

### Supply and Demand for Maize and Field Beans in 1996 and 2010

<i>Year</i>	<i>Population</i>	<i>Consumption (kg/person/day)</i>	<i>Gross Consumption (a) (ton)</i>	<i>Production (b) (ton)</i>	<i>Supply and Demand (a) - (b) (ton)</i>	<i>(b) ÷ (a) (%)</i>
<b>Maize</b>						
1996	322,644	0.473	55,689	23,216	- 32,473	42
2010	410,214	0.473	70,803	28,992	- 41,811	41
<b>Field Beans</b>						
1996	322,644	0.473	8,725	1,643	- 7,082	19
2010	410,214	0.473	11,093	2,465	- 8,628	22

Note: the consumption figures were obtained from POSTCOECHA-MAG (1995)

Although the production volume is bound to increase, the supply and demand for maize and field beans did not vary significantly in 1996. The production volume in 2010 for maize and field beans is estimated at 41% and 22%, respectively.

#### 5.2.2 Livestock Promotion Plan

##### (1) National Policy of Agro-pastoral Sector

The policy of El Salvador on the livestock sector is as follows:

- 1) El Salvador has changed to an import country from an export country in beef due to the civil war, deterioration of public peace, smuggling of live cattle, and insufficient supporting policy for livestock farmers. Thus, it aims at strengthening and activating competitiveness and profitability of the livestock sector.
- 2) A system on quality control of agro-commodities, pest and disease control in combination with regional monitoring system for crops and animals should be established.
- 3) El Salvador will advocate the international law adopted in the whole Central America on pesticides, and also adopt regulations on quarantine measures and control on animals, plants and agro-pastoral commodities.
- 4) Surveillance activity on quality control of animal products should be strengthened.
- 5) Safety measures should be introduced in order to prevent the smuggling of domestic animals across the border.

Considering the present condition of the Study Area with regards to these policies, the

following development plan shall be proposed.

## **(2) Reinforcement of the Livestock Sector**

### **1) Objectives**

This plan aims at: a) improving the standard of living of small scale farmers in the mid-upper basin with the stable supply of protein source by introducing small scale swine production and broiler poultry farming, and b) improving animal health services to cooperative farms raising livestock in the lower basin by establishing an animal health service office in the said basin. Accordingly, this plan comprises an animal health services improvement plan and extension of broiler poultry and swine farming to small scale farmers in the Study Area.

### **2) Animal Health Services Improvement Project**

The south-western area in El Salvador, which also covers the lower Jiboa River basin, is vital to livestock production. However, the medium and small scale cooperative farms into livestock raising do not receive necessary services for animal sanitation control. In order to improve current conditions, an animal health services improvement office will be established in the lower basin for cattle, swine and chicken.

#### **a. Outline of the Project**

The outline of the development plan is as follows:

- Organizing seminars on animal disease prevention for livestock farmers and cooperatives
- Training livestock farmers in animal health management
- Conducting regular animal health inspections in the area
- Collecting samples for analysis at the DGSVA laboratory in San Salvador
- Function as semen bank

#### **b. Required Facilities**

The outline of the plot, staff, facilities and equipment necessary for the implementation of the project is as follows:

- Plot (500 m<sup>2</sup>)
- Staff of 2 (a technician and a janitor)
- Office (60 m<sup>2</sup>, staff room, lecture room, storage, laboratory, lavatory)
- Crushpen
- One set of training & extension equipment, as well as office equipment
- One set of instruments and equipment for animal diagnosis, treatment and disinfection
- Pick-up truck
- Others

The project site shall be in the lower basin where most medium and small scale livestock cooperative farms are located.

### 3) Swine Farming Development and Extension Plan

One of the reasons why pork consumption has not increased is due to fear of parasite contamination via pork meat. This fear is based on the prevailing swine breeding method in the rural area. Swine grazing in farmyards is predominantly practiced and this exposes the animals to parasite (*Cysticercosis*) infection, which is contagious to humans as well. Therefore, this plan aims at improving the standard of living and diet of the small scale farmers in the mid-upper basin area by introducing an integrated in-house breeding method using formula feed. Arable lands in the mid-upper basin area are considerably limited due to a mountainous terrain, hence to effectively use the lands and achieve the goals at the same time, swine farming shall be introduced.

#### a. Outline of the Plan

The main components of the project are as follows:

- Production and sale of promising piglets
- Breeding and sale of fattening pigs
- Pork meat processing for WID

A core station shall be established to supervise these activities or these activities may be independently conducted by any interested farmer.

#### b. Required Facilities

The plot, facilities, staff, materials and equipment necessary for the implementation of the project are outlined as follows:

##### i. Core station

Facilities:

- Administration building (100 m<sup>2</sup>: office, feed storage room, meat processing room, laboratory)
- Piggery ( 350 m<sup>2</sup>: farrowing pen, nursing pen, reproductive pen, breeding pen, septic tank)
- Field for forage production (maize, sorghum, wiskil, aquatic weed etc)
- Compost yard
- Water supply and electricity

Materials:

- Reproductive swine: male and female

- Feeding related equipment: one set
- Breeding related equipment: one set
- Large refrigerator
- Meat processing equipment: one set
- Vehicle

Workers: three persons

ii. Breeding (3 heads)

Facilities and materials:

- Pigsty made of concrete floor and with paddock: 7.5 m<sup>2</sup>
- Water supply facilities and electricity
- Septic tank or compost yard
- Storage for formula feed
- 5 piglets, formula feed supply, etc.

Worker: One person

4) Poultry Farming Development Plan

Poultry farming, either by the collection of eggs or the use of broilers, is an industry effective in the hilly areas upstream and midstream where land resources are limited. However, because the poultry market in El Salvador is monopolized by several large poultry enterprises, poultry production in the study area shall be confined to the local market.

a. Facilities, staff and materials

- Poultry house ( 10 m<sup>2</sup>: 50 chickens)
- Feeding and water supply devices: one set
- Chicks: 55
- One set of apparatus and drugs for vaccination
- Formula feed
- Worker: one person

### 5.2.3 Inland Fisheries Extension Plan

#### (1) Government Policy of Inland Fisheries and Basic Concept of Project Formulation

The policy of inland fisheries in El Salvador is aimed at developing promising species in inland environments (river, lake and pond) in order to improve the living standard of subsistence fishermen in terms of employment opportunities as well as increase in fish yield. An inland fishery at Ilopango Lake poses the question of safety in the food chain between fish and water

quality which contains arsenic and boron. Meanwhile, some of the farmers in the upper basin desire to manage fish-culture, thus the introduction of inland fisheries is confined to the subsistence farmers in the mid-upper basin which is free from the influence of Ilopango Lake water.

From the above policy and present condition of the Study Area, the following development plan shall be proposed.

## **(2) Inland Fishery Development Plan**

### **1) Objectives**

This plan aims to improve the standard of living, diet, and employment opportunities of subsistence farmers in the mid-upper basin by developing and introducing fish-culture through the conduct of training and extension programs. This plan is desired especially because there is no promising fish-culture activity in the Study Area except for the Ilopango Lake fisheries. This plan shall comprise of an extension and training program for the breeding of tilapia and shrimps for subsistence farmers.

### **2) Introduction and Extension of Fish Culture**

The outline of the project is as follows:

- CENDEPESCA shall be responsible for the conduct of training and extension programs in terms of site surveys, construction supervision, acquisition of fries, and guidance in fish breeding methods.
- The farmers shall procure fingerlings from a nearby CENDEPESCA hatchery and start fish culture by constructing a fish pond, which can be also used as a drinking water source for animals, by using surface flow or spring water.
- Locally available organic matter like chicken manure, pig manure, cattle dung, bagasse, strained draff, compost, born-meat, rice bran, maize bran and formula lime pellet shall be used for feed.
- Sites for the construction of fish ponds shall be amenable to conditions requiring the pouring of fresh running water when BOD in the fish pond rises. The construction of small livestock barns directly above the ponds to make use of livestock excreta as fish feed shall be examined as well.

### **3) Facility and Materials**

- Fish pond: 100 m<sup>2</sup> (made of soil; with inlet and outlet pipes)
- Fingerlings: 330 tilapia or 500 baby shrimps
- Feed
- Labour requirement: one person

#### 4) Fish Yield

The conduct of intensive fish culture on a fish pond of 100 km<sup>2</sup> can yield 50 kg to 90 kg of fresh tilapia or 16 kg of fresh shrimp semi-annually.

#### 5) Possible Project Sites (7 sites)

The possible sites for the fish ponds are: Verapaz, Mercedes La Ceiba, San Pedro Masahuat San Ramon, San Antonio Masahuat, Santa Maria Ostima, and El Carmen.

### 5.2.4 Agricultural Infrastructure Development Plan

#### (1) Irrigation Plan

##### 1) Basic Policies of the Irrigation Plan

- a) Traditional crops (basic grain) shall be cultivated mainly in the rainy season. Crop diversification shall be promoted and agricultural productivity shall be improved by cultivating non-traditional crops in the dry season.
- b) Ilopango Lake and Jiboa River shall not be used for irrigation due to poor water quality.
- c) Sprinkler irrigation or drip irrigation will be promoted through the effective use of water resources and because of the highly permeable quality of the soil in the basin.
- d) It is impossible to make a detailed plan during this master plan study because the scale of the planned irrigation system, which shall use surface water, is very small. This irrigation plan shall depend on the conditions that may result from the implementation of this development project. Therefore, the main water resource to be developed for this irrigation plan shall be groundwater.

##### 2) Proposed Project Area

A field study shall be carried out in areas with a high potential for agricultural development using acreage maps and land registers. Further, the selection of agricultural lands for development shall be based on the results of the hydrogeological and groundwater studies.

The sugarcane fields, pasture and forests in the Jiboa River downstream basin area shall be excluded from the study. The areas to be affected by the irrigation project are shown below and total 2,100ha (refer to Figure 5.2.4.1):

a)	Areas in the northwestern part of San Vicente Volcano-Chichontepec	<u>660 ha</u>
-	Verapaz	(490 ha)
-	Guadalupe	(170 ha)
b)	Areas in the central zone of the municipality of San Pedro Masahuat	<u>655 ha</u>
-	Canton El Carmen	(360 ha)
-	Hacienda San Mauricio	(125 ha)

- Canton Tilapa (140 ha)
- c) Areas in the southern zone of the municipality of San Pedro Masahuat 785 ha
  - Cooperative Astoria (130 ha)
  - Cooperative San José Luna (250 ha)
  - Cooperative El Achiotal (240 ha)
  - Cooperative Sta. Emilia (70ha)
  - Cooperative Sta. Teresa Indigena de la Paz (25 ha)
  - Cooperative El Triunfo de San Felipe (70 ha)

### 3) Potential Groundwater Volume

The results of the hydrogeological and groundwater studies conducted in the San Vicente Volcano area (Chichontepec) and the Jiboa River basin were used to determine the groundwater volume that can be developed, number of wells to be constructed, and well depth (see Figure 3.1.1.4 ~ 5).

### 4) Proposed Crops

The proposed crops are as follows:

- a) Areas in the northwestern zone of San Vicente Volcano (Chichontepec)
  - rainy season maize, sorghum, beans
  - dry season green peppers, cucumber, tomato
- b) Areas in the central zone of the municipality of San Pedro Masahuat
  - rainy season maize, sorghum, beans, squash
  - dry season green peppers, peppers, watermelon, melon
- c) Areas in the southern zone of the municipality of San Pedro Masahuat
  - rainy season maize, sesame, sugarcane
  - dry season watermelon, melon

### 5) Irrigation System Using Groundwater

#### a) Irrigation system

The area subject to irrigation is determined based on the amount of groundwater to be pumped up. In addition, the selection of the irrigation area shall also be determined in terms of farm management and O/M, in consideration of the irrigation facilities to be installed and the construction cost of groundwater production facilities. Because the initial investment is high for groundwater irrigation, sprinkler irrigation or drip irrigation is recommended instead. The groundwater irrigation system basically consists of deep tube wells and irrigation facilities.

#### b) Cropping Pattern

Groundwater makes irrigation possible all year round. Since the construction cost of irrigation facilities is high, cash crop cultivation is recommended. The cultivation of staple

food, e.g., maize, and pasture is recommended in the rainy season. The land occupation period of the main crops is as follows:

watermelon:	3 months	melon:	3 months
sesame:	3 months	eggplant:	3 months
cucumber:	3 months	maize:	4 months

Three crops are assumed per cropping year. Allowing 10 days for plowing and soil disinfection, the estimated cropping rate is 90 % or more per year. Three kinds of crops are planned to be cultivated in one irrigation district. Sowing and/or transplanting period is assumed to take 20-30 days.

