hunting of crocodiles and varanus | Special permit is delivered for hunting of crocodiles and varanus in view of commercialization of skin; |
| | Order 3 of 20/2/74 about closing of hunting | X |
| | Law 94-442 of 16/8/94 amending the Law 65-255 of 4/8/65 about the protection of fauna and practice of hunting | 5 categories of hunting permits are established. The list of species with protection rules are attached in appendix of the law; crocodiles are classified as strictly protected species; |
| Forestry rules and protection of trees | Law 65-425 of 20/12/65 on forestry (forestry code) | Classification of State forest into 4 types and corresponding use rights; definition of rules for forestry and to use trees species that are protected species; |
| | Decree 66-122 of 31/3/66 about determination of the so-called protected forestry species | Listing of tree species that are protected. These species cannot be used excepted in specific cases under special authorization; |

Source: MLCVE

1.1.1 Legislative and Regulatory Network for the Protection of the Environment in Côte d'Ivoire (2/2)

| Items | Laws, decrees, orders | Comments |
|----------------------------------|--|----------|
| System of protected areas | Law 66-433 of 15/9/66 stating and regulating the procedure of classification of natural, integral or partial reserves and national parks | X |
| | Decree 77-348 of 3/6/77 redefining the limits of the national park of Taï and establishing a protection peripheral zone | x |
| | Order 9 MINEFOR/DPN/DCDF of 11/5/83 about definition of a protected area between the national park of Taï the paper-maker area | x |
| Classified forest of Rapide Grah | Decree 66-422 of 15/9/66 establishing a state company called the Society for Development of Forestry Plantations (SODEFOR) | x |
| | Decree 75-385 of 6/6/75 establishing the preserved area of Rapides Grah forest in view of a paper-maker area | x |
| | Decree 77-15 of 7/1/77 establishing extension of the paper-maker area and defining its new limits | x |
| | Decree 85-132 (1985) about transformation of SODEFOR in a public establishment with industrial and commercial character | x |
| Pesticides / Pollution | Decree 74-338 of 7/8/74 about the agreement of pesticides | x |
| | Law 64-490 of 21/12/64 about the protection of vegetal | x |
| | Order 654 AGRI/MRS of 23/5/79 establishing the conditions of application of Decree 74-388 of 7/8/74 about the agreement of pesticides | x |
| | Decree 89-02 of 4/1/89 about the agreement, production, sale and use of pesticides | x |
| | Decree 91-662 of 20/2/91 establishing the anti-pollution (CIAPOL) and its attributions, organization and activity | x |
| Continental fishery | Law 86-478 about fishery (1986) | X |
| Cultural patrimony | Law 87-807 about the protection of cultural patrimony (1987) | X |

Source: MLCVE

1.1.2 Environmental Policy and Institutions in Côte d'Ivoire

(1) National Action Plan for Environment (PNAE)

The National Action Plan for Environment (PNAE 1996-2000) has been established in order to set up the environmental policy of Côte d'Ivoire. This PNAE is the result of the report on national state of the environment for Côte d'Ivoire, which has been based on the orientation given in Agenda 21. The PNAE has been adopted by the Council of Ministers in 1995. The PNAE has identified 3 general objectives, which are:

- Promotion of sustainable development and improvement of the management of natural resources;
- Protection of the biodiversity;
- Improvement of the living conditions.

A set of priority actions has been defined, arranged according to 10 basic programs:

- Sustainable agricultural development
- Conservation of biodiversity
- Management of human settlements
- Control of industrial pollution and nuisances
- Management of the coastal area
- Integrated management of water
- Improvement of the management of energy sources
- Research, education, training, and public awareness
- Integrated management of the environmental information
- Improvement of the institutional and regulatory framework

(2) National Agency of Environment (ANDE)

Attributions of the ANDE have been defined by decree in 1997. The ANDE is in charge of following up the proper execution of the objectives of the PNAE. It is the executive agency of the environmental projects that have been defined within the scope of the PNAE, and the co-ordinating agency of those environmental actions that have been defined by sector based policies. Moreover, the ANDE makes also a linkage between the NGOs and the international aid agencies, and it executes the international conventions in the field of environment.

Missions of the ANDE include the supervision of the EIA and the elaboration of environmental standards and criteria. Since the EIA procedure has been settled before establishment of the ANDE, the EIA is actually supervised by the BEIE, which belongs to the DE.

(3) Anti-pollution Center of Côte d'Ivoire (CIAPOL)

CIAPOL is under the administrative and technical tutelage of MLCVE. Its financing sources however depend on the state subsidies and endowment, environmental taxes and remuneration of study and consulting services.

CIAPOL works as a laboratory of analysis of water, air and soil. Its purpose is to follow up pollution and nuisance, to create quantitative data, to analyze and diffuse information, especially for the environmental agencies. Its action comes within the scope of the classified installations system (analysis of discharges) and that of keeping up with the quality of environment, specially the marine and coastal environment. The execution of urgency action plans in case of accidental marine or coastal pollution is also an important prerogative of CIAPOL.

The Central Laboratory of Environment (LCE), which is a sub-direction of CIAPOL, is more specifically dealing with data, studies and information. Among its objectives are the following tasks:

- to collect various environmental data with the objective of improving the water quality and the quality of the livelihood;
- to ensure the management and interpretation of analytic data of the state of environment;
- to make recommendations about quality objectives;
- to participate in the environmental impact assessment studies of development projects.

Concerning the follow-up of environmental quality, CIAPOL manages about 20 monitoring sites, with measurements taken once per month for marine and lagoon water, and once per semester or yearly for continental water. The later measurements are operational for the Komoué, Bandara, et Sassandra rivers. The results are transmitted to the DE, first in the purpose of storing useful data within the framework of the evaluation of environmental standards, or in view of heightening awareness actions. Furthermore, these data are directly usable for eventually taking actions once they have been compared with international criteria, especially those of the EU. However, CIAPOL has no enforcement jurisdiction for control of pollution.

**The priority Actions and Projects of the Government
for Achieving the Objectives of the PNAE**

| Basic programs | Priority actions | Current projects |
|---|--|---|
| Sustainable agricultural development | <ul style="list-style-type: none"> - Education of farmers - Agricultural intensification - Promotion of sustainable agricultural development - Strengthening land tenure | <ul style="list-style-type: none"> - National project of supporting to agricultural services PNASA - GEPRENAF project - National program of countermeasures against bush fires - Agro-forestry projects - Forestry project |
| Conservation of biodiversity | <ul style="list-style-type: none"> - Conservation of biodiversity - Protection of forest | <ul style="list-style-type: none"> - GEPRENAF project - Network project of management of protected areas |
| Management of human settlements | <ul style="list-style-type: none"> - Urban environment | <ul style="list-style-type: none"> - Project of management of the urban environment - Project of municipal development - Project of urban development |
| Control of industrial pollution and nuisances | X | X |
| Management of the coastal area | <ul style="list-style-type: none"> - Quality of lagoon water | <ul style="list-style-type: none"> - Water and sewerage project - Project of countermeasures against proliferation of aquatic plants |
| Integrated management of water | <ul style="list-style-type: none"> - Reduction of water borne diseases | <ul style="list-style-type: none"> - Water and sewerage project - Project of countermeasures against proliferation of aquatic plants |
| Improvement of the management of energy sources | <ul style="list-style-type: none"> - Measures against greenhouse effect gas substances that decrease the ozone layer - Economy of energy | <ul style="list-style-type: none"> - Project of inventory - Project of reduction of greenhouse effect gas |
| Research, education, training, and public awareness | <ul style="list-style-type: none"> - Enforcement of capacities | <ul style="list-style-type: none"> - National plan of management of the environment and natural resources |
| Integrated management of the Environmental information | <ul style="list-style-type: none"> - Strengthening land tenure - Management of environmental information | <ul style="list-style-type: none"> - National project of land management |
| Improvement of the institutional and regulatory framework | <ul style="list-style-type: none"> - Support to environmental NGOs | <ul style="list-style-type: none"> - National plan of management of the environment and natural resources - Program of micro-financing of NGOs projects |

Source: PNAE, Progress Report II – Study by PNAE

1.1.3 Water Management Policy in Côte d'Ivoire

(1) Statement

A Water Policy Project Document has been prepared by the High Commission for Hydraulics in 1997. The High Commission for Hydraulics is in charge of setting up the institutional framework for water management and sewerage. The new water policy is focusing on the integrated management of water resources, and stands on the reform of the institutional framework on the one hand, and of the juridical and regulatory framework on the other hand.

(2) Institutional Reform

The institutional framework will be composed of several agencies, firstly a National Observatory of Water, itself chaired by the National Committee of Water, consultative agency that provides advice and recommendations. Planning and execution of the decennial programs will be assumed by a National Agency of Water. The national policy will be executed at watershed level through water management plans that will have been approved by the Watershed Commissions. These commissions will be in charge of co-ordination at the watershed level, of arbitration about water use conflicts, of approval of the rate for water use related fees and of the multi-annual programs proposed by the executive agencies.

The objectives of the National Agency of Water as they have been proposed by the High Commission for Hydraulics, and that are pertinent within the scope of this study, are the following:

- Settling process of agriculture, promotion of irrigation and drainage;
- Better use of water resources (fishery development, self-sufficiency of food by irrigation);
- Development of potable water supply systems in rural area;
- Protection of watersheds and wetlands;
- Execution of the master plans for water management and development once approved by the basin commissions, the users and other parties involved.

Among these objectives, it is worthwhile to note that there is one of them pertaining to the villages hydraulics for potable water supply. The general orientation is to withdraw groundwater in priority, and use criteria such as the supply of 15 to 20 l/day/capita of potable water on average, the establishment of one water supply site for 100 inhabitants, with an additional one for a unit ratio of 400 inhabitants. Villages of 100 inhabitants and more should be all equipped with pumps that can be moved by the people. Villages of 1000 to 3000 inhabitants should be equipped with simple supply networks.

(3) Juridical and Regulatory Reform

Juridical and Regulatory Reform stands on the Water Law Project. The main objectives of the Water Law Project are: To manage water resources and water works in an integrated manner; To plan water use at the watershed level; To improve living conditions in an environment friendly manner; To implement sustainability; To manage the protection of water environment; To set up the new institutional framework.

The integrated water management issue is based on certain priorities, namely:

- Preservation of the aquatic ecosystems, sites and wetlands;
- Environmental protection against pollution;
- Development and protection of water works;
- Enhancing the value of water as economic resource, through the satisfaction of all types of uses: potable water, salubrity, maintenance of the base flow, agriculture, fishing and others.