#### c) Water Requirement

The required water volume was calculated as follows:

$$E_{\text{crop}} = K_c \cdot E_{\text{to}}$$

where,

$$E_{\text{crop}} = \text{Required water volume (mm/day)}$$

$$K_c = \text{Crop Coefficient}$$

$$E_{\text{to}} = \text{Potential of evapotranspiration (mm/day)}$$

The values of  $E_{\text{to}}$  are based on the climatic data of the La Provincia observation station on the right bank of Jiboa River.

#### d) Net Irrigation Water ( $I_n$ )

The net irrigation water is calculated as follows:  $I_n = E_{\text{crop}} - (P_e + G_e + W_o)$

where,

$$I_n = \text{Net irrigation water}$$

$$P_e = \text{Rainfall}$$

$$G_e = \text{Amount of groundwater supplied by capillarity}$$

$$W_o = \text{Residual moisture in the soil in the initial cropping stage.}$$

#### e) Design Irrigation Water Volume

##### i) Net Irrigation Water: $I_o$

In general, the volume of water which should be given at one time is decided by the depth of the effective root group zone and the water storage capacity of the soil, according to the following procedures:

$$d : \text{Depth of effective root zone}$$

$$C_p : \text{Moisture absorption figure of crops}$$

$$AM : \text{Amount of effective moisture according to each level}$$

$$AM = 1/100 \cdot \Sigma (F_{24} - M_i) \cdot S_a \cdot d$$



where,

- AM : Amount of effective moisture  
 $F_{24}$  : Volume of water for 24 hours at each level  
 $M_i$  : Moisture ratio in growing obstruction points at each level (%)  
 $S_a$  : Specific gravity at each level  
 $d$  : Depth of each level (mm)  
 TRAM : Total readily available moisture  
 TRAM =  $AM/C_p \cdot 100$   
 or  $\approx 0.6 \sum AM$   
 $C_p$ : The moisture absorption figure of crops was determined as follows:

TRAM of two soil types was obtained with the depth of the effective root group zone based on the results of the general investigation of the soil of the districts covered by the study. The effective depth was set at 60 cm and the following case studies were carried out (Case I: clay loam type soil, and Case II: clay type soil):

**Case I Clay loam type soil TRAM**

<i>d cm</i>	<i>F 24</i>	<i>M 1</i>	<i>Sd</i>	<i>AM</i>	<i>Cp</i>	<i>TRAM</i>	<i>IO(mm)</i>
0 ~ 15	41.04	28.3	1.03	19.68	40	49.2	49.2
15 ~ 30	41.04	28.3	1.03	19.68	30	65.6	
30 ~ 45	37.37	26.69	1.18	18.90	20	94.5	
45 ~ 60	37.37	26.69	1.18	18.90	10	189.0	
60	$\Sigma 77.16 \times 0.6 = 46.3$						

**Case II Clay type soil TRAM**

<i>d cm</i>	<i>F 24</i>	<i>M 1</i>	<i>Sd</i>	<i>AM</i>	<i>Cp</i>	<i>TRAM</i>	<i>IO(mm)</i>
0 ~ 15	28.01	14.76	1.47	29.21	40	73.0	73.0
15 ~ 30	28.01	14.76	1.47	29.21	30	97.3	
30 ~ 45	25.86	13.19	1.49	28.31	20	141.5	
45 ~ 60	25.86	13.19	1.49	28.31	10	283.1	
60	$\Sigma 115.04 \times 0.6 = 69.0$						

f) Design Interval

Irrigation interval should be calculated as follows:

Irrigation interval =  $TRAM/\text{maximum consumption rate} = I_o(\text{mm})/I(\text{mm/day})$

The peak consumption percentage is 5.5 mm or less per day. If a maximum TRAM of 49.2m is assumed, the irrigation interval shall be 8 days ( $49.2 \div 5.5 = 8.9$ ).

On the other hand, if P is assumed to be 50 % for sprinkler irrigation and 100 % for drip irrigation, the crop coefficient (Cr) shall be 0, and the point of irrigation (Pf) shall be equal to 3 (see calculation below), making the irrigation interval 4 days ( $24.6 \div 5.5 = 4$ ).

$$\begin{aligned} \text{DTRAM} &= (1-\text{Cr}) \times \text{TRAM} \\ &= \text{TRAM} \\ \text{TRAM} \times P &= 49.2 \times 0.5 = 24.6 \end{aligned}$$

g) Design Irrigation Water Volume

If sprinkler irrigation is assumed to have an irrigation efficiency of 75 %, the maximum irrigation water volume required would be 7.1 ~ 7.4 mm/day. The following irrigation method shall be applied:

- Irrigation interval : 8 days
- Irrigation hour : 10,12 or 15 hours/block
- Required water volume : 14.2 l/sec/10 hr, 11.8 l/sec/12 hr, and 9.5 l/sec/15 hr

The total irrigation water volume required for drip irrigation is 60 ~ 70 % of the sprinkling irrigation system.

6) Irrigation Facilities Plan

The facilities to be constructed for irrigation are deep wells, pumps, and electrical installations. The scale of the facilities are as follows:

a) Groundwater Production Facilities

① Well Construction

Northwestern Zone of San Vicente (Chicontepec)	150m
Central Zone of San Pedro Masahuat Municipality	100 ~ 150m
South Zone of San Pedro Masahuat Municipality	100m

② Submersible Motor Pump : 50 ~ 75 HP

b) Electrical Installation

① Electrical Power Source

The power required to operate the submersible motor pump may be derived from a diesel generator or power cables. The former shall be used due to the following:

- easy to operate and maintain
- cheap installation cost

**c) Irrigation Facilities**

PVC pipelines shall be used when installing the main and secondary irrigation facilities. Sluice valves and air valves shall be installed in appropriate areas. A water supply valve shall be installed at each farm entrance.

**(2) Drainage Plan**

**1) Basic Policy of the Drainage Plan**

**a) Setting of buffers against outside water**

The route of the embankment, which will be set on both sides of the Jiboa River according to the river course improvement plan, will function as a buffer against outside water.

**b) Drainage improvement**

The drainage systems to be improved are the El Lirial drainage system on the right bank of the Jiboa River and the central drainage system on the left bank. Repair and construction works shall be carried out to secure the cross-sectional area of flow on these drainage canals.

Bocana La Choca shall be the outlet of El Lirial drainage, while the outlet of the central drainage system will be directed toward Jiboa River.

**2) Selection of Project Area**

**a)** In accordance with the objectives of the drainage plan, the selection of the area to benefit from the plan are as follows:

- Area susceptible to inundation damage due to the flooding of Jiboa River.
- Areas usually submerged or once damaged by flooding due to defective drainage.

**b) Project Area**

The 1,800 ha of land to the south of Cooperative Astoria in the lower part of Jiboa River basin shall benefit from the drainage improvement project.

**3) Planned drainage system**

The drainage development plan in the Jiboa River basin shall be conducted on the El Lirial drainage system on the right bank and the central drainage system on the left bank.

**a) El Lirial drainage system**

The drainage plan shall cover about 1,130 ha, from Cooperative Astoria to Cooperative Las Hojas.

**b) Central drainage system**

The drainage plan shall cover about 660 ha, from Tres Ceibas to Marcelino.

#### 4) Drainage discharge

The design drainage discharge from the field was calculated by adopting the McMath's Formula described in the USDA drainage manual, using the amount of rainfall with a probability of five days.

$$Q = 2.3 \times C \times I \times S^{(1/5)} \times A^{(4/5)}$$

where,

Q : Design discharge (m<sup>3</sup>/sec)

C : Basin characteristic coefficient (Cu = 0.38)

I : Rainfall intensity (38.93 mm/hr)

S : Average head every 1,000 m from the highest point to the lower point (m/km)

A : Drainage area (ha)

#### a) Maximum discharge

Maximum discharge in the catchment area will be calculated by the rational formula.

$$Q_p = re \cdot A/3.6$$

where,

Qp : Maximum discharge (m<sup>3</sup>/sec)

A : Catchment area (km<sup>2</sup>)

re : Average effective rain intensity during flood attainment time (mm/hr)

#### 5) Drainage Method

The slope in the project area is less than 1%. The plan shall adopt the natural drainage method.

#### 6) Drainage Route

##### a) El Lirial drainage system

The drainage improvement and construction plan will be done on the 7km main drainage canal extending from Cooperative San José Luna to Bocana La Choca, and its 10 secondary drainage canals.

##### b) Central drainage system

The drainage improvement plan will be done on the 4km main drainage canal extending from Tres Ceibas to Marcelino. The outlet of this canal may be directed toward Bocana Río Jiboa. The route of the temporary drainage canals is shown in Fig. \*.

#### 7) Drainage facilities plan

The drainage facilities are as follows:

<i>Type</i>	<i>depth (m)</i>	<i>slope gradient</i>
Type V	0.3 - 0.6	1 : 2
Trapezoid Type	0.6 - 2.0	1 : 2

<i>Area (ha)</i>	<i>Design Discharge (m<sup>3</sup>/sec)</i>	<i>Canal Type</i>
50	0.99	Type V
100	1.73	Type V
200	3.01	Type V
300	4.17	Trapezoid
400	5.24	Trapezoid
500	6.287	Trapezoid
600	7.25	Trapezoid
700	8.21	Trapezoid
800	9.13	Trapezoid
900	10.03	Trapezoid
1000	10.92	Trapezoid
1200	12.63	Trapezoid
1300	13.47	Trapezoid
1400	14.29	Trapezoid
1500	15.10	Trapezoid

### (3) Rural Road Improvement Plan

The defective span of the Third Class Road and Rural Roads A and B in the Study Area will be repaired to improve the efficiency of transporting agricultural products and carrying out farming operations, as well as for environmental improvement.

<u>Class</u>	<u>Road Length</u>
Third Class Road	83.4 km
Rural Road A	42.6 km
Rural Road B	148.0 km

Roads are under the jurisdiction of the Ministry of Public Works (MOP). This implies the need for coordination between MAG and MOP when rural roads are included as components of the Project.

- 1) Basic policy
  - a) Only repair of existing roads is considered, and linear planning will be conducted during the detailed design stage.
  - b) Roads in the mountain area will have ditches.
  - c) For the benefit of livestock farmers in the area, a dirt road will be constructed on one

side for cattle and horses, as long as land expropriation is possible.

- d) Third Class Roads shall be paved with asphalt after the subgrade and the road board are repaired. Mortar coating or concrete block pavement shall be carried out on other roads.