Few additional aspects of the Water Law Project need to be considered in this study:

- Hydraulic development and water works are submitted to an environmental impact study; a future decree will be launched by the Council of Ministers to establish the list of such projects;
- It is the role of the government to take care that prevention of and countermeasures against the water borne diseases are implemented;
- potable water supply is the first priority for the use of water resources.

1.1.4 Biodiversity and Fauna

Fauna Species in Côte d'Ivoire and their Ecological Importance According to the Red List of IUCN

| Total number of spec | Number of endemic spe in the Guinean forest | Number of threatened spec according to the IUCN lis | Naming of certain species among those that are threatened (IUCN) |
|--|---|--|--|
| Mammals 232 Primates 17, Antelopes 19, Bats 12 Other mammals 184 | About 25 | 25 | Banded Duiker Jentink's Duiker Pygmy Hippopotamus Wild Dog Chimpanzee Diana Monkey Red Colobus White-collared Mangabey Johnson Genet Leighton Genet Liberia Mongoose |
| Birds 756 | | 7 | |
| Reptiles and amphibians | | 8 Amphibian species 6 Reptile species | Nil Crocodile Long Face Crocodile Forest Crocodile |

Source: Livre Blanc de l'Environnement, and Guide de la diversité biologique de Côte d'Ivoire (GEMS, 1991)

Fauna Species (mammals and reptiles) and their Protection Status in Côte d'Ivoire, according to the Attached List of the Hunting Law of 1994 (List under actualisation)

| | (1) Class I strict protection | (2) Class II Partial protection | (3) Class III almost no protection |
|----------|--|--|--|
| Mammals | Royal Antelope Bongo Yellow Backed Duiker Jentink Duiker Banded Duiker Diana Monkey Water Chevrotain Chimpanzee Western Red Colobus Western Black and White Colobus Elephant Dwaerf Galago Giant Forest Hog African Manatee Léopard Lion Antbear Giant Pangolin Bosman's Potto Pygmy Hippopotamus Shrew (Micropotamogale Lamottei) | Lesser Flying Squirrel Bubal Hartebeest Buffalo Black Duiker Side Striped Jackal Defassa Waterbuck Roan Antelope Spotted Hyaena Cape Clawless Otter Wild Dog Mona Monkey Two-Spotted Palm Civet Tree Pangolin Long Tailed Pangolin Bush Pig Honey Badger Serval Green Monkey Striped Polecat | Brush Tailed Porcupine Cane Rat Black Striped Duiker Red-flanked Duiker Grimm's Duiker Blue Duiker Golden Cat African Wild Cat African Civet Kob Tree Dassie Genet Bushbuck Hedgehog Greater White-nosed Monkey Squirrel Hare Dark Mongoose Egyptian Mongoose Slender Mongoose Banded Mongoose Oribi Red Monkey Warthog African Linsang Pocupine Otter Shrew Bohor Reedbuck |
| Reptiles | Nil Crocodile Long Face crocodile Forest crocodile Marine Turtles | Seba Python Royal Python | Turtles Varanus |

Source: Attached list of the Hunting Law of 16/8/94 amending the Law of 4/8/65 about the protection of fauna and practice of hunting

1.1.5 Environmental Impact Assessment Requirement (EIA)

The requirement of an environmental impact assessment of development projects has been stated in the environmental law of 1996. The rules regarding the environmental impact studies procedures are presented in the application decree n°96-894 (8/11/1996). There is no decree or guideline for sector based EIA. It is planned that guidelines will be prepared for each development sector, of which the hydro-agricultural developments sector.

The status of a project as regards to the regulatory obligation of an EIA is first determined by the type of activity to which it belongs and to the scale and characteristics of this activity.

Within the range of hydraulic projects, to which this project belongs, the decree provides that an EIA is required if the project consists in land reclamation for 1000ha or more and with rural land regrouping. The land surface concerned by the development project is planned for about 1000ha, but there is basically no rural land regrouping neither land reclamation. Half of the cultivation land which will be developed by the project is concerned by rehabilitation of the existing irrigation perimeter. Land extension will be made almost on the already cultivated lowland.

The appendix II of the decree also stipulates that for infrastructure projects, water canalisation and regulation works require an EIA. Although the project under study is not properly speaking an infrastructure project, it will however induce some infrastructure components for irrigation and for rural improvement. Basically, the project will consist in rehabilitating the already existing hydraulic facilities. However, there will be as well new hydraulic facilities in addition to those already existing, like canalisation works of the Grand Canal. In that case, they would be components of the project that should need a specific attention from the environmental point of view, during the feasibility study.

Finally, the decree also stipulates that those projects that are implemented in sensitive sites should require an EIA. Sensitive sites as defined by the decree are protected areas, wetlands and mangroves, sites with scientific, cultural or tourism interest, areas defined as being ecologically sensitive, protection perimeter of potable water intake, and maritime areas. None of the mentioned sensitive sites of the decree can be found on the project site. The San Pedro river has been designated as a protected area by SODEFOR in its management plan, but as this has been underlined above, this statement has no jurisdictional value. Moreover, the classified forest, which lies on the right bank of the river, cannot be assimilated to a protected area, but need careful institutional coordination in order that the effects of the project on the classified forest if any are not going against the management objectives of SODEFOR.

In conclusion, the conditions of the project are not potentially those that require launching an EIA. However, the project has components that can be considered as being potential sources of impacts, namely hydraulic facilities, and as such should be the object of an environmental evaluation, even in the absence of EIA. The analysis of environmental conditions and the screening of potential impacts of the project are performed within the scope of this report study. They will help to clarify the needs for further environmental study at the stage of the

feasibility study, from the point of view of the possible effects of the project on the environment. Whether an EIA is required or not depends on the conclusion of the environmental evaluation on the one hand, and on the decision of the Impact Studies Bureau on the other hand. As established in the decree, an EIA can be required by the Direction of Environment on a case by case basis without consideration of the requirements put in the appendix of the decree.

1.2 Environmental Conditions

1.2.1 Classified Forest of Rapides Grah

(1) The System of Classified Forest in Côte d'Ivoire

Classified forests belong with the protected areas of the so-called permanent state forestry domain. In total, classified forests cover 2,300,000ha, which are 41% of the total state forestry domain (5.6 millions ha). The rate of illegal occupation of the forestry domain by plantations and crops is between 30 and 60% of surface area. It is estimated that about 450,000 persons are established inside the classified forests (72,000 households) for 650,000ha of plantations (coffee and cocoa). This is the background of the development policy of classified forests that has been initiated by the government starting in 1990. The development of classified forests is based upon the objectives of rehabilitating the forest following priorities set according to local conditions. These priorities are classified into geographical areas called series: Series of production (reforestation and natural forest), series of protection, and agricultural series. The later had initially the purpose of providing time to the people for their resettlement in the rural domain. It was unexpected that this system would on the contrary lead to a kind of demographic overflow and continuous land clearing in other series.

It seems that the present policy of classified forests is to follow the following principles:

- Stopping the current land clearance;
- Destroying all the non productive plantations;
- Providing a transitory period in order to make feasible the resettlement of people outside the forest, while agricultural series are maintained for the time being;
- Resettling the cultivators on sites developed outside the forest;
- Reforestation of the recovered land.

The concept of agricultural series is changing and is going to result into the new concept of enclave, with the idea that population settled in such enclaves could definitively stay there in compensation of the evacuation from the series.

(2) Description of the Classified Forest of Rapides Grah

The Rapid Grah classified forest lies between the San Pédro plain and the National Park of Taï, which is classified as world natural patrimony by UNESCO since 1982. The forest of Taï is the last example of natural tropical forest covering an important surface area in West Africa, and it is a refuge for several endemic species of fauna and flora that are specific to the Guinean forest domain.

The Rapides Grah forest is separated from the Taï forest by a protection buffer zone since 1977, with a special status of partial reserve of fauna. Important species of fauna are still living in some parts of the Rapides Grah forest.

The forest has been classified in 1973, with successive extensions to reach a total surface area of 315,000ha, which is 13.6% of the total surface area of classified forest in Côte d'Ivoire. The Rapides Grah forest is the largest classified forest of the country, far beyond the average surface area. The SODEFOR center of Gagnoa and more specifically its division of San Pédro is in charge of its management.

(3) Environmental Conditions

The forest of Rapides Grah belongs to the swampy forest sector, but is seriously degraded by human occupation and cultivation. A total of 18 villages and about a thousand of dispersed camps can be found there. The population reaches about 145,000 persons. The cultivated area is about 160,000ha (half the total forest cover), with 10% only in food crops (paddy, maize, manioc, banana, yam, taro), and 10% in fallow land. The remaining 80% are agro-industrial production, especially cocoa cultivation. One third of the settled population is native, and cultivates only 4% of the cultivated land, mainly following the method of shifting cultivation with fallow land.

This intense demographic pressure inside the forest has been induced as soon as in 1975 with the establishment of the San Pédro port and development of the wood production industry. People previously employed in this industry have settled first and have favoured an immigration movement of population from center and north regions of Côte d'Ivoire between 1983 and 1987, within a context of climatic drought.

(4) Development Plan

In order to rehabilitate the forest, SODEFOR has started studies in 1993 and presented a management plan in 1996, which was adopted in 1997 by ministerial decision. However, this plan is presently under review by MINAGRA.

The decision stipulates that objectives of the development plan are:

- Production of timber within the limits of the capacity of renewal;
- Establishment of plantations for production of paper paste
- Protection of the buffer zone of the national park of Taï.

Any modification of the plan must be done with authorization of the minister in charge of water and forest under proposition of SODEFOR and with consultation of the DGEF.

The plan has defined several objectives with the following distribution: Protection (61,386ha), reforestation for production (118,440ha), natural forest for production (86,675ha), and cultivated land (48,500ha). The protection areas have been defined as being:

- a buffer zone all along the national park of Taï;

- a 300m large zone of riverside along the San Pédro river and the Nero river;
- a 200m large zone of riverside along other rivers (Hana, Kré, Go rivers).

SODEFOR has estimated that there are about 16,000 households illegally settled in the forest, employing more than 20,000 persons. In total, this represents 145,000 persons to relocate. Among them, there are a lot of people that are native. The application of the objectives of the development plan is intertwined with the execution of national objectives such as a clear definition of land ownership and the setting of a policy of intensive agricultural development.