2) Proposed road improvement plan

Third Class Road

SANTIAGO TEXACUANGOS - SAN MIGUEL TEPEZONTES

DESVIO PARAISO DE OSORO .....	41.1 km
EL ROSARIO - SAN MIGUEL TEPEZONTES.....	15.8 km
KM 50 - GUADALUPE - SAN PEDRO NONUALCO .....	26.5 km
<u>SUB-TOTAL.....</u>	<u>83.4 km</u>

Rural Road A

RAMAL (COJUTEPEQUE - SAN RAMON) - CANDELARIA.....	6.8km
EST. FENADESAL - SAN CRISTOBAL.....	4.0 km
RAMAL (CA: 1 - SAN RAMON) - JIBOA .....	7.0 km
SAN SEBASTIAN - LA LABOR - L.D.CABAÑS .....	2.5 km
SAN PEDRO MASAHUAT - BUENA VISTA - TAPALHUACA .....	6.8 km
CA: 2 COMALAPA - TAPALHUACA .....	8.1 km
SAN PEDRO MASAHUAT - CANTON CICAHUITE - ROSARIO DE LA PAZ	4.9
km	
RAMAL (SAN SEBASTIAN-TECOLUCA) - HACIENDA SAN FRANCISCO.	2.5 km
<u>SUB-TOTAL.....</u>	<u>42.6 km</u>

Rural Road B

COJUTEPEQUE - CANTON EL CARRIZAL .....	3.3 km
CANDELARIA - CANTON EL CARRIZAL .....	2.3 km
CANDELARIA-CANTON SAN ANTONIO-BOCANA LAGO DE ILOPANGO	4.5
km	
RAMAL (SAN RAMON - SANTA CRUZ ANALQUITO) - SAN JUAN	
MIRAFLORES-RAMAL (CANDELARIA - SAN RAMON) .....	5.0 km
RAMAL (COJUTEPEQUE - SAN CRISTOBAL) - CANTON LA VIRGEN - SANTA	
ANITA - DESVIO SAN RAMON.....	6.1 km
RAMAL (SAN CRISTOBAL - SAN FRANCISCO) -DESVIO SAN ANTONIO - RIO	
JIBOA .....	4.0 km
RAMAL (SANTIAGO TEXACUANGOS - COJUTEPEQUE)-PARAISO DE	
OSORO.....	1.6 km
RAMAL (SANTIAGO TEXACUANGOS - COJUTEPEQUE) - SAN BARTOLO -	

PARAISO DE OSORIO .....	10.0 km
MERCEDES LA CEIBA - JERUSALEN - L.D.LA PAZ.....	5.2 km
CANTON CONCEPCION - DESVIO NUEVO JERUSALEN .....	3.9 km
CANTON EL CARRIZAL - SANTA MARIA OSTUMA - CANTON SAN ANTONIO .....	4.2 km
SAN PEDRO NONUALCO - SANTA MARIA OSTUMA.....	3.8 km
SAN JUAN TEPEZONTES - CANTON LOS LAURELES.....	3.3 km
SAN PEDRO NONUALCO - CANTON HACIENDA VIEJA.....	4.3 km
SAN JUAN TEPEZONTES - LA ESPERANZA - CANTON SANTA CRUZ .....	8.0 km
SAN ANTONIO MASAHUAT - LA LOMA - SAN JUAN TEPEZONTES .....	7.9 km
RAMAL (CA - 2 SAN PEDRO NONUALCO) KM4 - RAMAL (CA-2- SAN PEDRO NONUALCO).....	KM 10
.....	7.5 km
CA-2 SANTA CRUZ EL TUNAN - BARAHONA.....	6.4 km
SAN PEDRO MASAHUAT - BUENA VISTA - TAPALHUACA .....	6.8 km
INTERCONEXION (CA-1 - CA-2) KM 22 - CONCEPCION - LOS PLANES - SAN FRANCISCO CHINAMECA .....	8.0 km
RAMAL (SANTIAGO TEXACUANGOS - SAN MIGUEL TEPEZONTES)-SAN FRANCISCO CHINAMECA .....	3.1 km
ILOPANGO - ASINO .....	6.5 km
RAMAL (SAN SALVADOR - COMALAPA-KM 13) - DESVIO ASINO .....	4.5 km
LAS FLORES - EL ACHIOTAL - BALNEARIO LAS HOJAS.....	14.8 km
<u>SUB-TOTAL.....</u>	<u>148.0 km</u>

### 3) On-farm road

The 3.0 wide inspection road is constructed in the groundwater irrigation district along the trunk pipeline for the operation of the valve and installation of irrigation facilities. Moreover, the roads between each irrigation district shall be paved in gravel. The farm roads will be 4.0 m in width in consideration of the passage of agricultural implements, and the density will be 25 m/ha.

#### 5.2.5 Rural Infrastructure Development Plan

##### (1) Water Supply and Sewerage

In order to improve the farmers' sanitary environment, the use of unsanitary river water and the discharge of human excreta into the river shall be eliminated through the implementation of the water supply and sewerage system improvement plan. The plan shall be implemented by ANDA. The number of households in need of water supply and lavatories by 2010 was

estimated based on the 1992 number of households without such facilities, the 1993 to 1995 ANDA census on the number of households with such facilities, and the estimated number of households in 2010. The figures are as shown in the following table.

unit: household

<i>Department</i>	<i>Entire Basin Area</i>		<i>Rural Area</i>	
	<i>No. of households receiving water supply services</i>	<i>No. of households with lavatories</i>	<i>No. of households receiving water supply services</i>	<i>No. of households with lavatories</i>
San Salvador	15,173	12,007	5,267	2,928
Cuscatlan	9,226	7,458	6,443	4,656
San Vicente	2,244	1,336	1,345	865
La Paz	9,041	8,037	5,615	5,793
Total	35,684	28,838	18,670	14,242

Pipeline systems for the water supply and flush toilets will be planned in the urban areas by ANDA. Water supply systems using rain water and simple lavatories were planned for rural areas in this master plan. It is necessary to plan water supply systems with a more detailed investigation of the quality and quantity of groundwater.

## **(2) Multipurpose Building**

It is desirable that a school be located within a distance of 1km and that every municipality has at least one Unidad de Salud with resident doctors. In order to transfer patients from a remote area to a clinic or from a clinic not equipped for emergencies to a hospital, it is necessary to have ambulances. The Ministry of Education is in charge of the installation of educational facilities, and the Ministry of Health with the provision of medical facilities.

The formation of a farmers' organization is very important in order to smoothly carry out extension of agricultural techniques, acquisition of agricultural implements, adequate use of financing systems, operation and maintenance of facilities, and the marketing of agricultural products. Meeting rooms are also necessary to promote such organizations, and young villagers and women have requested the construction of halls for soccer teams and WID activities. For use as temporary classrooms or makeshift clinics, multipurpose buildings are planned at cantons with a population (1992) of more than 500, excluding capital cities of municipalities with city halls and the municipality of San Salvador where farmers are few. The multipurpose buildings are planned for the following 40 cantons.



<i>Department</i>	<i>Municipality</i>	<i>Canton</i>
Cuscatlan	Cojutepeque	Cujuapa, El Carrizal, Los Naranjo
	Candelaria	San Jose La Ceiba, San Juan Miraflores Abajo, San Miguel Nance Verde, San Rafael La Loma
	El Carmen	Candelaria, Concepcion, La Paz, San Antonio, Santa Lucia
	San Cristobal	La Virgen, San Francisco, Santa Anita
	San Pedro Perulapan	Buena Vista, San Agustin
	San Rafael Cedros	El Copinol, El Espinal, Palacios
	San Ramon	San Agustin, San Pedro
	Santa Cruz Michapa	Delicias, Rosales
San Vicente	Guadalupe	San Emigdio El Tablon
	Santo Domingo	Izcanales
La Paz	El Rosario	El edregal, Tilapa
	San Antonio Masahuat	El Socorro
	San Luis	El Pimiental
	San Pedro Masahuat	arahona, Dulce Nombre, El Achotal, El Carmen, Las Flores, Las Isletas, Marcelino
	San Pedro Nonualco	Hacienda Vieja, Nahuilstepeque
	Santa Maria Ostuma	San Jose Carrizal
	Tapalhuaca	La Basa

### 5.3 Improvement Plan for Farmers' Organization and Support Services

#### 5.3.1 Need for Farmers' Organization and Support Services

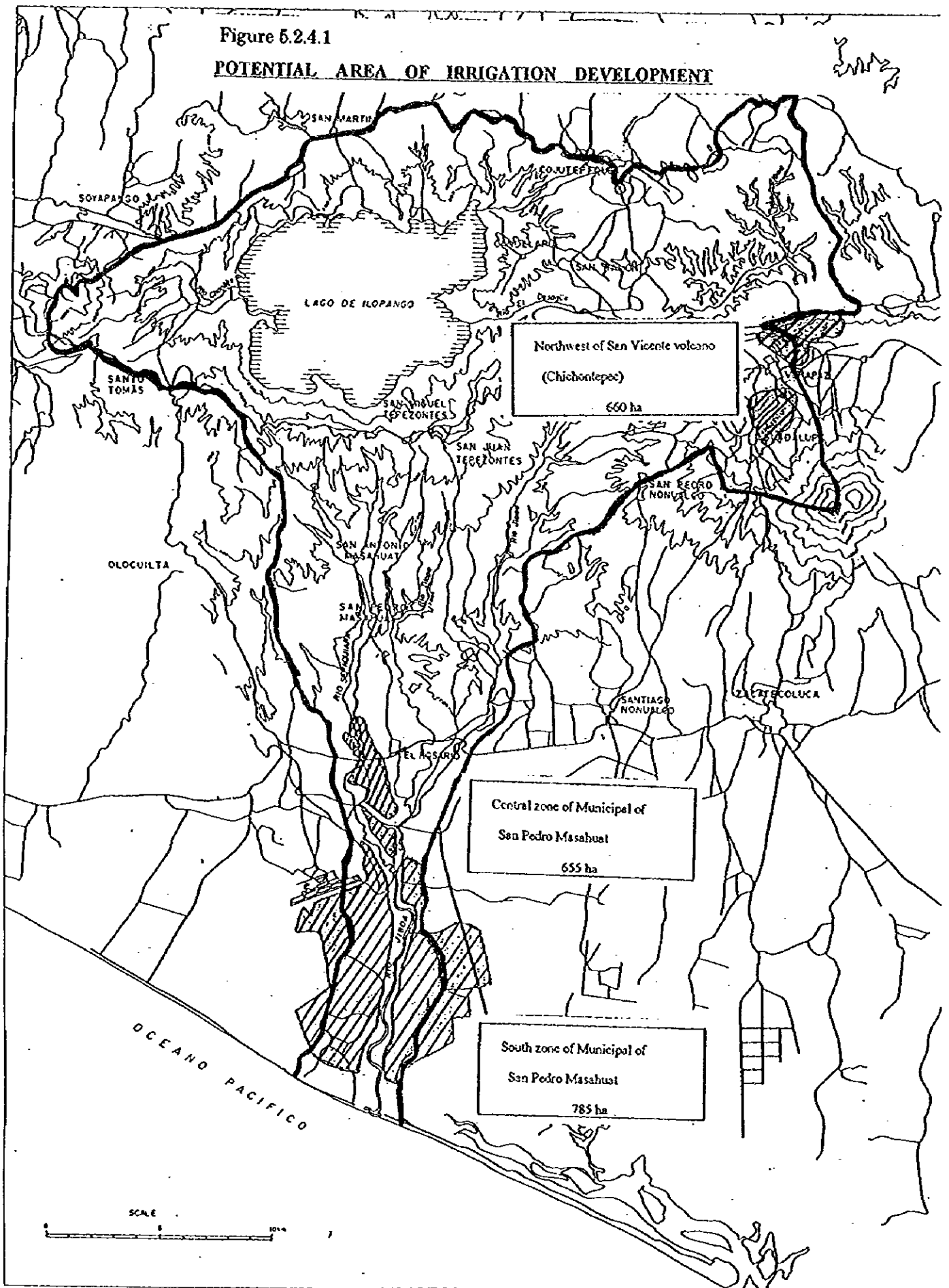
##### (1) Farmer's Support service

The people living in the Jiboa River basin face problems that are familiar to inhabitants of watershed areas in other parts of the world. The problem can be characterized as subsistence agriculture conducted with limited resources, which cause further impoverishment due to inadequate resource use such as deforestation, overgrazing, burning of vegetation cover and cultivation on steep slopes. Farm operators usually have low levels of education, have limited access to training opportunities, and do not have enough money for investment.

The problem may be prevented or significantly mitigated if land and other resources were plentiful relative to the constantly increasing human and livestock population. The scarcity of resources forces the opening of new agricultural land by removing forest trees, which accelerates soil erosion, thereby contributing to rises in river bed levels. This aggravates flash flood damages downstreams, which destroy infrastructure, crop, livestock and human lives.