(5) Resettlement of People

Since 1993, the management of classified forest has been based on the idea of co-management with the local population through the so-called farmers - forests commissions (CPF). However, the present situation is that deforestation has still progressed during this period, while the objective of resettlement of people has almost not been executed. The present approach of the problem of resettling people is indicated by the various forms of human occupation inside the classified forests:

- People who have been affected by public development projects in their own area and have been relocated in the classified;
- People who have occupied the land before establishment of the classified forest status;
- Illicit settlers who, according to the forestry law, should be resettled outside the classified forest.

All these typical cases can be found in the classified forest of Rapides Grah.

(6) Present Performances in Executing the Plan

The management plan provides several kinds of rehabilitation measures, mainly reforestation and resettlement the people illegally settled in the protection series. However, reforestation program is beyond the capacity of SODEFOR, as SODEFOR itself recognises (annual reforestation is about 500ha while the plan requires 5000ha).

Implementation of the plan has started in 1997 but it found so much opposition of the settlers that it was necessary to stop its execution. In addition, the plan does not provide clear measures for resettlement. Some people have been however relocated during this time, generally in the cultivation series, like in Kremoué or Ouaté for example. In that case, cultivators move their homes but they keep the use of the plantations outside. People complain that SODEFOR actions are not made in due coordination with the people involved, and without information or public awareness. Moreover, villagers that have been resettled in the enclaves did not receive any kind of compensation or arrangement.

Actually, SODEFOR maintains pressure on the illegal settlers to avoid a probable further extension of land clearance in the forest. Progress in the execution of the development plan is now determined by the process of revising and agreement of the plan by MINAGRA.

1.2.2 Hunting and Cynegetic Resources

(1) Background

In Côte d'Ivoire, the consumption of bush meat in 1996, has been estimated to reach the amount of 35.5 million heads, for a value of about 80 billion FCFA (production price). If the marketed volume of these products is integrated in the estimates, the total value reaches 100 billion FCFA. The consumption average is 8kg/year/inhabitant. In terms of economic value, the most important species are Cane Rats, Duikers, Antelopes, and also Porcupines. These estimates do not include birds and reptiles, neither the collection of snails. Only the later was however representing an amount of about 8000 tons in 1986, and it is considered to be similar today.

There is no clear estimate of the use of hunted animals, but self-consumption could be about 80%, the remaining going to supply restaurants specialized in bush meat (called maquis). The most preferred bush meat in maquis, is supplied by hunting of the following animals: Cane Rat, Brush Tailed Porcupine, Long Tailed Pangolin, Giant Rat of Emin, and Blue Duiker.

(2) Hunting Activity

Hunting is a common activity in the Study Area. The hunting techniques use mainly the snare and the hunting gun. In the villages, it may be possible to find a cultivator-hunter in each household. However, there are also cases of households with no hunter, and cases of hunters with experience. Experienced hunters are cultivators spending time for hunting and having their hunting territories sometimes far away from their habitation. Basically, the hunting territory is all around the village. Accordingly, the hunting game species generally correspond to those animal species that can easily adapt to an environment modified by people. Hunting is practised all round the year, with a peak of activity in the rainy season.

Hunting is obviously an important activity for people living in the Study Area. Hunting games, as well as products like snails for example, are a major source of proteins in the daily diet of people. The catch of a *Varanus* can provide protein food for the family during three days. One Cane Rat, putting aside its gastronomic aspect, can supply a household in meat food for one week. Small catches like rats or squirrels can be used as ingredients for the cooking of sauce.

Hunting seems to be also not negligible in terms of additional revenue by the sale of hunting game. However, the number of hunters who can get such revenue seems limited because self-consumption is the first priority. The sale of hunting games generally involves that several preliminary conditions that can hardly be met by the hunters of the Study Area have been gathered:

- Having a large hunting territory, and generally including the Monogaga forest;
- Having satisfied its own needs in bush meat;
- Having the financial capacity to buy the necessary gun cartridge for hunting, and which costs about F.CFA 500 each.

The price value of hunting game as practised by the hunters is presented in the table below. The source of information is given by the hunters of Petit Pédro village. These values are higher than

those estimated by the preliminary study report of DPN on hunting in Côte d'Ivoire. This can be due to local factors like the high price of the San Pédro market, and possibly to the under-estimates in the DPN study.

The hunting activity is then variable according to the households in the same village, and according to the villages in the same Study Area. Villages that are lying along the national road on the eastern side of the Study Area have an easier access to the Monogaga forest, which could explain the presence of experienced hunters there. Villages lying in the northern part of the Study Area are more dependent on hunting than those in the south. This difference can be partly explained by the more or less availability of hunting game within the territory of the village. For example, at Lassinakro there is no fish, and bush meat is a subsistence food for the inhabitants.

Estimated Price by Head of Hunting Game at Petit Pédro Village

| Animal species (hunting game) | Estimated unit price (FCFA) |
|----------------------------------|--------------------------------|
| crocodile | 3,500 |
| varanus | 5,000 |
| cane rat | 9,000 |
| hedgehog | 3,000 |
| rat | 500 |
| monkey | 6,000 |
| squirrel | 300 |
| civet | 12,000 |
| duiker | 8,000 |
| chimpanzee | 15,000 |

Source: JICA study team

(3) Hunting Territories

Hunting territories can be distinguished according to the categories of hunters:

- Hunting around the villages by villagers themselves, mainly for self-consumption.
- Hunting by villagers of the Study Area in the territory of Monogaga forest. This forest is still a refuge for several species that are appreciated as hunting game. The Study Area cannot ensure the supply of hunting game for commercial purpose, excepted for species like the Cane Rat.
- Hunting by people living in San Pédro within the territory of the Study Area. Hunters come 1 or 2 times per 15 days in the Cité Agricole Rice Project Area for hunting cane rats. They are organized in-groups of 8 to 10 persons with dogs. Local cultivators find it rather convenient since Cane Rat is a harmful species causing damages in the paddy fields. People also come from San Pédro to fish crawfish in the San Pédro river.
- Seasonal hunting by outside hunters: There are groups of experimented hunters, like Liberian hunters, who come in the Cité Agricole Rice Project Area to hunt ducks.

Surprisingly, the classified forest of Rapides Grah does not appear as a territory more valuable than that of the Study Area for hunting game. Hunters of the Scaf village, which belongs both to the Study Area and the classified forest, is apparently more dependents on the cynegetic resources of the Study Area than those of the classified forest itself. There are 3 reasons that could be given here:

First, because hunting game is present enough in the Study Area; second, because hunting is more subject to supervision by the authorities in the classified forest than it can be in the rural domain; finally, because there is already a hunting population established in the classified forest.

(4) Fauna and Hunting Game

The general observation is that villages are more or less depending on fishes or meat for the diet, hunting game is more or less abundant, and the frequency of species differ according to areas. These differences are both cultural and geographical. In the consumption of meat, there are also various behaviour depending on religion, taboo, customs and availability of hunting game, or personal reasons. However most of the species are generally consumed. All the animals present in the Study Area have adapted to the cultivation mixed environment. The crocodile moves between the river and the swamps during the rainy season. The Cane Rat lives moving between paddy fields and forest or bush.

Buffalo can cause damages in the paddy fields and the banana fields. Such damages have been cited at Cité Agricole, Lassinakro, and Cpt Bernard. It seems that such damages are not very important, but farmers do not receive any compensation. Buffalo is not hunted because it is a protected species and because its hunting necessitates a special experience.

The table below shows the fauna species that provide hunting game in the villages of the Study Area. This information has been collected through interviews in the villages of the Study Area, generally with the chiefs of the villages and hunters. Only 4 villages are represented in this table. In this table, occasional catches mean approximately 1 to 5 catches per year. Hunters have frequently mentioned does and gazelles as hunting game. These species have been interpreted as Duiker species. It is possible however that they include the Water Chevrotain or other species not identified.

(5) Example of Cité Agricole Village

At Cité Agricole village, fish and crawfish could constitute approximately 90% of the average daily diet in wild animal products during the rainy season. Within 10 households, maybe 8 practice fishing, mainly in lowland swamps or irrigation drains, and rarely at the San Pedro river.

From the point of view of the importance of wild animal products in the diet, fish is followed by Varanus and Cane Rat (about 15%) and then Snails (5%). Other products are small Monkeys for example, but they remain special meals. Occasional bush meat (1 time or more per year) is supplied by animals like Swamp Crocodiles, Porcupines that look for food in manioc fields, and Hedgehogs. Python is eaten 2 or 3 times per year. Birds and especially pigeons are killed to protect the crops and for their meat. Frogs and Squirrels are also an important source of food in this village. There are also hunting and poaching catches from larger hunting territories that provide other kinds of bush meat like meat of Bushbuck, Duikers, and even possibly Chimpanzee for example.

**Checklist of Species Hunted in Cité Agricole, Petit Pédro, Grand Gabo,
Lassinakro and Polo Villages**

| | Catches hunting game, fishing catches, collection of snails | Comments |
|---------------------------------|--|--|
| Cité Agricole (Campus I and II) | Frequent catches: cane rat, varanus, crawfish, frog, fish, snails (Campus I) Occasional catches: duiker, civet, python, porcupine, hedgehog, squirrel | Fish is important in the daily diet; hunting game remains secondary; there are outside groups of hunters for hunting Cane Rat and ducks. There is no snail in Campus II. |
| Petit Pédro | Most frequent catches include cane rat, hedgehog, squirrel, porcupine, snail Less frequent are duiker, varanus, civet, monkey, viper, python, crocodile Frequent birds catches are kalao, hornbill, toukan, pigeon | Since there are hunters going to Monogaga, hunting game seems to include also species like chimpanzee, bush pig, pangolin, and probably giant forest hog. |
| Grand Gabo | cane rat, monkey, rat, duiker, squirrel, crocodile, varanus | Caiman is also mentioned, but it could be species of crocodile. |
| Lassinakro | Cane rat, monkey, rat, porcupine, squirrel, mongoose, duiker, pangolin, crocodile, varanus, hedgehog, snails Birds include kalao, toukan, pigeons | Villagers of Lassinakro are strongly dependent of hunting game for protein food; bush pig is not hunted because of Moslem customs. |
| Polo | Fish and crawfish | The river is rich in fishery resources. There is no hunting at Polo. |

Source: JICA Study Team

1.2.3 Fishing and Fishery Resources

(1) Subsistence Fishing

Subsistence fishing is practised by villagers in small rivers and swamps. They rarely go to fish in the San Pédro river. The people established in the Study Area, even including most of the Kroumen who were known for their tradition of navigators, have not the necessary know-how for fishing. It is then a paradox to see that these people living near the San Pédro river do not take advantage of its fish resources.

Subsistence fishing can be classified in 3 types:

- Fishing in swamps and small rivers, especially after flooding (Cpt Bernard, Cité Agricole)
- Fishing in irrigation drains (Cité Agricole);
- Fishing in the San Pédro river (mainly Polo).

At Grand Gabo, fishing is an activity, which only aims at self-consumption. At Polo, fishing is practised both for self-consumption and for sale too. The fishermen of Polo take advantage of having a rich and diversified fish resource during the rainy season. Fishermen sell the fish that they have caught on the local San Pédro market.

Fishing techniques include fillet fishing, hook fishing, hoop net fishing, and hand fishing. Hand fishing is generally practised by children or women.

(2) Commercial Fishing

Commercial fishing is practised in the Fahé dam reservoir and the San Pédro river by several Malien ethnic groups permanently or temporarily established in San Pédro and Fahé. The fishing territory of the fishermen of Fahé is the dam reservoir of Fahé. The fishing territory of the Malien fishermen of San Pédro includes the San Pédro river and the lake of San Pédro city, although fishing in this lake has been prohibited by the municipality. Prohibition is a sanitary measure because of contamination by the wastewater of the San-Pédro hospital that is discharged into the lake without treatment. There are about 100 fishermen in Fahé, of which 45 are permanent, and who exclusively live of their fishing activity.

There is a permanent potential conflict between these Malien fishermen and the inhabitants, who have no fishing tradition. It seems that the fishing catches are often made without consideration of the requirement to meet the size criteria of fishes, which constitutes a cause of degradation of the available resource. It is probable that this practice is largely accentuated by the seasonal fishermen, who do not care about the sustainability of their practice.

There is no recorded data about fishing in the San Pédro river. Existing data pertains to the dam reservoir of Fahé only (see Table below).

Data of Fishing Activity in Fahé

| Year | 1996 | 1997 |
|---------------------|------|------|
| Number of fishermen | 101 | 99 |
| Number of pirogues | 88 | 76 |
| Number of filets | 186 | 189 |

Source: San Pédro Office of Pisciculture and Fishing

(3) Fishery Resource

The economic value and quantity of fishing catches in Fahé have been recorded for 1997 as it is shown in the Table below. There is no estimate for the fishing catches made in the San Pédro river, but they are certainly below those made at Fahé. In addition, the fishermen who operate in the San Pédro river are not organized, and their number is limited.

Annual Catches of Fish in Fahé in 1997

| Fish | Tons | FCFA (unit: thousand) |
|-------------------|--------|-----------------------|
| Tilapia | 75,6 | 37802 |
| Chryshistis | 75,9 | 37991 |
| Papyrocranus afer | 0,3 | 151 |
| Heterobrancus | 0,18 | 55 |
| Eutropus | 0,5 | 261 |
| Gnatoneirus | 0,4 | 121 |
| Crawfish | 4,4 | 4427 |
| Various species | 33,7 | 11955 |
| Total | 115,38 | 92763 |

Source: San Pédro Office of Pisciculture and Fishing

(4) Issues

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

- It is a source of revenue for 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 is a favourite dish in the San Pédro restaurants. This confers a specific value to continental fishing, although it is quantitatively negligible in comparison with sea fishing.

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 strengthens the feeling of despoilment of the resource.

Basically, the problems to be solved are:

- Seasonal fishermen do not care about the sustainability of the resources, at the difference of the permanent fishermen, who can manage the activity in a sustainable manner. Then, the fishing rights of the permanent professional fishermen should be given priority about those of the seasonal professional fishermen;
- The effective enforcement of the fishing law is necessary in order to preserve the regional halieutic resources.

1.2.4 Water Borne Diseases

(1) Water Borne Diseases

Those diseases that cause serious threat in the Study Area are the malaria and the Buruli Ulcer. Both these diseases are in principle related to the presence of water in the living environment.

The Sanitary District of San Pédro has summarised the available data about water borne diseases at the hospital center of San Pédro. These data have been summarised in the following table.

Number of patients having received health care in the District of San Pédro and by type of disease: Diarrhea, Guinean worm, Malaria (1995/1996), and Schistosomiasis (1996/1997)

| | Total population | Diarrhea | Guinean worm | Malaria | Schistosomiasis |
|--|------------------|----------|--------------|---------|-----------------|
| Number of cases | 146,952 | 3,405 | 6 | 17,103 | 63 |
| % of total cases at the San Pédro hospital | 41% | 50% | 50% | 57% | 63% |

Source: Direction Départementale de San Pédro, District Sanitaire

(2) Ulcer of Buruli

The Ulcer of Buruli disease belongs to the tropical diseases that have recently emerged (about 15 years ago) and seems to be associated with tropical humid environment. According to the present knowledge, the disease could be caused by a bacterium lurking mainly in hot and humid forest soil and developing well near dams and irrigated land, in the areas threatened by deforestation. The bacterium develops by destroying the skin and flesh of limbs.

It seems that the bug has infected 6000 people in Côte d'Ivoire. WHO set up a Global Buruli Initiative in 1998 in order to better fight with the disease. The Yamoussoukro conference held on July 7th, 1998 has resulted in the Yamoussoukro Declaration, which is targeting the identification and treatment of the disease as soon as it appears, at the earliest nodular stage, and specifically through awareness campaigns.

An investigation has been launched by the Sanitary District of San Pédro about the Buruli Ulcer in November 1997. This investigation has concerned 397 villages (274 villages, 123 camps), and 2 towns, mainly in the San Pédro department. The table below shows the results of this investigation for localities lying in the Study Area. The investigation has shown the following points:

- A total of 386 cases have been declared for the localities under investigation within the department of San Pédro;
- In about 79% of the cases, contact with water has been confirmed;
- The occurrence of the disease started in 1976 for San Pédro, but exploded in 1992 with an optimum in 1996 and 1997. During a 10 years period, about 60% of the cases have been recorded for the last 2 years only.
- Mortality rate for those with the disease is about 7,7%.
- The patients who recovered but remained with handicapping after effects of the disease represent 20% of their total number.

During the interviews made by the JICA Study Team in villages in August 1998, some additional data have been collected about the Buruli Ulcer. It appears that the number of declared cases of the disease at the Cité Agricole has reached 56 persons, of which 11 died, which is more than the estimate of the Sanitary District. Furthermore, in Cité Agricole, the disease, which emerged first in 1989, has not been recorded since 1996, without understanding the reason of such change. The Cité Agricole village has been obviously more concerned with this disease, in comparison with the population. At Lassinakro, there could have been 6 cases starting in 1997, one in grand Gabo, and two in Campement Colonel.

Number of Recorded Cases of Ulcer of Buruli Disease in the Study Area Until 1997

| | (1) Total number of cases (sanitation study) | (2) number of cases for thousand persons |
|-------------------|--|--|
| San Pedro city | 23 | 0,1 |
| Scaf | 45 | 14 |
| Cité Agricole | 41 | 91 |
| Campement Bernard | 33 | 12 |
| Petit Pedro | 7 | 4 |
| Fahé | 34 | 32 |

Source: (1) Sanitary District of San Pedro; (2) according to the population data of the JICA Study Team

1.3 Environmental Assessment

1.3.1 Project Components and Site Description

Description of the Project components and of the site of the Project is the first steps of evaluation of the effects of the Project on the environment as shown in the following four tables:

- Review of the Project Components;
- Environmental Conditions According to the Geographical Components of the Project;
- Environmental Conditions According to the Main Environmental Components of the Study Area;
- Summary of the Environmental Conditions and their Relevance for the Project.

The last Table is a summary of the environmental conditions in relationship with the components that do or do not belong to the Project definition. This review is useful in order to make clear that there are environmental components of the environmental study of the Project that belong to the Study Area but are outside the Project Area itself, while there are environmental components that are not induced by the Project itself but are taken into account as components of the Master plan study.

Review of the Project Components

| Project Component | Study Area (rural development project) | Project area (Components specific to the rehabilitation project) |
|--|---|---|
| Agricultural development by a) irrigated paddy land, b) intensified and more appropriate use of upland crops | Irrigation area of Fahé (430ha) Irrigation area of Cpt. Colonel (130ha) Irrigation area of Cité Agricole (920ha) | Irrigation area of Cité Agricole (920ha) |
| Drainage system | Cross drainage structures to ensure water runoff on both sides of the Grand Canal between San Pédro river and watersheds; facilities to protect irrigation area against flood | Drainage system to contain high water runoff of the Gonou watershed outside the irrigation area through establishment of 4 dikes and several flap gates; |
| Grand Canal Access / maintenance road | North-south irrigation water canal together with rural road(19km) | North-south irrigation water canal and rural road (19km) |
| Population settlement | Expected population of more than 3000 persons in total at the stage of full implementation of the project; | Expected population of more than 2000 persons at the stage of implementation of the Project; Human settlements to be newly established near Cité Agricole Transfer of population from surrounding area and from the Rapides Grah forest |
| Social development | not specified | Rural water supply Social and sanitary improvement |

Environmental Conditions According to the Geographical Components of the Project

| | Natural environment | Social environment | Environmental stress |
|--|---|--|--|
| Project component: Grand canal lying area | Along its 19km length, the Grand canal cuts through crop fields, pieces of forest, swamps. Large extension of flood prone areas; Most significant natural areas lie between Grand Gabo and Campement colonel. Existence of isolated big kapok trees on the line of planned Grand canal | Scattered settlements, crop fields | illegal hunting loss of natural habitats loss of animal species land clearance for crops |
| Project Area: Irrigation area of Cité Agricole | This area has already been developed for prior irrigation project; Forest is 0% of the area; no natural environment is drains which are partly natural and the San Pédro river | 59 established households Livelihood partly based on wild resources like fuelwood and bush meat, but actually more dependant on the San Pédro market; General low level of quality of life and revenue; Large extension of unused lowland inherited from the previous paddy project | Bad quality of well water; Health damages due to Ulcer of Buruli and malaria, and others; Shortage of fuelwood; shortage of traditional resources due to the loss of wildlife habitat |
| Study Area: Irrigation area of Cpt Colonel | Presence of forest (42% of the area, 55ha) which is a refuge for species, especially the forest unit of 26ha on north | Major settlement Livelihood strongly dependant on wild resources | land clearance for crops; loss of natural habitats |
| Study Area: Irrigation area of Fahé | This area is almost cultivated, but there are 14 small pieces of forest totalling 62ha (= 14% of the area), all related to watercourses or stagnant water; the larger forest area is 13,8ha, while the smallest is 0,6ha; | Important population at Scaf and Fahé Actual extension of the rubber plantations in the plain area; | Illegal hunting and poaching; Loss of animal species |