The above description underscores the complexity of the problem. Projects can be formulated

Figure 5.2.4.1  
**POTENTIAL AREA OF IRRIGATION DEVELOPMENT**



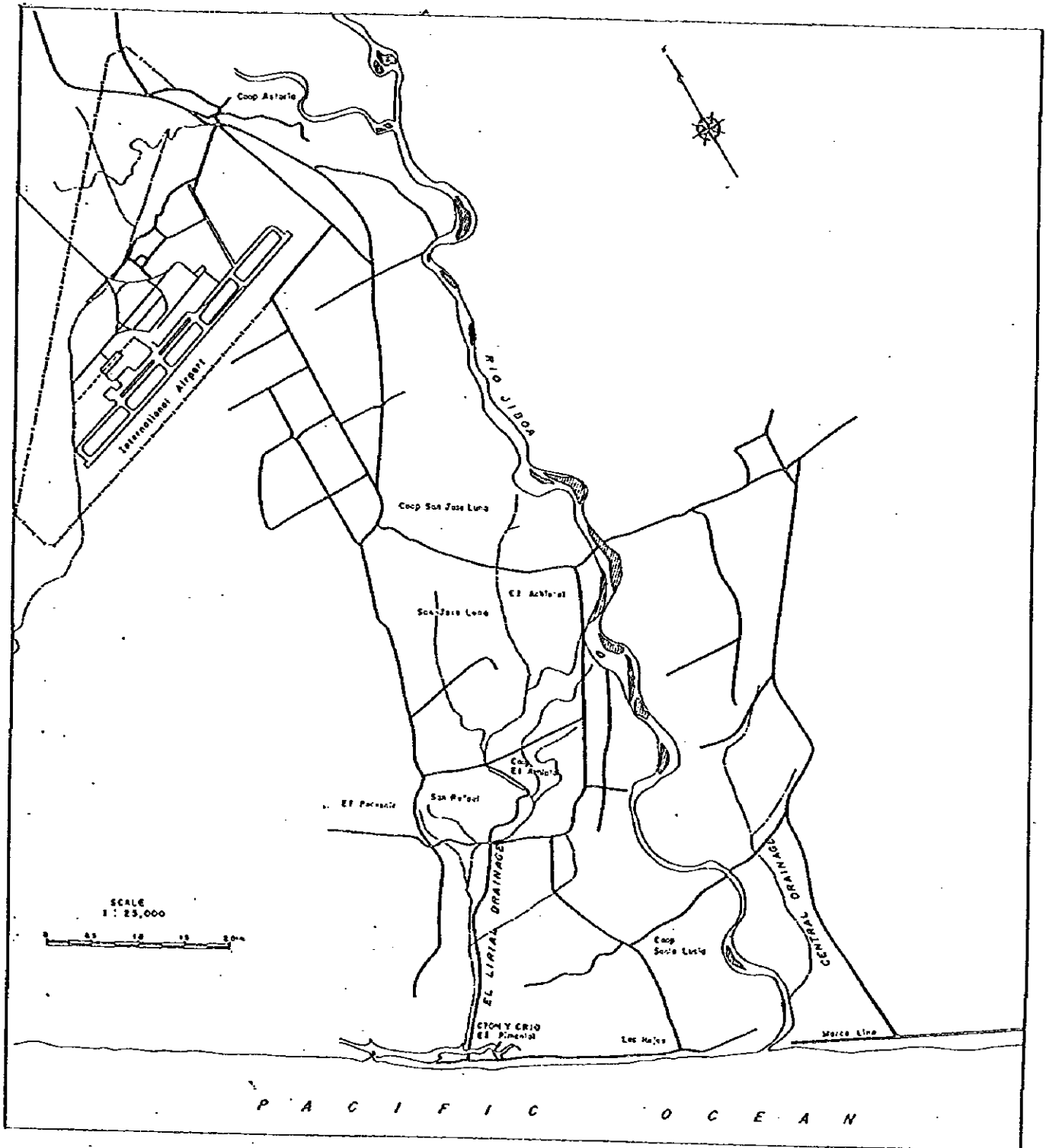


Figure 5.2.4.2

Drainage Plan

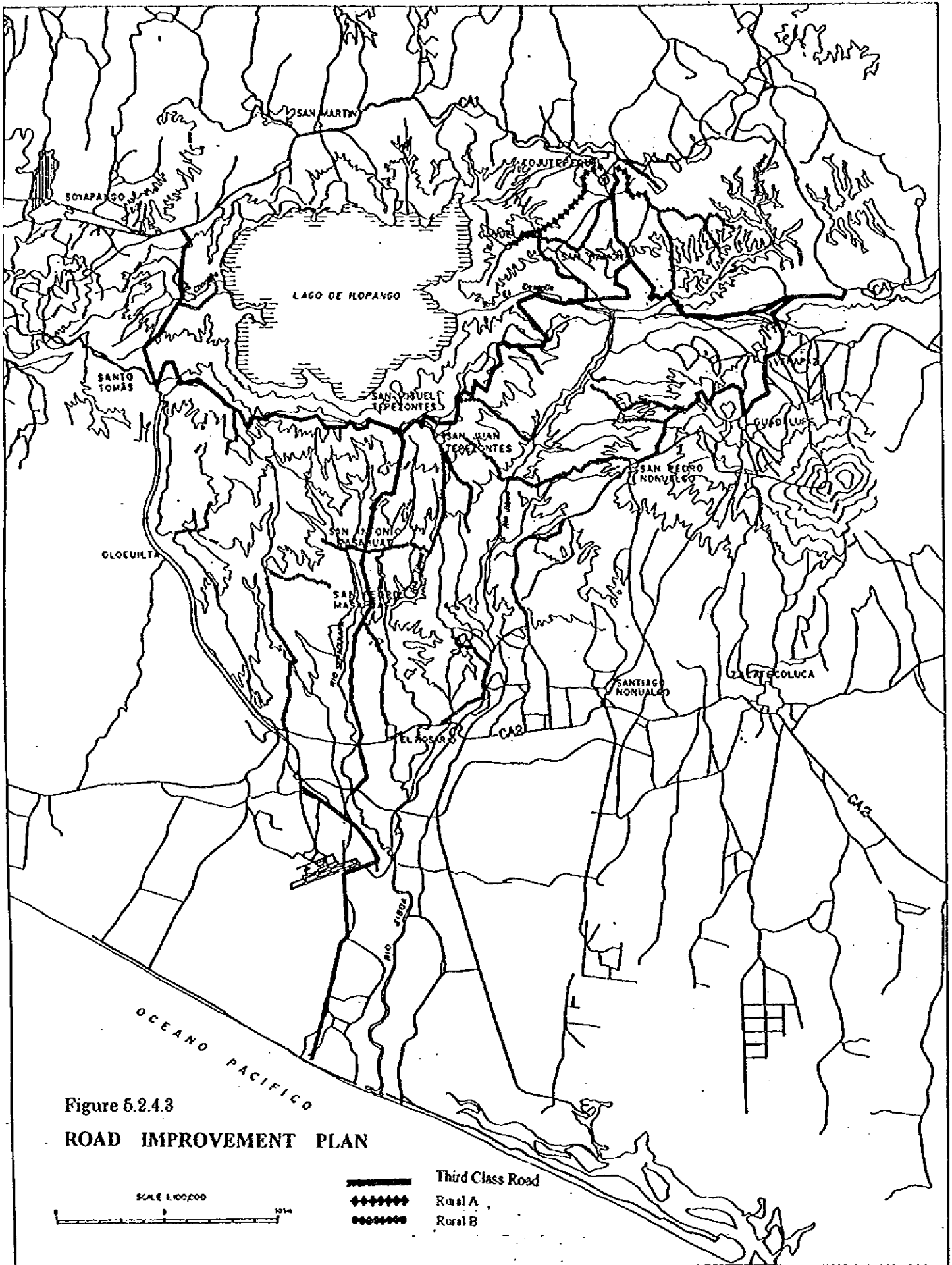


Figure 5.2.4.3  
ROAD IMPROVEMENT PLAN

SCALE 1:100,000



- Third Class Road
- ◆◆◆◆◆ Rural A
- Rural B

as means to solve the described problem, but no project, large or small, will achieve desired results unless the people living in the Jiboa River basin are fully involved. Appropriate technology can be applied to range management, afforestation, check-dam construction, gully plugging, river bank protection, contour terracing, alternative energy supplies, and improved farming technology, but these techniques should be convincing and agreeable to the watershed inhabitant, who still remains the most important component of the entire watershed system. Accordingly, the answer to the problem should be sought in the people's motivation, education, and organization, which imply removal of bottlenecks through an integrated approach. As long as the watershed inhabitants remain dissatisfied, disillusioned and skeptic, no significant improvement can be expected in the existing situation.

An integrated approach to solving the problem can be used within a given project in reference to both technical aspects and support services for small farmers. However, there are exogenous factors which can not be dealt with within the confines of a given project. These exogenous factors refer to policy decisions and enactment of legislation, e.g. review of cooperative legislation, policies on land tenure and agricultural credit; macroeconomic policies, e.g. stabilization of price levels and interest rates, preferential status for import of farm inputs and export of farm outputs.

The acute need for farmers' organization and support services for smallholders in the Jiboa River basin became clear from peasants' answers to the questionnaire survey conducted during Phase I field work, from personal observation of peasants' farming and living conditions, and from conversations held with extension agents and farmers. The main issues facing smallholders and landless farmers are the following.

- (1) Peasants own small plots that are not financially viable when based on traditional crops, or are landless with little hope to buy land.
- (2) Technical assistance is quite limited in coverage.
- (3) Credit is extremely difficult to access in terms of availability and interest rate.
- (4) Marketing of surplus production is based on hard work of women.
- (5) Cooperatives are discredited and have a poor image.
- (6) Women are restricted in their advancement opportunities.

The diagram presented as Figure 5.3.1.1 presents a summary of the proposed measures which are explained below.

## **(2) Farmers' Organization**

It is very important to conduct technology transfer to the farmers and to form a farmers' organization as a means of increasing farmers' income. Once again, the conditions and problems that would affect the technical extension activities and the establishment of a farmers'

organization in the Study Area are enumerated below.

- Forty seven (47) percent of the cultivated lands in the study area are on slopes, more than 11% of which are distributed in zones that seriously require soil erosion countermeasures. Farmers in the area only own small lands, at 2.4 Mz.
- With the exclusion of the farmers' organization in D block, farming and shipment of agricultural products are carried out independently due to the absence of an organization that would supervise local agricultural activities. There is, however, a small and exclusive financing organization that rotates their funds to support the agricultural activities of the members.

Some of the farmers trained by the extension office is observed to share the techniques they have learned with each other by lending each other a hand in field work. The farmers' group in San Ramon was also observed to be attempting to establish an irrigation association. The women's group formed through the extension office in Rosario de la Paz is also aggressively pursuing poultry farming, conducting the vaccination of chickens against the new castle disease on their own.



Through the extension activities, the farmers are beginning to work collectively and form their own group, although in a small scale. Through technical extension activities, this project intends to improve the standard of living of the farmers and increase agricultural production. Therefore, the extension office should reinforce its activities, in terms of quality and quantity, to be able to actively support the newly formed farmers' groups. The farmers' organization can be formed through the following activities:

a) Promote collective farming activities

Depending on the kind of agricultural work, shortage of help within the family makes farmers in the area heavily rely on farm laborers. There are times, however, when farm laborers are hard to find. To get rid of this dependency, it is important to create jobs that would lead to the permanent use of laborers, as well as improve farming techniques. The farmers' organization shall take charge of the hiring of farm laborers, and in so doing establish interdependency among farmers.

Figure 5.3.1.1 Summary of Proposed Measures for the Improvement Plan of Farmers' Organization and Support Services

Proposed Measures	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>1. Land Tenure</b>															
1.1 Long-term leases															
1.1.1 Govt measures															
1.1.2 Third-party guarantee															
1.1.3 Commodatum															
1.2 Land Bank															
<b>2. Technical Assistance</b>															
2.1 Research improvement															
2.2 Extension improvement															
<b>3. Financial Assistance</b>															
3.1 Special credit line															
3.2 Rural credit institutions															
3.3 Guarantee funds															
<b>4. Agricultural Marketing</b>															
4.1 Market information															
4.2 Storage and cargo facilities															
<b>5. Farmers' Organization</b>															
5.1 CVP (group) formation															
5.2 Expanded CVP activities															
5.2.1 Collective input purchase															
5.2.2 Collective marketing															
5.3 Update Cooperative Law															
5.4 Cooperative education															
<b>6. Women's Organization</b>															
6.1 Economic role of women															
6.2 Improved living conditions															

References:  Construction/Preparation/Set up  
 Operation

b) **Promote collective marketing of agricultural produce**

At present, agricultural produce in the study area, except for maize, are taken to the rural market by the farmers' wives using public transport (small pick-up trucks). The amount loaded is usually small, and the market price is influenced by market agents and retailers. Collective marketing of products would not only reduce the working time of the rural women, but would also increase the marketable volume, enabling farmers to directly negotiate or enter into a contract with supermarkets or food manufacturing factories.

c) **Promote joint purchase of agricultural implements**

The joint purchase of agricultural implements would lead to curtailments in production cost and would facilitate the control and supervision of the type and amount of agricultural chemicals or fertilizers used.

d) **Provide assurance for agricultural loans**

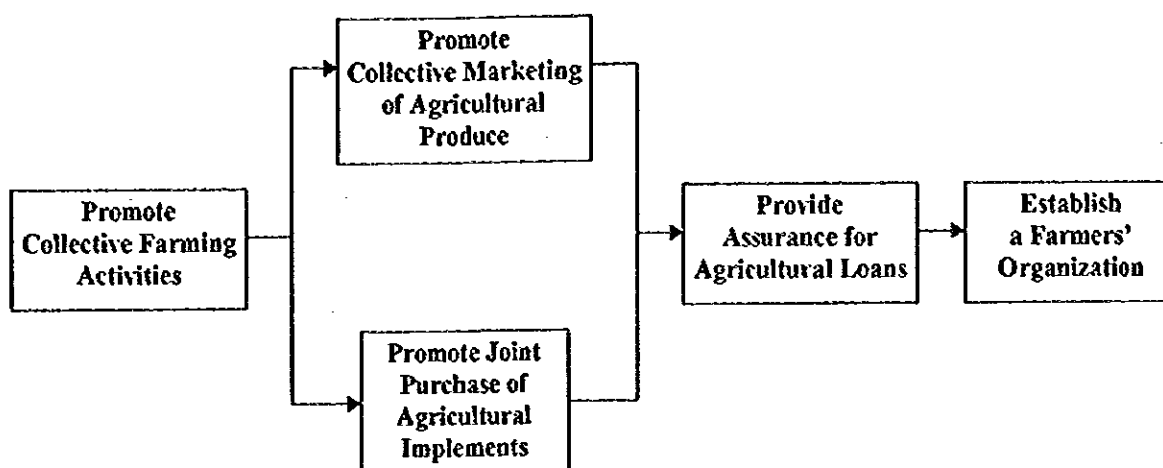
Farmers are usually required to present some form of assurance or mortgage their property when applying for a farming loan in any financing institution. And this requirement is not feasible to small scale farmers in the area. Although there are some market agents, retailers, or private entities that lend capital to farmers in the area, these entities usually impose a 10 - 35% interest on the borrowed amount. Acting as a financier, the farmers' organization would facilitate lending and would realize the introduction of new crops.

e) **Establish a farmers' organization**

As a farmers' organization, this group shall conduct the activities outline in items a) to d). Because of the absence of a body or a legislation that would aggressively support the formulation of a farmers' organization, the government should take necessary measures to extend help toward the realization of this plan.



The flow chart below shows the proposed activities of the Farmers' Organization.



### 5.3.2 Land Tenure Improvement Plan

#### (1) Situation of Land Tenure

Forms of land tenure that showed up in the questionnaire survey and were considered to need attention are "tenants" and "other forms". Tenants comprised more than 20% of farms in Blocks A, C and D. "Other forms of land tenure" include cooperative members who comprised 71% of sampled farms in Block D. Most cooperatives have not paid for their land acquisition debt, which is a serious obstacle to access credit. "Own with title" are full owners and do not face land tenure problems, while "own without title" are in the process of paying for their land. It follows that "tenants" find themselves in the most difficult situation.

#### (2) Issues in Land Tenure

The point is, then, what to do about "tenants" in the Jiboa River basin where land is in short supply. The situation would be more bearable if long-term leases, encompassing more than one production cycle, are possible. In the Jiboa River basin, long-term leases were observed only in San Pedro Nonualco, which appears to be one closed community where most families are related to each other. The case of San Pedro Nonualco suggests that trust between land owners and tenant farmers is a strong determinant of long-term farmland leases.

As a general rule, however, land owners shy away from long-term leases, which are perceived as encouraging tenants to establish permanent land claims. Ironically, when tenants make land improvements, they are suspected of attempting to lay claim to the land, and are therefore often evicted if such actions are detected by land owners. Consequently, tenants on a one-year lease are not likely to improve the land. Both owners and tenants lose under this arrangement of yearly replacement of tenants.

### **(3) Proposed Land Tenure Improvement Plan: 1996-2010**

In the questionnaire survey, many farmers answered that what they needed most was land, or soft loans to buy the land to till. Different types of assistance should be envisaged, especially relating to the availability or unavailability of land for sale. However, the plan to improve land ownership will depend heavily on political and administrative measures to be taken by the Government of El Salvador (GOES). The problem involves two facets: (a) insufficient land on the market to meet the demand of peasants, and (b) financing of land acquisition when available.

Apparently, GOES considers the agrarian reform, which has been implemented since 1980, to have fulfilled its purpose. Accordingly, agricultural cooperatives have been given the opportunity to cancel their agrarian debt (land acquisition debt), through payment of only 30% of the debt if they pay in cash by June 30, 1997. These agricultural cooperatives have the option of selling part of their land to raise the necessary cash, and a provision can be made to sell the land to other farmer groups, but these groups too will probably be hard pressed for cash.

Where land owners do not wish to sell their land, assistance could take the form of increasing the trust between land owners and tenants, so as to encourage long-term leases. Here, the intervention of a trusted third-party, a church or a NGO may be needed.

Where land is available, appropriate administrative mechanisms could be created to enable farmers to buy land, including soft loans from donated foreign funds, revolving funds, and loans based on solidarity or collective guarantee in which each member of the group is responsible not only for the payment of his own land but also of his associates. Banco de Tierras (Land Bank) can play a decisive role in this scheme. This can be greatly facilitated by the formation of farmers' organizations, either for general agricultural development purposes, or for the specific purpose of buying land.

Possible measures are the following.

- (1) Governmental measures to encourage long-term leases by increasing the trust between land owners and tenants: 1996-2010
- (2) Intervention of a trusted third-party, a church or a NGO, to favor long term leases: 1996-2010
- (3) "Comodato" (commodatum) or long-term land leases: 1996-2010
- (4) Strengthening of Banco de Tierras (Land Bank) or establishment of a bank to finance peasants purchase of land: 1996-1998
- (5) Establishment of a credit line similar to FOCAM, which gives reforestation credit at 6% annual interest rate and up to 25 years: 1999-2010

### 5.3.3 Technical Assistance Improvement Plan

#### (1) CENTA

##### 1) Situation of Technical Assistance

CENTA is the main source of technical assistance of small and medium size farmers. Among farms sampled for the questionnaire survey of Phase I field work, farms receiving technical assistance comprised the largest proportion in Block B with 58%, followed by Block C 45% and Block E 39%. Since the questionnaire survey was conducted by extension agents, sampled farms were probably skewed towards those farmers known by extension agents, which meant that those farmers were likely to have been already receiving technical assistance from CENTA.

Farmers' answers to the questionnaire survey indicated that they wished to engage in cash enterprises, and needed technical assistance for this purpose. Frequently mentioned enterprises included fruit, vegetables, poultry, cattle, and fishery in some Municipios located near the Ilopango Lake (Santa Cruz Analquito, Candelaria, San Ramón).

To expand coverage, CENTA has an ambitious plan, which should be thoroughly implemented as financial and human resources can be secured. At present, CENTA provides training to a group leader, who is responsible for the technology transfer to around 10 farmers comprising the group. Each extension agent is assigned 24 groups, that is, approximately 240 farmers on 8 visiting routes that the agent should cover systematically.

Although the number of farmer groups that an extension agent can assist satisfactorily appears to be around 15 in the Jiboa River basin, the work load of extension agents will increase, since coverage is being expanded from 240 to 300 farmers per extension agent. By increasing the number of extension agents from 220 in 1994 to 640 in 1999, CENTA plans to provide technical assistance to 192,000 small and medium size producers by 1999.

El Salvador is currently receiving agricultural technical assistance from Taiwan and international agencies such as FAO. Three Taiwanese experts supervise and assist in vegetable and paddy cultivation and in swine farming, while three FAO experts direct and supervise the conduct of soil conservation techniques, which are essential to sustainable agricultural development.

##### 2) Issues in Technical Assistance

Farmers in the Jiboa River basin have limited access to the agricultural extension service. Expanding the breadth of CENTA coverage is unquestionably important, but care should be taken to give appropriate depth to the technical assistance provided by CENTA. In this regard, extension agents should be continuously trained, domestically or abroad, in better extension methods, as well as having access to research results as means to solve farmers' problems. CENTA organization favors upgrading the technical knowledge of extension

agents, since CENTA is also responsible for agricultural research. In this regard, the key unit is known as GyTT (Generation and Transfer of Technology) of the regional offices of CDTs (Technological Development Center).

3) **Proposed Technical Assistance Improvement Plan: 1996-2010**

Since CENTA is in charge of research and extension, both aspects should be taken into account in the technical assistance improvement plan. This will make it possible to conduct research which is responsive to farmers' needs, thereby fulfilling the role of extension agents as the link between researchers and farmers.

The questionnaire survey indicated that 77% to 98% of respondents felt the need for technical assistance. This is probably a reflection on the interest of farmers to diversify and improve farming techniques in an effort to make it financially viable to operate farms of up to 2 and 3 manzanas. Similarly, extension agents are trying to improve farming operations, by recommending soil analysis as a basis for proper fertilization, and by introducing non-traditional crops.

a) *Research improvement plan: 1996-2010*

The purpose is to strengthen research facilities of the two regional experiment stations that have jurisdiction over the Municipios of the Jiboa River basin. They are known as Centro de Desarrollo Tecnológico (CDT), or Technological Development Center, and are located in Santa Cruz Porrillo and San Andrés. A great service that CDTs can provide is the fertilization advice to farmers who submit soil samples for analysis.

At present, soil samples from all over the country are sent by some 550 extension agents to the soil laboratory in CENTA headquarters in San Andrés. If other soil analyses requests are included, the laboratory handles 5,000 to 7,000 soil samples a year. It is obvious that with such a load, the laboratory is unable to complete soil analyses in time before the planting season, thereby constituting obstacles for farmers to undertake proper fertilization. The soil laboratory in CENTA headquarters is understaffed and needs to replace some equipment. Another soil laboratory, even with the most basic analytical capabilities to just recommend proper fertilization, may be most helpful.

Accordingly, a soil laboratory equipment and computers are proposed for the Centro de Desarrollo Tecnológico (CDT), or Technological Development Center, of Santa Cruz Porrillo, which is located far from the existing soil laboratory and oversees six of the nine extension agencies with jurisdiction over the Jiboa River basin. The San Andrés CDT oversees the remaining three extension agencies, but it is located right next to CENTA headquarters, whereby the same set of equipment is proposed for the soil laboratory existing in CENTA.

- Office equipment (computer, copy machine) 2 sets
- Computer software 2 sets
- Soil analysis equipment 2 sets
- Reference materials for research 2 sets
- Pick-up trucks and spare parts (4WD , double cabin) 4 sets

b) *Agricultural extension improvement plan: 1996-2010*

The purpose is to expand and improve the capabilities of the nine extension agencies covering the Municipios in the Jiboa River basin. Despite the strong need for technical assistance felt by farmers, extension agencies are generally understaffed. Therefore, facilities are proposed to accommodate 10 technical personnel, of which up to 8 extension agents and with the possibility of including a few persons from cooperating offices of MAG such as the Agricultural Economics Bureau or the Animal Health Bureau. The extension office currently in Santo Tomás is proposed to be relocated in Santiago Texacuangos, which is more convenient for farmers wishing to visit the CENTA office, and also more centrally located for extension agents with respect to their service coverage area.

In addition, facilities are proposed to expand technical assistance to women so as to train them in sewing, bakery and food preservation (jam, marmalade, sausage). These skills were preferred by women, as indicated by the questionnaire survey, and can improve women's employment opportunities in industrial free zones or bakeries or agroindustries. The assistance to women may have to be coordinated with ISDEMU, the Salvadoran Institute for Women's Development.

Proposed agricultural extension offices include the following components.

- Building construction (Office: agency head, Office: technical personnel (10), Reception-Secretary, Classroom, Library, Computer room, Laboratory, Radio communication room, Storage, Sewing room, Bakery, food processing room)
- Farm machinery shed and workshop
- Pick-up trucks and spares (9 agencies, 2 CDT, DGEA) 9 sets
- Microbus and spares (trainees mobilization) 9 sets
- Motorcycles and spares (10 per agency) 90 sets
- Computer, peripherals and software 12 sets
- Fax machines (9 agencies, 2 CDT, DGEA) 12 sets
- Radio communication equipment 12 sets
- Training materials and equipment (video, OHP, slide) 9 sets
- Sewing machines (10 per agency) 90 sets
- Tables and accessories for sewing 9 sets

- Bakery equipment (gas oven, kneading equipment) 9 sets
- Food preservation and cooking equipment 9 sets
- Soil conservation machinery 9 sets

**(2) DGRNR/CENTA**

The extension of support to each agricultural and livestock industry, as well as the improvement and construction of relevant infrastructure, shall significantly influence the activation of the agricultural sector.