Environmental Conditions According to the Main Environmental Components
of the Study Area (1/2)

| | Present conditions | Environmental value | Issues |
|------------------|---|---|---|
| Natural lowlands | Various states of degradation of swamps, but average size of swampy forest is larger than upland forest average (60ha once Idefor forest has been considered apart); remains along San Pedro river; | Refuge for wildlife Habitat for valuable species Fishing resource for local consumption of fish | Lowlands are actually reconsidered by the people as suitable places for paddy cultivation and pisciculture; they are also sites having an environmental value within the Study area; |
| San Pedro river | River hydrology is determined by the upstream dam and changing land use conditions of watershed; There is a dynamic of water exchange between the river and swamps through natural channels; Stagnant water pattern during drought season downstream due to the sand at the estuary; | Impoverished fishery due to overcatch; role of refuge of the river banks because generally lying outside the traffic zone and presence of forest pieces; San Pedro river zone seems to be more valuable for wildlife than outside zones, specially for species like monkeys and chimpanzee that are sensitive to disturbance; | Overfishing without control; already advanced clearance of river banks for crop fields; erosion of banks; |
| Idefor Forest | Characterized by its large extension (about 600ha) in contrast with the general landscape of the study area, which is made of very small pieces of woods; is made of swampy and hilly forest together; | The forest is not primary, but there are wild animal species that find refuge here, of which valuable ones like chimpanzee. | Land clearance by the people; Intensive hunting; Forest development policy of IDESSA |
| Wildlife | Various species of wildlife remain of which very valuable ones (see below) but only species able to adapt to the rural environment are still common; | There are species belonging to the first and second priority classes of protection according to the hunting law (see below); Wildlife contributes to the livelihood of people and local economy (bush meat); Local fisheries of swamps contribute to supply food for the villagers; | Trends of extinction of species within the area due to human pressures (land clearance, noise, hunting and poaching); Also conflicting aspects between farmers and animals that feed the crops (cane rat and duiker, bushduck, buffalo); |

**Environmental Conditions According to the Main Environmental Components
of the Study Area (2/2)**

| | Present conditions | Environmental value | Issues |
|-------------------|---|--|--|
| Human settlements | Overall presence of scattered traditional human settlements; modern village of Cité Agricole with 59 households living there, and 26 households having only the fields; | Low availability of local natural resources that are traditionally used for sustaining livelihood, in the village of Cité Agricole. Unproductive and impoverished land as a result of failure of the previous paddy irrigation project; | Health problems: Ulcer of Buruli; endemic malaria with trends of increased serious cases; Extensive use of pesticides for cocoa and paddy, and cases of intoxication because of inappropriate handling; Potential friction for the use or ownership of land in relationship with new values induced by the project like introducing newcomers, developing lowlands, intensifying land use; Potential shortage of resources; |

Summary of the Environmental Conditions and their Relevance for the Project

| Relation to the Project | Project Components | Study Area | Project Area |
|---|--|--|--|
| The Project (of rehabilitation of the paddy cultivation project of San Pedro) | Irrigation area of Cité Agricole (The Project) | | health conditions potable water quality agricultural practice lack of fuelwood and traditional resources contaminated water insufficient sanitary infrastructure poverty |
| | Grand Canal | Swamp forest lying between Grand Gabo and Campement Colonel Water runoff San Pedro river bank illegal hunting loss of natural habitats loss of animal species land clearance for crops | |
| Outside the Project (but inside the whole project area as given in the Master plan) | Irrigation areas of Cpt. Colonel and Fahé | Plain forest lying Southwest of Cpt. Colonel | |

1.3.2 Natural conditions of the Study and Project Areas

Description of the present conditions of the environment in the Study and Project areas aim at defining the quality level of the existing environment, which is a basic condition for understanding the relative importance of the effects induced by the project. Such description has already been provided within the scope of the Master plan study. The following is more specifically focusing on the most relevant aspects, those components of the natural environment that are both valuable and liable to possible effects of the project of rural development. They are the lowland forest (swamps), the San Pedro river, and wildlife.

(1) Lowland forest

Description of the upland and lowland forest area in the Study area is provided in the Table below. In this Table, lowland forest is divided into plain forest and swampy forest in order to make a distinction between large areas of swamps in morphological depressions and isolated roparian forest remaining generally along the water. In this table, the San Pedro riverside forest is any forest area that has one of its sides lying along the San Pedro river. Idefor forest is considered separately first because it is the only remaining large forest in this area, including both upland and swamp forest, and second because this forest is property of the ex-IDEFOR (actually IDESSA). The location and extension of the Idefor forest block as it is defined for this study is put on the Map Figure attached below.

The table below shows that:

- Forest cover is about 25% of the Study area, the remaining 75% being almost cultivated. If the Idefor forest area is put aside from this calculation, the rate is less than 20%.
- San Pedro riverside forest is 9% of the total forest cover, which is relatively low;
- Lowland forest is less extensive than upland forest in total.

However, while pieces of upland forest are on average very small (mosaic forest), those of lowland forest, especially swamps, are larger (more than 60ha on average). This means that lowland forest is more liable to have environmental value since extension area is a condition to preserve wildlife habitats. Furthermore, while upland forest is in an irreversible process of extinction for cultivation of upland, lowland forest is more liable to remain outside such influence. However, lowland forest has been also strongly affected by human pressure, which explains that only narrow corridors remain along watercourses, while in larger swamps there are various disturbances like hunting and burning. Swamps have more or less remained in the landscape outside the land clearance dynamics that presently works in the area for all uplands. Lowland forest is in most cases a reconstituted or degraded forest, as shows the presence of *Raphia* trees.

Swampy forest is constituted of typical tree species with predominantly *Raphia* species, *Mitragyna ciliata*, and *Symphonia globulifera*. Vegetation cover is an indication of the ecological quality of swamps. Swamps are supposed to be exclusively ombrophile swampy forest in this area under natural conditions, but the humans have influenced so much the landscape during the last 3 decades that several kinds of inherited swamps can be distinguished:

- Grassy or bushy land in morphological depression, generally with small trees and periodical flooding; this type is the most degraded form of swamp, and almost concerns lowlands that have been used for pluvial paddy cultivation
- Inundated Raphia trees forest, where Raphia trees took benefit of light after land clearance to recolonize the depression. In this category can be found various situations, from the reconstituted forest to the forest regularly destroyed by fire.
- The inundated swampy mixed forest, constituted of Raphia for the lower canopy and Myragina species for the higher canopy. This type is the best condition of swampy forest in the area, but there are 2 sub-categories: large morphological depressions where water is stagnant, on the one hand, and linear water courses preserved from land clearance, where water is stagnant or slowly flowing to the San Pédro river.

Description of forest conditions in the Study Area

| | Upland forest mosaic | Idefor forest Block | Plain forest Mosaic 171 (of which 34 ha are also riverside forest) | Swampy Forest | San Pédro riverside forest | Total |
|------------------------|----------------------|---------------------|--|---------------|----------------------------|-------|
| Surface area (ha) | 1139 | 607 | | 415 | 241 | 2539 |
| % of total forest area | 45 | 24 | 6 | 16 | 9 | 100 |
| % of total Study area | 11,4 | 6 | 1,7 | 4,1 | 2,4 | 25,3 |

Note: Idefor forest bloc is defined as the large piece of forest that almost belongs to the Idefor's jurisdiction. It can be considered separately because it occupies a large territory and includes together upland and lowland forest. Limits of the so-called Idefor forest are given in the Map Figure attached.

The large lowland forest lying in morphological depressions represents the best conditions of natural forest remaining in the Study area, since land clearance has generally not been intensive. They are described in the Table below. However, there are several forms of human degradation: Farmers go inside for hunting, poaching and stubble burning of shifting cultivation has often caused forest fire outside of control.

The San Pédro river, plain forest and swampy forest are all belonging to the same system of aquatic environment. For example the largest swamp in the area, lying in the north east side at Lassinakro, is connected with the San Pédro river through an almost permanent water course where lies a corridor type plain forest. The swamp of Escabé south, which is on the left bank of the San Pédro river, is connected with the river through 2 natural channels, one of them being specially important considering its size. It is about 3 meters entailed in the soil and its bottom is 2 meters higher than the San Pédro river flow when it runs into the San Pedro river, during the drought season. This channel typically ensures the exchange of water between river and swamp, mainly from the river to the swamp as shows the morphological context, and secondarily from swamp to the river. There are cases where the hydrological link between San Pédro river and swamp is not clear if any, like for the swamp of Zilekro.

Swamps need special consideration since they might have various environmental functions:

- Stagnant water and absence of sun light under canopy provide very specific living conditions for the aquatic species, which are typically represented by the species of "black fishes"

(*Polypterus*, *Paraphiocephalus Obscurus*). These fishes are not very appreciated by the people as food, and consequently have a low economic value. However they have the advantage of being locally available fisheries for villagers who generally have no experience of fishery in river. These species of fish provide seasonal food (drought season). From ecological viewpoint, these species are those adapted to the specific ecological conditions swamps, characterized by the low oxygen waters.

- There are valuable species that largely depend on such habitat for survival, like swamps crocodiles (first class protection), pythons (second class protection), and Nil varanus. However, due to the combined effects of hunting and firing, these species are no more common;
- Well preserved swampy forest with full canopy are habitats for a large variety of local birds. However, these swamps do not appear as having a priority value for the avifaune, as this is often considered to be the case for wetlands.
- Swamps seem to be also a pool of organic matter that will feed fishes during high water in rainy season. This function is more likely to occur for swamps directly linked with the San Pédro river. From this point of view, the aquatic life of the San Pedro river could be in high dependency of swamps. Then it seems that swamps are supplying planctonic food to the fish species of the San Pédro river through its water with very high concentration of organic matters, and then play a major role in the whole food chain of the San Pédro aquatic life.
- Swamps have also several additional functions like absorption and regulation of flooding, maintenance of a minimum flow in San Pédro river, supply of fish food during the drought season, supply of papo leaves for housing, capacity of assimilating agro-chemicals that are used uplands before discharge into the San Pédro river.