The small scale farmers in the basin who have been granted lands by the agrarian reform system include former soldiers, guerillas, and repatriates. Because they are untrained, improvements in farm management were not fully realized. The absence of ① a low-interest rate credit system that would support agricultural investments, ② funds for the procurement of required agricultural implements, and ③ agricultural production and transportation measures also slowed down agricultural development in the study area, resulting in low productivity, low income and extremely poor standard of living. Another detriment is the underdeveloped state of rural infrastructures. The lack of access roads to the closest municipality makes the shipment of agricultural produce difficult, incurring huge post harvest losses and severely affecting the farmers' economic conditions.

The same difficulties could be cited out for the extension of soil conservation and afforestation measures, which are urgently needed in the study area. An effective measure to counter-act these conditions would be installing necessary equipment in the extension offices and the DGRNR to rent out to the farmers.

Accordingly, the renting out of equipment to small scale farmers will be planned to extend soil conservation, afforestation, and agricultural techniques. It is important, therefore, to form a support group and a farmers' organization, and to reinforce these systems and their activities to promote a basin conservation plan that incorporates this extension program in the study area. Improving existing infrastructure to support independent farmers' groups in terms of soil conservation, afforestation, and construction of agricultural infrastructure, is forecast to improve agricultural production and eventually the farmers' standard of living.

DGRNR and CENTA shall be the owners of the equipment to be purchased and donated for this project. In accordance with the equipment utilization plan, these agencies shall directly, or through the extension offices, rent out the equipment to the farmers. Regulations on the use of the equipment shall be decided by a higher ranking group made up of representatives from DGRNR, CENTA, and other relevant organizations. The rental fee to be imposed by DGRNR and CENTA shall be used to cover the costs for the maintenance (including fuel costs) and operation (including operators' wage) of the equipment.

### **5.3.4 Financial Assistance Improvement Plan**

#### **(1) Situation of Financial Assistance**

Credit is not easily available, as the assistance by banks reaches a maximum of only 24% of farmers in Block E, being as low as 6% in Block A. Credit from other sources, such as intermediaries and shop owners, reaches 17% in Block D but is as low as 3% in Block E.

Land is the preferred collateral in Blocks B, C and E, while cattle is preferred in Blocks A and D. The preference for cattle as guarantee is presumed to be mostly due to the low level of individual land ownership, as tenants predominate in Block A and cooperatives in Block D. Interest rates are high, ranging from 18% to 25%. If bank commissions and loan processing charges were added, real interest rate may turn out to be so high as to be unaffordable, especially for small farmers. A high interest rate may be acceptable if farmers have easy access to timely granted credit, but this definitely is not the case in El Salvador at present.

#### **(2) Issues in Agricultural Credit**

The issues facing agricultural credit include restricted availability, cumbersome procedures when available, high interest rates and commissions, and short-term, just enough to cover the production cycle. Credit reform should include: (a) increased availability, not only through financial institutions but through other ways such as NGOs and cooperatives; (b) simplified credit procedures that farmers can easily understand; (c) longer term to cover beyond the production cycle so as to allow farmers to market their products when prices improve, which usually occurs a certain time after the harvest season. In addition, (d) credit guarantees should do away with the predominance of land, and explore whether group solidarity can be more widely applied (e.g. Grameen Bank of Bangladesh, Banco Solidario of Bolivia), perhaps with the backing of a trusted institution like a church or a NGO; (e) expedite credit procedures, so as to make inputs and money available in a timely manner; (f) structure credit so as to provide the necessary inputs at competitive prices, while limiting the money to the minimum necessary to pay for the indispensable labor or contract task, such as land preparation and harvesting.

#### **(3) Proposed Financial Assistance Improvement Plan: 1996-2010**

The problems of credit for the agricultural sector are basically to be dealt with by political and administrative decisions at the highest levels of government. These government measures should involve the lenders and the borrowers.

From the lenders side, the case of FOCAM (reforestation credit at 6% annual interest rate for up to 25 years) shows that political will can make accessible a special credit line for farmers. It appears that a yearly 6% is an affordable interest rate for smallholders, even under the current cropping pattern dependent on basic grain. However, these are highly subsidized interest rates in relation to the prevailing market interest rates. Hence, care should be taken to prevent that subsidized interest rates for financing the risky agricultural activities do not lead to unviability

of financial institutions. Interest rates have powerful effects on the economy, whereby a special interest rate below the prevailing market rates should be reserved for specific purposes. Perhaps, rather than subsidized interest rates, more beneficial to agriculture in general is the easy availability of soundly managed financial institutions serving the sector.

From the borrowers side, farmers are expected to gain increasing understanding of the credit operation through the activities in rural areas of such institution as Bancos del Progreso. Although agriculture is not being financed, beneficiaries of Bancos del Progreso receive a practical training in credit, which qualifies them to be subject of formal credit after completing the credit cycle of Bancos del Progreso. Such activities will improve the credit awareness of peasants, who will be able to better understand and use the limited credit opportunities available to them.

Consequently, peasants will benefit from political and administrative measures to encourage expanded operation of financial institutions in rural areas, even without involving direct financing of farming activities. On the other hand, members of cooperatives benefit from the guarantee provided by the cooperatives to access some credit lines. This is an additional benefit derived from farmers associated in cooperatives.

Beneficiaries of credit may have to earn their rights to credit by proving their creditworthiness. This may be done by a credit system structured in successive stages of larger and larger credit amounts, as borrowers pay back the previous loan. Alternatively, interest rates may be made flexible, and applying lower interest rates to borrowers who have proved to be creditworthy. In addition, group solidarity as a loan guarantee should be given serious consideration. Finally, mechanisms should be explored to extend Fondos de Garantía (Guarantee Funds) of the Central Bank to the agricultural sector.

### **5.3.5 Marketing Improvement Plan**

#### **(1) Situation of Marketing**

Most farmers in Block D did not market their products, presumably because they were mainly cooperative members who produced for family consumption on part of the land owned by the cooperative. The questionnaire survey indicated that many farms produced only for their own consumption. Among farmers who sold their products, predominating in Blocks A and B were the farmers bringing their products directly to the market, while those selling to intermediaries predominated in Blocks C and E.

Farmers' wives are in charge of marketing the excess production over that needed for family consumption. The marketed amount per person is limited to the amount each woman can carry on the basis of her muscular strength. Main destination markets for these women in



charge of agricultural marketing in the Jiboa River basin are San Salvador, Cojutepeque and San Martín.

## **(2) Issues in Agricultural Marketing**

Intermediaries, although frequently blamed for the exploitation of low-income farmers, may be performing useful roles, such as a provider of credit where no financial institution exists. Still, improved marketing presupposes elimination of intermediaries, as a way to increase the profit margin of producers.

The issues facing agricultural marketing include the physical aspect and the information aspect of marketing.

## **(3) Proposed Marketing Improvement Plan: 1996-2010**

A marketing improvement plan should deal with problems concerning the physical aspect and the information aspect of marketing.

The physical aspect refers to roads, transportation and cargo consolidation facilities. The road improvement plan, presented elsewhere, is a logical way to improve marketing. In the case of intermediaries, better roads will increase competition among them since many intermediaries are transport operators. Better roads will arguably increase traffic, bringing about a better transportation service in terms of higher frequency and lower cost, either for passenger or for cargo. This will benefit farmers' wives and daughters who are in charge of bringing farm products into the market. Another assistance to improve the physical aspect of marketing is to build storage and buildings to facilitate consolidation of small cargo ("centros de acopio"), which can give rise to a more efficient transportation of products.

The information aspect of marketing refers to timely collection and dissemination of market information, basically prices of products, in the different markets of the country. At present, DGEA collects wholesale prices in San Salvador and a few main cities, but timely dissemination is deficient. Ideally, as a long term goal, prices should be collected and immediately disseminated as farm gate prices, wholesale prices and retailer prices. This will help farmers to optimize their operations by timing the sale of their products according to market information.

As of October 1996, DGEA sought to implement a market information system covering the whole country. Then, the plan proposed here for the Jiboa River basin may be implemented by CENTA and make the information available to DGEA. The market information system is to be located in each extension agency, and the necessary equipment (data processing, communication and mobilization) is included in the technical assistance improvement plan. A decision should be made on whether the person to collect and disseminate the market information will come from DGEA or from CENTA.

Storage and cargo consolidation facilities are needed when CVPs begin collective marketing of

their production, which can be estimated to occur in the 1998-2000 period. These facilities are to be tentatively located in San Ramon, Verapaz, Rosario de La Paz and Santiago Texacuangos. The idea is to have one storage and cargo consolidation facilities for every four or five Municipios, but the number, the size and location of these facilities should be flexibly decided according to the implementation of road improvement plans and the progress in CVP activities.

<i>Cargo Consolidation Facilities</i>	<i>Beneficiary Municipalities</i>
San Ramon	Santa Cruz Analquito, San Emigdio, Paraiso de Osorio
Verapaz	Jerusalen, Mercedes La Ceiba, Santa Maria Ostuma, Guadalupe
Rosario de La Paz	San Pedro Nonualco, Santiago Nonualco, San Antonio Masahuat, San Pedro Masahuat, Tapalhuaca
Santiago Texacuangos	San Miguel Tepezontes, San Juan Tepezontes, San Francisco Chinameca

Storage and cargo consolidation facilities include the following components.

- Construction
- Weight scale 4 sets
- Forklifts and/or tractors 8 sets
- Communication equipment 4 sets
- Grain dryer 4 sets
- Light trucks (2 ton) 8 sets
- Pick-up 4 sets
- Motorcycle 4 sets

### 5.3.6 Farmers' Organization Improvement Plan

#### (1) Situation of Farmers' Organization

Farmers belonging to some kind of organization reached 80% in Block D, due to the presence of large cooperatives, but ranged between 22% and 30% in the remaining Blocks. Years of membership in organizations were the longest in Block D with 12 years, while being less than 10 years in the other Blocks.

Farmers in all Blocks except D wish to belong to an organization for the collective purchase of farm inputs, more than for the purpose of improving production or collective marketing. Farmers in Block D are dependent on intermediaries for the sale of their products, and therefore wish to belong to an organization for the marketing of their products.

Other than ISTA, which is the government institution in charge of agrarian reform cooperatives, the function of Agricultural Cooperative Division (Departamento de Asociaciones Agropecuarias) of MAG is merely to register agricultural cooperatives, without the capacity for cooperative promotion and education. However, the agrarian reform that promoted formation of cooperatives is considered by GOES as having completed its purpose.

Accordingly, ISTA, the institution in charge of the Phase I agrarian reform is reported to cease to exist after June 30, 1997, which is the deadline for agricultural cooperatives to pay up their land acquisition debt with a 70% discount if paid in cash. It is worrisome that agricultural cooperatives, at least most of them in the Jiboa River basin, cannot be regarded as being able to make on their own. A study shows that in a meeting held upon passage of the decree condoning 70% of the land acquisition debt, only 24 of 101 cooperatives were found to be capable of paying the debt.

## **(2) Issues in Farmers' Organization**

The broad conclusion that can be drawn from the questionnaire survey is that it is extremely difficult for each farmer individually to solve the myriad of problems facing small farmers. This underscores the need of small farmers to get organized, so as to take advantage of the strength of a group, especially if it is formally organized with the necessary legal support. However, farmers' organization by itself should not be viewed as an end. On the contrary, farmers' organization should be a tool or an instrument to pursue further goals, such as agricultural development or resource management.

Most farmers' organizations have generally been set up under inducement from outside influences, rather than under their own initiative and conviction. This implies that they may not be solidly constituted groups. Information and education on farmers' organization seem to be fragmented, and farmers frequently appear to be misled with high expectations in the initial stages, but often result in disappointments with these organizations.

The point is how to organize farmers. Initially, farmers may have to be organized for specific purposes, but subsequently farmers should be educated that a cooperative association provides multiple advantages to its members. Cooperatives are thought to be one of the most complete forms of farmers' organizations. Cooperatives are based on mutual trust and solidarity, and each member should behave and act for the common good. Thus, cooperatives may be difficult to apply to the strongly individualistic farmers. However, if farmers get to understand the advantages of cooperatives, this type of farmer organization can overcome difficulties pertaining to technical and financial assistance, marketing of products and purchase of inputs, as well as opening the possibilities for engaging in new farm enterprises and activities.

Although cooperative associations in El Salvador have been viewed as one result of the agrarian reform, farmers should be made more widely aware that cooperatives are not restricted

to agrarian reform, and interested farmers should be encouraged to join together to form a cooperative. This group of farmers should thoroughly understand the rights and obligations of each cooperative member. This implies a rather lengthy and continuous process of preparation and education. Even after a cooperative is organized, continuous assistance should be provided for the actual operation of a cooperative.

The need for a continuous cooperative education underscores the requirement for a strong government office in charge of promotion and education of agricultural cooperatives, probably set up as an office of CENTA or MAG. Such an office should provide assistance concerning cooperatives to independent farmers who are not beneficiaries of the agrarian reform. This requires passing a good Cooperative Law or updating and consolidating the existing legislation. For this purpose, consultants should be hired, or assistance should be actively sought from foreign governments which have proven track records on agricultural cooperatives.

### **(3) Proposed Farmers' Organization Improvement Plan: 1996-2010**

The purpose is to promote formation of agricultural cooperative associations among farmers of the Jiboa River basin. The plan to improve farmers' organization will be possible in practice only over the long run, after many political decisions are made, including the review, updating and consolidation of cooperative legislation and establishment of the necessary administrative structure. Small farmers face problems that are difficult to solve on an individual basis. If these small farmers get formally organized as a group, with the necessary legal support, then they improve the chances of solving their problems. Therefore, agricultural cooperatives are suggested as the farmer organization that can favorably deal with most of the problems of small farmers.

Cooperative education is a long term and continuous process, even under the most favorable conditions of members attitude and government support. It appears that the term "agricultural cooperative" has been frequently misused, and government support, even with the best of intentions, has been less than sufficient. These factors created suspicion among farmers concerning cooperatives, and the image of "agricultural cooperative" has been deteriorated. Therefore, prior to a full swing campaign to promote and strengthen agricultural cooperatives, a patient work is required to restore its image and to build up the trust of farmers.

A good basis to start with is the group of 10 farmers assisted by an extension agent (CVP), because of the experience of working in a group. Activities of CVP should be gradually expanded to encompass, in addition to production, collective purchase of farm inputs and collective marketing of products. As farmers realize the benefits of working in a group, organizing them formally into a cooperative, say by joining several CVP, can be done on a more solid basis as farmers will be better predisposed to work in groups. The step from CVP to cooperatives, or the graduation of farmers from CVP, means a significant advancement, since

cooperatives can hire their own technical assistance tailored to their specific needs, and extension agents will be freed to provide assistance to new farmers.

The above indicates that CENTA will have to be willing to assume a leadership role in farmers' organization, through the following activities.

- Continued formation of CVP: 1996-2010
- Expansion of CVP activities to input purchase and product sale: 1996-2010
- Review, update and consolidation of cooperative legislation: 1996-1998
- Intensified cooperative education: 1999-2010

### **5.3.7 Women's Organization Improvement Plan**

#### **(1) Situation of Women's Organization**

Women belonging to some kind of organization comprise less than 5% in Blocks A and C, between 5% and 10% in Blocks B and D, while reaching 17% in Block E. These organizations are either production oriented or church related. Years of membership in these organizations are 7.5 years or less.

For women, technical assistance was considered to be more necessary than financial assistance, but even so it did not surpass 32% (Block B). Financial assistance was not considered necessary at all in Block D. The need for financial assistance was usually related to the expressed technical need, e.g., if technical assistance was expressed to be needed for sewing, then financial assistance was needed to buy sewing machines.

#### **(2) Issues in Women's Organization**

Women's organization was viewed as a way to acquire new skills. Vocational schools and specific group training were expressed to be necessary to improve employment possibilities or earning abilities of women. Other needs for organization referred to improvement of living conditions. Some needs for organization referred to both economic and domestic aspects affecting women.

##### **a) *Improvement of women's economic role***

The economic role of women can be improved if, properly organized, they can receive technical and financial assistance that are needed to engage in production activities specific for women. These include dairy, poultry and vegetables, which can be sold in the market, thereby increasing the family income, or alternatively can be consumed to improve the family nutrition. These production activities require acquiescence and cooperation of men, in terms of the land where these activities can take place and some help in the marketing of outputs. According to the survey results, women are interested in food processing and preservation, which may become a cottage industry that contributes to family income or to family nutrition by making available a

greater variety of food throughout the year.

b) *Improvement of living conditions*

Women, if organized, stand a better chance to seek training to improve their living conditions. Interests were expressed in a type of cooking facilities that consume less firewood (“cocina Lorena”), as well as in learning sewing, handicraft skills and nutrition. These aspects can undoubtedly improve living conditions, but also have beneficial side effects in terms of additional income or favorable environmental effects (lower firewood consumption implies less degradation of forest).

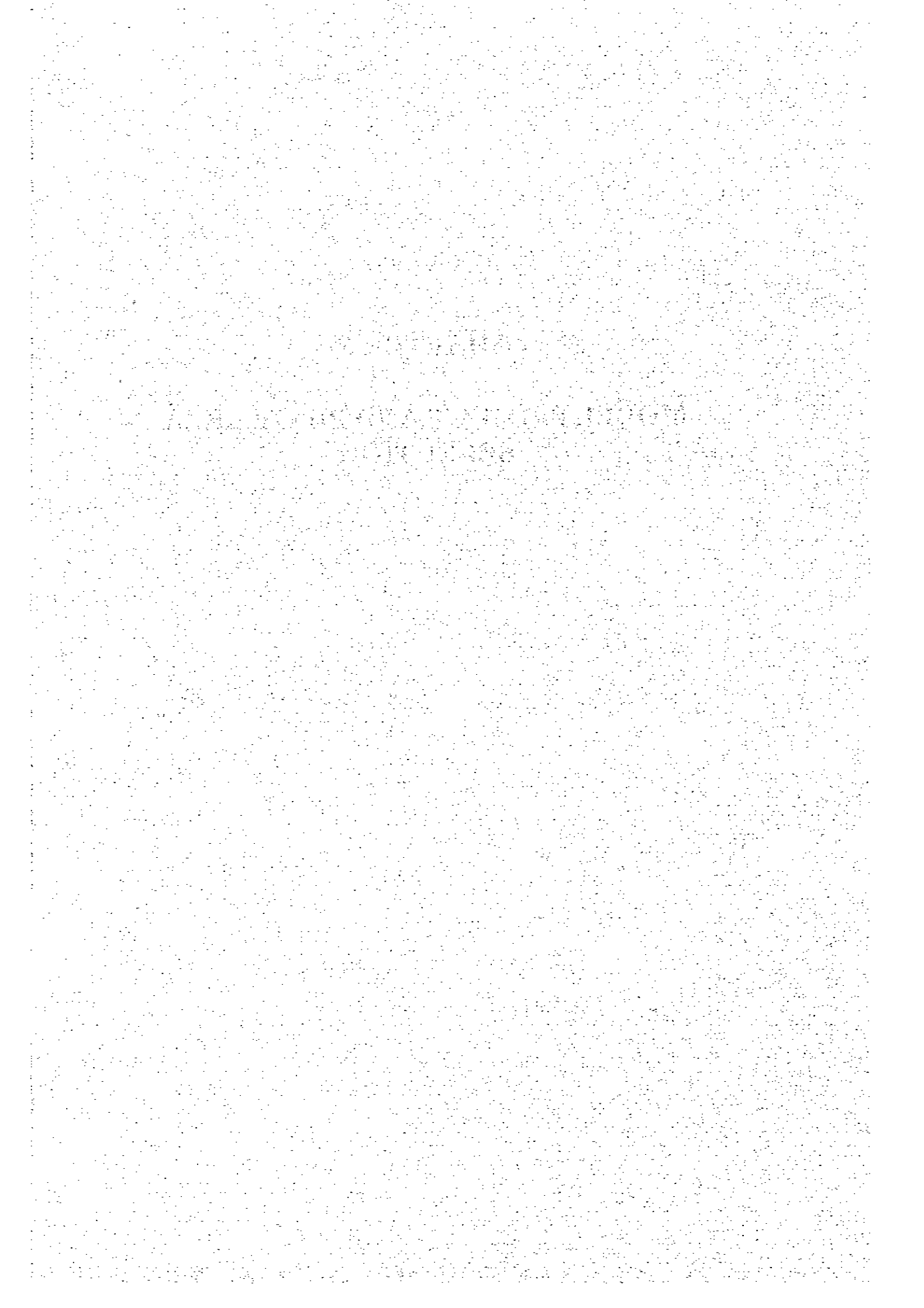
**(3) Proposed Women’s Organization Improvement Plan: 1999-2010**

The purpose is to promote organization of women in the Jiboa River basin. These activities are to be promoted by the agricultural extension service (CENTA) and ISDEMU. Accordingly, some office space and meeting rooms should be jointly used with CENTA offices, as already was described under Technical Assistance Improvement Plan. However, women’s organization will need exclusive spaces for group training in sewing and handicraft, bakery and food processing (cottage industry).

The facilities and equipment deemed necessary were described as expanded functions of extension agencies in Section 5.4.3 Technical Assistance Improvement Plan.

## **CHAPTER 6**

# **MODEL PROJECT AND PILOT AREA SELECTION**





## **CHAPTER 6 MODEL PROJECT AND PILOT AREA SELECTION**

### **6.1 Model Project Selection Policy**

#### **(1) Importance of Model Projects**

In accordance with the 5 Year Socioeconomic Development Plan (1994 - 1999), this project aims to build a solid agricultural foundation to improve agricultural production and revenues, basically through diversification and the effective and continuous use of natural resources. These would essentially entail the improvement or installation of infrastructures relevant to ① the development and extension of production techniques, ② the extension of financial assistance, ③ the formation of a farmers' group, and ④ the improvement of the distribution system. Because this project is very extensive, involving the introduction of various new concepts and techniques which are vital to its successful implementation, small scale model projects shall precede its execution. These model projects should be able to investigate for the proposed project, establish a support system, and conduct demonstration and extension activities to the farmers.

#### **(2) Model Project Selection**

An integrated agricultural development plan must take into consideration the standard of living of the farmers, farm household economy, and the farmers' agricultural skills. It is, therefore, significantly important to first of all construct infrastructures for basin conservation and agricultural development and conduct supporting projects that would promote these two pursuits. The selection of the model projects was based on the items below.

##### **1) Criteria**

The selection was based on the following 6 criteria:

##### **a) Criteria 1**

The project must be very economically effective, can generate benefits within a short term, must have an impact on farmers in neighboring areas, and must serve as a model for the agricultural development of other basins (Lempa River basin, San Miguel River basin).

##### **b) Criteria 2**

The project must be socially very effective and crucial to the socioeconomic conditions of El Salvador.

##### **c) Criteria 3**

A project whose implementation is faced with very few restrictions.

##### **d) Criteria 4**

A project that meets the farmers' needs indicated in the questionnaire survey results

**e) Criteria 5**

A project that meets the farmers' needs specified by the municipal mayors interviewed.

**f) Criteria 6**

A project that would generate greater benefits when combined with another, is not limited to basin conservation, but one that also endeavors to activate local economy.

**2) Method of Assessment**

**a) Assessors**

The project shall be assessed by both the Japanese and the El Salvador counterparts.

**b) Assessment Points**

Excellent (1)	=	4 points
Good (2)	=	3 points
Feasible (3)	=	2 points
Unfeasible (4)	=	1 point

**c) The criteria shall be given the following points by importance (see Table 6.1.1):**

criteria 1	=	0.2
criteria 2	=	0.2
criteria 3	=	0.1
criteria 4	=	0.2
criteria 5	=	0.2
criteria 6	=	0.1

**d) Model Project:**

The model projects shall be arranged by assessment points. The project with the highest points shall be given priority; in all, ten projects shall be given priority and carried out within a short term, from 1998 to 2000. The priority shall not be altered even if the project evaluated to induce internal revenues is within the priority list (see reference documents for details on project evaluation).

**3) Evaluation Results and Prioritized Development**

Table 6.1.1 shows the results of the evaluation. The 7 prioritized model development projects are as follows:

**Table 6.1.1****Project Evaluation**

<i>Project Names</i>	<i>Evaluation</i>	<i>Ranking</i>
1) Land Use Plan	4.9	14
2) Flood Control Plan	6.0	12
3) Afforestation Plan	7.7	2
4) Soil Conservation Plan	7.8	1
5) Water Management Plan	6.4	8
6) Farming Plan	5.6	13
7) Livestock Extension Plan	6.1	10
8) Inland Fisheries Plan	6.4	8
9) Agricultural Infrastructure Plan	7.1	6
10) Rural Infrastructure Plan	7.5	3
11) Land Tenure Improvement Plan	4.7	16
12) Technical Assistance Improvement Plan	7.5	3
13) Financial Assistance Improvement Plan	6.5	7
14) Marketing Improvement Plan	7.2	5
15) Farmers Organization Plan	4.8	15
16) Women's Organization Plan	6.1	10

- a) Basin Conservation Model Project Plans
- Afforestation Model Project Plan
  - Soil Conservation Model Project Plan
  - Water Management Improvement Model Project Plan
- b) Agricultural Development Model Project Plans
- Agricultural Diversification Model Project Plan (upstream and downstream basins)
  - Agricultural Production Improvement Model Project Plan (upstream and downstream basins)
- (Livestock development model project, inland fisheries development model project, agricultural infrastructure development model project, rural infrastructure development model project)
- c) Agricultural Support Group and Farmers' Organization Model Project Plans
- Agricultural Technology Extension Reinforcement Model Project Plan
  - WID Development Model Project Plan
- (The improvement of the financing system and agricultural distribution system shall not be considered as it requires time to materialize.)