Description of the Swampy Forest Conditions in the Study Area

| Designation and area in ha | Total surface (ha) and water runoff characteristics | Type and environmental conditions | Environmental State |
|------------------------------------|---|--|---|
| 1. Lassinakro 148ha | Water runoff toward the San Pédro river | Mixed raphia (low canopy) and mitragyna | Habitat for birds and wildlife; refuge for species; pool of nutriments for the San Pédro fisheries; |
| 2. Zilekro 132ha | Water runoff pattern unknown | Mainly Raphia | Devastated by fire 2 times during the 3 last years; landscape of dead raphia trees mixed with new small trees; poor wildlife; |
| 3. Escabé south 26ha | Alternatively: water runoff toward San Pédro river (small catchment area) and flooding from San Pédro river through 2 natural chanel; | Mainly Raphia | Habitat for wildlife; refuge for species; pool of nutriments for the San Pédro fisheries; |
| 4. Escabé north 19ha | Same as above | Mainly mitragyna | Wildlife habitat; |
| 5. Central swamps 16ha and 73ha | Water runoff pattern unknown | The smallest one is predominantly raphia forest The biggest is mixed forest; | Habitat for birds; Partly degraded into bushy land (flooding area); |
| Grand Gabo 70ha | This swamp lies on east of the Project area in the Gonou watershed; Regularly flooded during the rainy season | Large area of grassy land and raphia forest with permanent water along the hills | This swamp has been entirely cleared of in the 80ties for pluvial paddy cultivation and burned several times; |

(2) San Pedro River

The environmentally significant features of the San Pedro river are:

- The presence of meanders that work as swamps during the dry season; It is observed that these meanders have functions similar to other swamps as habitats and production of nutrients for aquatic life. There is a punctual invasion of water lettuce in these habitats;
- The double dynamics of sedimentation / erosion in convex / concave banks respectively; It is observed that land clearance for crops on riverbanks is accentuating this dynamics;
- The regular natural closing of the river mouth by sea silting, which give to the San Pedro river some lake like conditions; This situation results of local conditions: the oceanic current of Guinea involves the transfer of sand from west to east, and the present river mouth is directly exposed to silting action; The extraction of sand is accentuating this process of erosion, sedimentation all along the coast according to ocean current; the land clearance of watershed and the new patterns of hydraulics are factors of regular closing of river mouth.
- Most significant consequences of the later are: a) Flooding of the downstream area during dry season, leading to several types of nuisances: Rising of wastewater in latrines of urbanized lowland (Seweke and Bardot); Damage to crops riverside, increasing the risk of malaria and mosquito nuisance. b) Higher sensitivity to pollution discharge up-stream (pesticides, fertilizers) during dry season. There is no indication that this process could reach the site of municipal water withdrawal.

Since the downstream area of the San Pedro river belongs to the jurisdiction of the Autonomous Port, managing such problems should be done by this agency together with the municipality. However, there is no significant action taken. The Port agency has forbidden the extraction of sand at river mouth but there is no enforcement tool. Opening of the river mouth against flooding damages is entirely based on the spontaneous and voluntary action of the farmers.

(3) Wildlife

a) Statement of the Local Conditions

The following table is an attempt of classification of the valuable wildlife species that are or could be present in the Study Area. This table has been formulated based on the information obtained from the farmers and hunters crossed with the zoological conditions.

Local wildlife has dramatically decreased during the last decades with deforestation and increasing density of population. While there is a potential diversity of wildlife, specially mammals and reptiles, actual trends show the extinction of species within the Study Area. Monkeys and chimpanzee find refuge in the sites that still remain forested and outside human pressure, like the Idefor forest and the area lying along the San Pedro river, like the Cpt. Colonel forest. However, these places are now threatened by land clearance and hunting practice, and such animal species are not common. Species like Forest crocodile, Python, Varanus, Bongo, Civet are more specific to the presence of swamps and still live in the swampy forest, although this habitat is generally in various states of degradation. Forest crocodiles are now rare animals because of intensive hunting. Python is caught in order to protect domestic cattle and to provide valuable skin (which commerce is however restricted by

Washington convention) and even meat for the farmers. The buffalo is also strongly dependent on water, for drinking, and has a faculty to adapt to the rural environment. Then, farmers of villages along the San Pedro rivers often mention the occasional presence of buffalo, generally. Finally, species like Duikers, Bushduck, Cane rat are species that have a capacity to adapt to the rural environment and live in the Study area finding refuge in the mosaic forest and bush land.

As a result, one can say that the local wildlife species are strongly affected by the loss of forest habitat, the land use and human presence, together with uncontrolled hunting and poaching by the farmers. Present wildlife shows several signs of extinction, at the exception of species that have a capacity to adapt to the rural environment.

Wildlife survival actually depends on the presence of remaining forest refuges, which are very few, and strict control of the hunting practice. The remaining potential refuges are bushy land, upland and lowland forest. For species that do not strongly depend on water and easily adapt to the rural environment, upland forest can still provide refuge. On a whole, wildlife survival depends first on the swampy forest, and second on the site of Idefor forest as the ultimate refuge when swamp has been destroyed by fire, as this commonly occurs. This means that basically, present wildlife survival of the area almost depend on both the preservation of swampy forest and Idefor site forest.

Since wildlife has no more its own habitat for survival, it overlaps with human use of land and can appear as harmful species, leading to potential conflicts between farmers and animals. Examples are monkeys and squirrels looking for cocoa plantation, Buffalo for maize or paddy, Python for small cattle, Cane rat for paddy, and others.

b) Fish Species in the San Pedro River

The following table has been made from local information source (ANADER) and results of an inventory mentioned below. This inventory has identified 480 species among 528 that are known for the investigated rivers to which the San Pedro river belongs. It appears that 31 species are present in the San Pedro river compared with the 480 species mentioned in the inventory study. This number reaches 53 species when local information is added like shown in the Table. However, a certain number of species like *Tilapia Nilotis*, *Labeo*, *Eutropius Mentalis*, all *Mormyrops*, *Synodontis Occidentalis*, and *Auchenoglanis Occidentalis* have almost disappeared, according to ANADER.

Fauna Species (mammals and reptiles) in the Study Area According to the Classes of Protection set in the Appendix of the Hunting Law of Côte d'Ivoire

| | (1) Class I strict protection | (2) Class II Partial protection | (3) Class III almost no protection |
|---|--|--|--|
| Valuable species which presence is possible but improbable within the Study Area | Jentink Duiker Banded Duiker | Two-Spotted Palm Civet | Golden Cat African Wild Cat Greater White-nosed Monkey |
| Valuable species which presence has been confirmed or is probable within the Study Area | Royal Antelope Bongo Yellow Backed Duiker Diana Monkey Water Chevrotain Chimpanzee Western Red Colobus | Lesser Flying Squirrel Buffalo Mona Monkey Tree Pangolin Long Tailed Pangolin Bush Pig Honey Badger Seba Python Royal Python | Cane Rat Black Striped Duiker Red-flanked Duiker African Civet Tree Dassie Genet Bushbuck Dark Mongoose Egyptian Mongoose Slender Mongoose Banded Mongoose Pocupine Land turtles |
| Valuable species which presence has been confirmed or is probable in the Study Area but have not been mentioned in the hunting law | Spot nosed monkey | X | Nil varanus |

Source: Attached list of the Hunting Law of 16/8/94 amending the Law of 4/8/65 about the protection of fauna and practice of hunting

Checklist of the Fish Species of the San Pédro River (1/2)

| Fish Species | (A) according to local source | (B) according to the inventory study |
|-----------------------------|-------------------------------|--------------------------------------|
| Alestes | x | |
| Aphyosemion Walkeri | | x |
| Aplocheilichthys Normani | | x |
| Aplocheilichthys Rancurelli | | x |
| Aplocheilichthys Spilauchen | | x |
| Auchenoglanis Occidentalis | x | |
| Barbus Ablabes | | x |
| Barbus Bigomei | | x |
| Barbus Macrops | | x |
| Brycinus Imberi | | x |
| Brycinus Longipinnis | | x |
| Brycinus Macrolepidotus | | x |
| Chorophorus Lateristriga | | x |
| Chromidotilapia Guntheri | | x |
| Chrysichthys Maurus | | x |
| Chrysichthys Velifer | x | |
| Chrysichthys Walkeri | x | |
| Chrysichthys Nigrodigitatus | x | x |
| Clarias Ebriensis | | x |
| Clarias Lazera | x | |
| Clarias Senegalensis | x | |
| Ctenopoma Kingsleyae | | x |
| Eleotris Vittata | | x |
| Epiplatys Dagei | | x |
| Eutropius Mentalis | x | |
| Gnatonemes | x | |
| Hémichromis Bimaculatus | x | |
| Hemichromis Fasciatus | x | x |
| Hétérobranchus Isopterus | x | x |
| Hétérobranchus Longifilis | x | x |
| Labéo | x | |
| Lepidarchus Adonis | | x |

Checklist of the Fish Species of the San Pédro River (2/2)

| Species | | (A) according to local source | (B) according to the inventory study |
|---------------------------|-----|-------------------------------|--------------------------------------|
| Molapterurus Electricus | | x | |
| Micralestes Occidentalis | | | x |
| Mormyrops Deliciosus | | x | |
| Mormyrops Elongatus | | x | |
| Mormyrops Longicep | | x | |
| Mormyrops Rume | | x | |
| Papyrocranus Afer | D | x | x |
| Paraphiocephalus Obscurus | | x | |
| Parachanna Obscura | | | x |
| Pellonulla Leonensis | D | | x |
| Pellonulla Vorax | S/D | | x |
| Petrocephalus Bovei | | x | |
| Sarotherodon Melanotheron | S/D | | x |
| Schilbe Mandibularis | | | x |
| Schilbe Mystus | | x | |
| Synodontis | | | |
| Tilapia Zillii | | x | x |
| Tilapia Galifea | | x | |
| Tilapia Mariae | | | x |
| Tilapia Melanopleura | | x | |
| Tilapia Niloticus | | x | |

Source: (A) ANADER; (B) Article entitled Faune ichthyologique des eaux douces de l'Afrique de l'Ouest, Didier Paugy, Kassam, Traoré, Papa Samba Diouf, 1994 (symposium Paradi, Sénégal 1993);

c) Discussion

The importance of wildlife in the Study Area is ambiguous. On one side, one can say that wildlife should not be seen as being important from the viewpoint of biodiversity because of the advanced degradation and loss of natural habitats and species. On the other side, there are 2 reasons to underline the importance of this wildlife: One is the function of supplying the traditional needs of bush meat to the people, should it be directly (villagers) or indirectly (sold to the « maquis » of San Pédro city). The other is that there are quite valuable species from the standpoint of biodiversity, without consideration of the scarcity of these species in the area.

Both sides are seriously threatened because of human pressure. Then, the Project alone cannot be held responsible for the splitting up of the natural habitats. However, complete negligence of this wildlife issue would be in contradiction with the essential purpose of the project, which is upgrading people's quality of life and improving livelihood, which is also the final objective of the sustainability principle. Accordingly, the project should be at least an opportunity to improve the situation as regards to the wildlife preservation. There is a need to manage wildlife as a natural resource in balance with agricultural development, so that intensified agriculture should not be counteracting with the durable activity of hunting. There are 2 sides: a) Protection of habitats useful as refuges and also for species that depend on such habitats. This approach is almost impossible in the Study area but there is however potential for the large swampy forest that must be considered. b)

Protection of wildlife through control of hunting and poaching, and total protection of important species. This approach is quite possible for species adapted to rural environment and often providing bush meat, and could be useful for ecologically valuable species if the later condition of habitat preservation is effective. Implementation is however determined by the capacity to enforce the nature protection law in Côte d'Ivoire.

1.3.3 Main Sources of Impacts

Taking into account the components of the Project as well as the state of environmental quality as described above, it is possible to identify a set of major possible sources of impacts as related to the implementation of the Project. The following issues are possible sources of impacts considered for the study. They are relevant for the Study Area and the Project Area as well.

- Increased population established for paddy cultivation; Direct effects of such increase are higher pressure on local resources, shortage of locally available free resources like fuelwood, hunting products, fishing products, forest products, etc. Final effects are quality of life, life style pattern, and social cohesion. Pressure on land is also liable to occur leading to increased erosion, loss of biodiversity value, change of runoff pattern on the long term;
- Increased exposure to water borne diseases as a result of increased population, extensive use of water for paddy, existing endemism of malaria and presence of Ulcer of Buruli disease;
- New pattern of water availability and water allocation, new pattern of water flowing. Direct effects are water allocation conflicts at watershed level, and new pattern of flooding during rainy season, leading to final effects like crops damages, degradation of existing access;
- Use of pesticides;
- Discharge of used irrigation drainage water into river downstream, with organic matter and agrochemical substances;
- Social organising for water use and paddy production;
- Reclamation of forest and swamp forest;
- Construction of the Grand Canal and access road, and land levelling for the irrigation area;
- New pattern of access along the San Pedro river through the new road.

Among these issues, some are directly linked with the conditions of technical execution of the Project, like water allocation, appropriate drainage, social organization for paddy producing society etc. Others are more strictly relevant in terms of effects of the Project on the environment while not being necessary conditions for the technical execution of the Project. These are the use of pesticides, the use of local common resources, and the conditions of health. These sources of impacts are enlightened below, showing present conditions, potential change, capacity to manage, expected consequences.

1) Use of Pesticides

a) Present Use of Pesticides

Pesticides are used for cocoa plantations upland and paddy cultivation lowland. The main problems in relationship with pesticides are:

- Pesticides are often used without conformity with regulations. The case of Furadan, which is the most commonly used insecticide for paddy in the area (average use of 20kg per ha), is typical. The use of Furadan has been agreed as a soil disinfectant product in banana crops, with insecticide and nematicide actions. Furadan did not receive agreement for use in paddy cultivation.
- Recommended quantities are not respected due to the lack of awareness. Pesticides are also used for target crops different of those that justified agreement of the product, like for example the Cyprecal product, agreed for coton but also used by farmers for vegetables.
- Furadan is also commonly used for unacceptable purpose like poisoning of Cane rat, which is a potential way of intoxication to people who consume cane rat for food;
- There are also pesticides that did not receive any agreement but are still used for crops, caused by the absence of effective control of pesticides products available on the market.
- Application of pesticides is made without respecting the security conditions, which leads to common intoxication of people by inhalation, specially in the case of cocoa crops;

In the case of paddy cultivation, the following products are used in Côte d'Ivoire. Furadan is the most common product in the Study area for paddy. Furadan and Diazinon are examples of products used for paddy but not agreed for this purpose.

List of Insecticides and Herbicides Often Used for Paddy Cultivation in Côte d'Ivoire

| Insecticides | | Herbicides | |
|-------------------|-------------------------|--|-------------------------|
| Substance | Designation of Products | Substance | Designation of products |
| CARBARYL 50g /kg | Sevin 5% dust | PROPANIL 200g/l THIOBENCARBE 120g/l | Rical |
| CARBARYL 100g/kg | Sevin 10% dust | BUTRALINE | Amex Basagnan |
| CARBARYL 480g/l | Sevin sevimol 4 | AMINE | |
| CARBARYL 50g/kg | Sevin 5 G | GLYFOXATE | Ouragan |
| DIAZINON 600g/l | Sofudine | PARAQUAT | Gramoxone super |
| CARBOFURAN 10g/kg | Furadan 10G | OXADIAZON | |
| CARBOFURAN 480g/l | Furadan 4F | PROPANIL TRICLOPYBUTO- XY ETHYL | Gari EC |
| CARBOFURAN 5g/kg | Furadan 4G | OXADIAZON | Ronstar |
| CARBOSULFAN | Marshal | - | - |

b) Institutional Framework

Institutional organization for the protection of crops is organized in two jurisdictions, which are the Control of Imports and Exports on the one hand and the Protection of Crops on the other hand. The later deals with the policy of protection of crops and also with the control of products.

The San Pédro Office of control of pesticides is under jurisdiction of the Sub-directory of Control of Imports-Exports, this activity being induced by the port function of San Pédro. It employs 9 persons and 1 director. This office has no responsibility for the control of pesticides distributed on the market and their use. This responsibility is attributed to the Office of Protection of Crops. Unfortunately, while this office is officially present at San Pédro, it is not operational since there is no staff to fulfil its functions. Only the marketing side of the activities of this office, and more

specially the import-export of cocoa, is partly taken in charge by one person who belongs to the Sub-directory of Control of Imports-Exports. This person has very few opportunities to also deal with the control of products, since this responsibility covers all the territory of the department and needs specialized staff. It seems that there has been however few cases of seizure of non-authorized products and also withdrawal of the agreement for sale. There is never control as regards to the application of products on crops.

The institutional situation can be summarized as follows:

- There is no effective supervision of the agrochemical used in the area of San Pédro. It is the Office of Protection of Crops, within the Regional Directory of Agriculture, that should control the agrochemical products available on the market and their use. However, this office is not operational, because of lack of human resources.
- There is no guidelines about the use of pesticides that could be helpful for users. The JICA study team itself could not get any list of pesticides that have received agreement for the cultivation of paddy.
- On a whole, it can be said that while there is a good system of agreement of products, there is no measure taken in practice to respect and control use of pesticides. In such a context, the use of pesticides and specially an intensified agriculture appears as a major potential problem for the durability of the project.

c) Projects dealing with Pesticides Management

There is a project to improve the control of pesticides in Côte d'Ivoire with guidance of German experts. This project is however focusing on the effects of pesticides and on integrated pest management. These objectives are important and will provide solutions like:

- Financing the activities of follow-up and control of the effects of pesticides, based on the fiscal income;
- Establishing a national committee for integrated pest management, with objectives like coordination of various activities like planning, agricultural development, education, and follow-up;
- Establishing a national network of information about the follow-up of the effects (case of intoxication, analysis of residue in water, food).

The Integrated Pest Management Project has been launched in 1996 in Côte d'Ivoire for paddy cultivation at Sakasou, under guidance of the FAO. This program involves 17 technicians and 75 paddy producing farmers, for training in 8 paddy fields. The objectives of this project are: a) Promoting a sustainable agriculture with preservation of natural resources; b) Reducing the use of pesticides; c) Improving the yields of irrigated paddy. It is desirable that the experience done at Sakasou will be extended and improved in other areas like the Project Area. However, this approach should follow a more basic set of actions aiming at the management of presently used pesticides, as those described below.

d) Actions to be Taken

Large quantities of insecticides and herbicides are expected to be used for paddy production, which will put a potential threat on water quality during drought period or at beginning of the rainy season if not done properly. Then, measures to effectively apply existing regulations and to enforce the control of products used should be established in the area of San Pedro as background conditions for the implementation of the project. The principle of precaution should be applied to minimise such risk through the following measures:

- Use of pesticides in strict accordance with the agreement rules; this primarily means a drastic shift from Furadan product to paddy adapted products.
- Setting up the minimum institutional organization that can deal with guidance and control of agrochemical use; institutional needs are improving the coordination between the Direction of Agriculture and the ANADER, enforcing the actions of the Directory of Agriculture as regards to the pesticides matters, rehabilitating the Office of Protection of Crops together with the supervision staff.
- Observation and follow up of pesticides use, pesticides related health damages, and ultimately existing damages on water and aquatic life.

A basic requirement is the establishment of guidelines, with the following information for each product. In the absence of such guidelines at national level, the Direction of Agriculture should take initiative for regional purpose, in co-ordination with related agencies through the Project committee. Guideline must include the following information, especially those relating to the characterisation of products.

Information Needs for Pesticides Use Guidelines

| Characterization of the Products | Use Conditions |
|--|------------------------|
| Designation of products | Present use (quantity) |
| Chemical composition | Agreed quantity |
| Products characteristics and properties | Agreed type of use |
| OMS classification by danger (5 groups of danger) | |
| Ecological properties (biodegradable, toxicity) | |
| Risk for health and wildlife | |
| Existing evaluation of effects in CI | |

(2) Use of Natural Resources

a) Free Use of Natural Resources

Traditional resources include fuelwood, bush meat and fishery products, gathering (snails, plants), housing wood products (papo). These resources are far from being negligible and often constitute basic requirements for daily life while human pressure has generally resulted into more or less shortage of them. The question that is raised within the context of implementation of the project is to know if the area can sustain the new coming population or not for the daily needs of the established population, like those for fuelwood, bush meat, and even upland crops, which are not classified as natural resources but belong to the same kind of problematic.

Among these resources, fuelwood is the most basic one since it satisfies essential needs like cooking, heating and lighting, production of hot water for hygiene, and smoking of fish, which is an important activity of households for self-consumption.

Bush meat, including also fish, snails and crawfish, is the next type of resource in terms of priority needs. The supply of wood materials for housing (construction, regular maintenance of roof) is mainly ensured by Raphia trees of the swampy forest.

Wild plants collected for medical use are also important within the set of livelihood supporting resources, but the area of gathering plants for specific diseases is so large that this activity is no more related to the local conditions of environment. Accordingly, there is no perception of shortage even if this is the case. Medical plants are mainly used for malaria, cough, and « women diseases » (as called by the villagers), and also for the various children and babies' diseases. The use of plants for medical purpose is common. However, only few people at Cité Agricole have the necessary knowledge of plants. Only plants used for common diseases and available around the village are known by all villagers.

b) Natural Resources of the Project Area

In the Project area, the present and coming availability of natural resources is limited by the intensive agricultural development and population increase. Lowlands have been extensively developed for paddy production, and traditional resources generally supplied by forest are insufficient. In the other planned areas for paddy cultivation within the scope of the Master plan, traditional resources remain an important input of daily life and there is no acute shortage as this can be observed in Cité Agricole.

The Project Area raises specific problems as far as natural resources are of concern because the implementation of the project will provide confrontation of 3 types of population:

- Present inhabitants of Cité Agricole who will get paddy fields while keeping the presently cultivated food providing fields;
- New settlers coming from surrounding villages who will get paddy fields without complete loss of previously cultivated fields for food;
- New settlers of Rapides Grah forest who will have in principle to live upon paddy production without possibility of having reasonably food providing crops.

What is sure is that farmers having received irrigation plots would not easily move to accept buying basic products like manioc or maize. The fact that consumption products are specially expensive in the area of San Pédro strengthens the will for self-sufficiency. However, land competition is such that the advantage of buying these products could appear, as there are favourable conditions like the locally developed market economy and the capacity to pay for them. Since the allocation of 1,5ha should be largely enough to ensure income of the family, it will allow for spending a part of income for schooling of children or using comfortable cooking fuel, and then start a long term process of economic conversion.

Then people will have several constraints to deal with the new rules of land tenure, which leave no possibility of land clearance or free settlement for cultivation:

- Social rule for paddy production;
- Environmental constraint of land shortage

The Project provides good conditions for equitable income. However the shift in mentality will be more necessary for the newcomers who will completely depend on paddy production than for the present inhabitants who already benefit of housing and upland crops.

c) Discussion

Then, while land use is saturated and impairs the possibility of further land clearance, resources use should be critical and perceived by the farmers as a loss compared with what they could expect. Farmers must understand that the acceptance of such a loss in natural resources is in fact a change in mentality and consumption patterns that is required for the achievement of better standards of living.

Overcoming the problem of land and common resources shortage will imply a set of preventive measures together with awareness strengthening of the need to operate a radical change in life style. Prevention deals with the selection of young people that are able to keep with the intensive mono-activity of paddy cultivation, otherwise it would result into frustration and difficulty to adapt. There are also possible protection measures, like preservation of a minimum sustainable size of local resources. However, focusing on paddy production will progressively relegate these resources to a position of secondary importance, due to the increased difficulty to get such resources, together with higher revenue and more market dependant behaviour.

This change in mentality is also consubstantial with the cultivation of paddy, which requires strong community organization to cope with agricultural works and irrigation water use. Then, it seems that preparation to such change in life style and mentality is a priority for enhancing acceptance of the new environmental constraints by the newcomers. This point should be considered within the set conditions for selecting people who will benefit from the paddy plots cultivation.

(3) Case of Fuelwood at Cité Agricole

a) Conditions of Use

According to a small investigation made with 6 households of Cité Agricole chosen at random, use of fuelwood can be described as follows:

- Fuelwood is collected by women eventually together with children. The number of trips to collect fuelwood for equivalent number of family members is variable, certainly because of use patterns and availability. Trips might be done almost daily, and sometimes weekly, according to the case.
- Collection and transport requires on average 3 hours per family per day (April is assumed to be 10 hours per day, May to July is free, and others are normal, generally 3 hours per bundle.
- On average, one bundle is used per family and per week or 10 days period. The rate of use of fuelwood is largely varying according to the cases: Standards of living (use of hot water for

hygiene seems to be a sign of high welfare), quality of the wood, number of persons in the family. The most common quantity of fuelwood, which is required weekly per person, is a quarter of a bundle.

- People of Cité Agricole generally do not use charcoal, excepted in urgent cases like during the rainy season, which is known as a season with acute shortage. It seems that one bag of charcoal is equivalent to one bundle of fuelwood in terms of duration of energy use. One bag of charcoal provides the necessary energy for 10 days in a family of 8 persons. Such a family should then pay more than 300000FCFA per year if charcoal was substituted to fuelwood. This is almost equivalent to the average annual revenue per family at Cité Agricole.
- The main sources of fuelwood are the newly established crop fields, after forest burning. Such fields are still available near the San Pédro river or far from the village upland. In the fields, fuelwood belongs to the farmer who cultivates the field. However, there is a redistribution of the quantities available since farmers who have no more fuelwood on their fields can be authorized to get it where it is available. There are also common resources for fuelwood, like the woody meanders of the San Pédro during the drought season.
- The lack of fuelwood is strongly felt, but this shortage induces different situations: In most cases, collection is done far away from home; In special cases, distance problem has been resolved by the use of motorized cultivator; There is no case of regular use of charcoal due to the lack of money to buy it;

b) Supply Sources of Fuelwood

Supply sources of fuelwood around Cité Agricole are basically the cultivation fields and forest. People are authorized to collect in their own fields or in other fields under permission. Since a newly established field provides large amounts of wood, those who lack it in their own field can ask to others for collection. There are also the cases of woods that are attributed to somebody for clearance and establishment of fields, but have the aspect of forest because clearance is under process. There are also land owned by San Pédro citizens where fuelwood collection could be possible but is not practised because of the lack of relations with these new urban land «owners». Free collection of fuelwood in community land is almost limited to some places of the San Pédro river banks, corresponding to the meanders liable to flooding.

What can be said is that the collection places are generally far from the village: In the south-west along the San Pédro, or the north-east hills upland. In both cases, flooding of land during the rainy season is an additional limiting factor for collection.

Presently, fuelwood is collected by sharing available wood in the fields. However, share with the newcomers would be more difficult so that distance for collection will still increase for them, involving a progressive shift to charcoal, or the supply of fuelwood through market exchange, or conflicting with already established population.

c) Shortage Conditions

Shortage of fuelwood in this area is a relative phenomena, which means that people feel its collection as an increasingly time consuming constraint, which finally is perceived as a factors that affects the quality of life of the households, directly for the women who collect fuelwood, and indirectly for the household welfare.

There are specific conditions at Cité Agricole, which explain the general shortage of fuelwood: The village is surrounded by the irrigation area, while fields and forests that can provide fuelwood are beyond the perimeter. There are several factors that make sometimes difficult the access to the surrounding upland for fuelwood collection. Those are the new trends of appropriation by San Pédro citizens, the regular flooding of low areas between the village and the upland areas during the rainy season and the increasing distance from the village to the fuelwood resources.

Fuelwood problem at Cité Agricole is typically a factor that will more or less affect the quality of life of the people. On a whole, shortage of fuelwood can induce several possible effects. There are undesirable effects like more tree cutting along the San Pédro river for the short term, conflicts for collection cristalized around ethnic or population differences (local people and newcomers for example), and increasing time consuming trips to collect the wood. All these undesirable effects finally induce a loss in the quality of life, which can be interpreted as a failure within the process of achieving the Project, since the final objective of the project is to enhance the quality of life and living standards. There are also long-term effects that can be regarded as being positive within a context of economic and social development, and eventually environmental conservation, and are linked with the successful achievement of paddy production. Those are the shift from the use of fuelwood toward the use of charcoal or gas combustible, which are supplied on the San Pédro market. This change should be considered as an indicator of the successful shift of mentality from traditional to modern life style.

1.3.4 Mitigation and Improvement Measures

The main issues that have been raised in the environmental assessment of the Project belong to one or several of the following items:

- Use of agro-chemicals;
- Degradation of certain resource base (hunting);
- Conservation of swampy forest and certain fauna species;
- Sustainable use of water resources;
- Prevention of water-borne diseases.

Mitigating or improving measures have been proposed, as those listed below, each of them being representative of an impact issue and type of approach (tool) for environmental planning, as described in the Table below.

- 1) Institutional enforcement for the purpose of nature conservation (wildlife);
- 2) Follow up of the state of environment in the study Area;
- 3) Follow-up of the occurrence of water borne diseases;
- 4) Education and public awareness strengthening in health and sanitation;
- 5) Appropriate use of agrochemicals, by the farmers under guidance of ANADER;
- 6) Follow-up of the use and application of pesticides on crops;
- 7) Development of human resources for pest and pesticides management;
- 8) Education program for the appropriate use of pesticides;

- 9) Coordination for resettlement of peoples according to the policy objectives of SODEFOR;
- 10) Public awareness and community participation for the harmonious settlement of people;
- 11) Preventive measures for successful integration of people in the paddy producing society;
- 12) Protection measures during the construction works.

Measures Needed for the Environmental Management of the Project

| | Conservation of natural resources | Control of water borne diseases | Control of pesticides | Conditions of resettling people | Construction Works |
|---|-----------------------------------|---------------------------------|-----------------------|---------------------------------|--------------------|
| Institutional strengthening and coordination | 1 | - | 5 | 9 | - |
| Follow-up: monitoring, observation, evaluation | 2 | 3 | 6 | - | - |
| Human resources, training | - | - | 7 | - | - |
| Improvement of public awareness and participation | - | 4 | 8 | 10 | - |
| Preventive measures and compensatory or mitigating measures | | | | 11 | 12 |

Note: numbers refer to the above list of measures

Within the field of social environment, the question of settlement of newcomers in the Project Area and their good and long-term integration in the local society is a basic one, which explains the set of 3 measures (from 9 to 11). However, they largely depend on the SODEFOR actions in the Rapides Grah forest (community participation to join the Project and leave the fields that should be returned to the SODEFOR), together with those of the Project office (strict application of paddy production quota, which is one preventive measure for the successful integration of the newcomers in their new society).

The basic problem as regards to the implementation of the project in view of sustainability is the poor institutional organization for the protection of the environment in this area. Problems related to the use of agrochemical products, fishing, hunting, control of flooding, silting, control of water quality, are all examples of important issues that are lying outside the clear allocation of responsibilities between agencies involved, including the Regional Direction of Environment which should however be the co-ordinating agency.

As a matter of fact, improving the institutional conditions should be the first priority for setting the necessary conditions toward the sustainability of the project: First to avoid pollution by pesticides, second to protect remaining valuable wildlife species against disappearance, third to protect aquatic systems (fish resource) against degradation and depletion, and finally to avoid unacceptable levels of water borne diseases. While the management of wildland does not directly serve the project, it does improve the socio-economic benefits in the area since wildlife contributes to the livelihood of the people.