If there are programs or projects that when combined with the aforementioned priority projects would make implementation more effective, these programs or projects shall be incorporated in the implementation plan without delay.

The model projects selected based on the criteria aforementioned are the basin conservation project, the agricultural development project, and the agricultural support project. Areas with a high agricultural development potential shall be selected as pilot areas in terms of agricultural sustainability, the importance of the model projects, and their feasibility in the area. The model projects shall be arranged according to the characteristics of the selected pilot area therefore.

## **6.2 Selection of Pilot Areas**

Model projects will be carried out in pilot areas to confirm the effectivity and promote the development of the proposed project. These pilot areas shall be either towns or villages selected based on the following 4 points: ① the area must be a farming area, ② highly in need of the project, ③ the implementation of the project must be highly feasible, ④ and the conduct of extension activities highly possible. Though the target year of the project is 2010, the selection of the pilot areas is based on the present situation due to the urgency of the model projects. Municipalities covering less than 20% of the basin area are excluded from the selection. Each block shall be graded from 1 - 3 by parameter, with 3 being the highest. The three all around highest ranking areas will be the pilot areas.

### **6.2.1 Agricultural Dependency**

It is necessary to select areas that will always be farming oriented as pilot areas. Evaluation shall be based on the number of farmers, dependency on farming according to the number of full time farm households, and present condition of farmlands.

#### **(1) Number of Farmers**

According to the 1992 census, the ratio of farmers to the economically active population ranges from over 75%, 50 - 75%, and less than 50%. Areas with a ratio of over 75% shall be given 3 points, 50 - 75% 2 points, and less than 50% one point.

#### **(2) Number of Full Time Farm Households**

Studies were conducted in Phase I to determine the number of full time farm households in the basin area. The rating for areas by the number of full time farm households is 3 points for areas with more than 60% full time farm households, 2 points for 50 - 60%, and 1 point for less than 50%.

#### **(3) Present Condition of Farmlands**

Agricultural land use was evaluated by slope gradient using the present land use map.

### **6.2.2 Necessity of the Project**

Areas in need of agricultural development should be selected as candidate pilot areas. The availability of rural infrastructure and natural resource conservation measures shall not be used as a criteria, since none of the areas within the basin have any. Evaluation shall be based on the farmers' desire for the implementation of the project, the present conditions of rural infrastructure, the degree of firewood utilisation which shall greatly influence natural resources conservation measures, and the dangers of erosion and inundation.

#### **(1) Farmers' Needs**

Areas having more than 60% of its farmers requesting erosion control measures, afforestation, flood control, irrigation, road improvement, and the organization of a farmers' association shall be graded with 3 points. Areas having 45% - 60% requesting farmers shall be graded with 2 points, while areas with less than 45% one point.

#### **(2) Present Condition of Rural Infrastructure**

Based on the 1992 census, the average electrification rate, water supply service expansion rate, and the rate of lavatories per area were calculated. Accordingly, areas with a ratio of over 65% shall be graded with 3 points, 40 - 60% with 2 points, and less than 40% with one point.

#### **(3) Firewood Utilization**

The results of the 1992 census were used to determine the number of households (%) utilizing firewood for fuel. Areas where more than 90% of the households use firewood shall be given 3 points, 80% - 90% 2 points, and less than 80% one point.

#### **(4) Dangers of Erosion and Inundation**

The slopes were classified into three categories using the slope classification map.

### **6.2.3 Feasibility**

It is very important that model projects be successfully implemented, as the results will influence the progress of the proposed project. The project's feasibility will be assessed based on the following criteria: ① the number of tenant farmers who are very passive towards erosion control and soil improvement measures, ② number of years conservation activities reflecting the interest and experience of farmers on farmland conservation have been implemented, ③ number of farmers who are members of farmers' associations that are well informed of the benefits of such organizations, and ④ the area's development potential.

Tenant farmers can only lease the lands for a year, hence their unwillingness to invest their money and time on land improvement activities. In view of the fact that not much participation can be expected from these farmers, 50% of the overall evaluation ratio shall be placed on criteria ①

above.

**(1) Number of Tenant Farmers**

Areas with more than 30% tenant farmers shall be given 1 point, 10 - 30% 2 points, and less than 10% 3 points.

**(2) Experience in Conservation Activities**

The number of years activities on soil conservation, afforestation, flood control, and anti-shifting cultivation practices are carried out in an area shall be used for evaluation. Areas with over 10 years of experience shall be given 3 points, 3 - 10 years, 2 points, and less than 3, 1 point.

**(3) Participation in Farmers' Associations**

The results of the questionnaire survey show that the number of farmers that are members of a farmers' association ranges from more than 40%, 0 - 40%, and 0%. Accordingly, areas with more than 40% membership shall be given 3 points, 0 - 40% 2 points, and 0% 1 point.

**(4) Development Potential**

An area's potential for development shall be assessed based on its water and land resources potential. Since Ilopango Lake and Jiboa River are unsuitable water resources, areas located within the Chorreron River basin or downstream basin of the Jiboa River where groundwater resources are abundant shall be given 3 points. Two (2) points shall be given to areas within E block where water quality is good. As to land resources, evaluation shall be based on the land use maps.

**6.2.4 Extensibility**

As previously mentioned, model projects will be implemented to diffuse and promote the effects of the proposed project in the basin area and nationwide. The extensibility of the project effects shall be assessed based on the number of beneficiaries and the applicability of the project to other areas. The accessibility of the area shall not be used as a criteria as the implementation of the model projects is expected to improve road conditions.

**(1) Population**

Based on the 1992 Census, areas with more than 7,000 population shall be given 3 points, 4,000 - 7,000, 2 points, and less than 4,000, one point.

**(2) Applicability**

To be able to aid in the promotion of this development project, model projects must be applicable in other areas as well. Urbanized or areas to be urbanized shall be given 1 point, areas cultivating special crops like coffee and sugar cane, 2 points.

### 6.3 Pilot Area Selection

Based on the results of the evaluation and as shown in Table 6.3.1, the districts selected as pilot areas are San Cristobal, San Pedro Masahuat, and San Antonio Masahuat. These areas are located in the upstream, midstream and downstream basins, and therefore represent the agricultural characteristics of these basin divisions (refer to the Annex for details). Also, in consideration of the importance of this project to environmental conservation, the Ilopango Lake vicinity, which is observed to suffer seriously from soil erosion, was selected as the pilot area for the conduct of the soil conservation model project.

**Table 6.3.1 Pilot Area Selection**

<i>Municipality</i>	<i>Agricultural Potential</i>	<i>Necessity</i>	<i>Potential</i>	<i>Applicability</i>	<i>Total</i>	<i>Ranking</i>
El Rosario	1.7	1.5	2.2	2.5	7.9	18
Jerusalem	2.0	2.8	1.7	2.0	8.5	15
Mercedes La Ceiba	1.3	2.5	1.5	2.0	7.3	23
Paraiso de Osorio	2.0	2.3	1.2	2.0	7.5	21
<b>San Antonio Masahuat</b>	<b>3.0</b>	<b>2.3</b>	<b>2.3</b>	<b>2.5</b>	<b>10.1</b>	<b>3</b>
San Emigdio	2.3	2.3	2.2	2.0	8.8	12
San Francisco Chinameca	2.7	2.8	2.0	1.5	9.0	9
San Juan Tepezontes	2.7	2.8	1.9	2.0	9.4	7
San Miguel Tepezontes	2.3	2.5	1.5	2.0	8.3	17
<b>San Pedro Masahuat</b>	<b>2.7</b>	<b>2.3</b>	<b>2.5</b>	<b>3.0</b>	<b>10.5</b>	<b>2</b>
San Pedro Nonualco	1.7	2.3	1.3	2.5	7.8	19
Santa Maria Ostuma	2.3	2.8	1.5	2.5	9.1	8
Tapahuca	2.7	1.5	2.3	2.5	9.0	9
Cojutepeque	2.0	2.0	2.2	2.5	8.7	13
Candelaria	2.3	2.0	2.4	3.0	9.7	6
El Carmen	1.7	2.8	2.5	3.0	10.0	4
<b>San Cristobal</b>	<b>2.3</b>	<b>3.0</b>	<b>2.5</b>	<b>3.0</b>	<b>10.8</b>	<b>1</b>
San Pedro Perulapan	1.7	1.8	1.9	1.5	6.9	26
San Rafael Cedros	2.3	1.5	2.4	2.5	8.7	13
San Ramon	2.7	2.3	2.5	2.5	10.0	4
Santa Cruz Analquito	2.3	2.5	2.2	2.0	9.0	9
Santa Cruz Michapa	1.3	2.3	2.4	1.0	7.0	25
Guadalupe	2.3	2.0	1.5	2.0	7.8	19
Santo Domingo	2.0	1.5	2.4	1.5	7.4	22
Verapaz	3.0	1.8	1.7	2.0	8.5	15
Ilopango	1.0	1.5	1.3	2.0	5.8	29
San Marcos	1.0	1.3	1.3	2.0	5.6	30
San Martin	1.0	1.5	1.9	2.0	6.4	28
Santiago Texacuangos	1.7	2.0	1.5	2.0	7.2	24
Santo Tomas	1.7	1.8	1.3	2.0	6.8	27

### 6.4 Formulation of Pilot Area Model Projects

Formulation of the model project was done making use of whatever cooperation can be had from farmers' organizations existing in the pilot areas. The composition of the model project was

made with due consideration of pilot area characteristics and in accordance with conditions that could significantly contribute to solving the problems prevailing in these pilot areas.

The development and extension of techniques in agriculture, forestry and livestock raising, the collection, analysis and dissemination of data necessary to farm management, and the participation of the farmers in the project are the three factors essential to the implementation of the master plan and the model projects. It is therefore important to reinforce the agricultural support system prior to the implementation of the project.

**(1) Pilot Areas Upstream: San Cristobal District, Verapaz District**

Irrigation is not possible in small scale farms because of the tremendous capital involved. Accordingly, how to increase these farmers' profit is a significant concern, as these farmers total 280,000 nationwide. In San Cristobal there are two agricultural cooperatives focused specifically on production. However, because they are so big, the model project shall be formulated for the agricultural cooperative in San Francisco, which has only 32 members but experienced in poultry farming. Through the reinforcement of the CENTA agricultural extension office in Cojutepeque, cash crops and swine production can be introduced. For the small scale farmers, the master plan primarily intended to introduce inland fisheries. But because of its unsuitability to the area, the project shall be conducted instead in Los Encoentres in the district of Verapaz.

**(2) Pilot Area Midstream: San Antonio Masahuat District**

The formulation of countermeasures for the small scale farmers on slope areas is very significant, as slope farming is conducted on about 60% of the 1,255,000 ha of cultivated land nationwide. An agricultural cooperative was established in San Antonio Masahuat in 1994 to help farmers affected by the agrarian reform system with financing, the construction of houses and the introduction of poultry farming. Since this area is close to the town, faces the main road and is considered effective as a demonstration farm, it was selected as a pilot area. The CENTA extension office in El Rosario shall be reinforced and introduce cash crops, soil conservation methods, and agroforestry in the area, including the improvement of the district and rural roads for a better farm management, and the introduction of poultry farming.

**(3) Pilot Area Downstream: San Pedro Masahuat District**

San Pedro Masahuat has the highest agricultural development potential in the basin. Its abundant groundwater reserves are hardly utilized however.

El Carmen is another district with abundant groundwater reserves, and groundwater development shall be conducted in this area to introduce irrigation. On the other hand, cash crop cultivation and cattle raising shall be introduced to small scale farmers in the downstream plain mostly covered by agricultural cooperatives and solely used for the contractual cultivation of sugarcane with sugar mills.



**(4) Lake Basin Model: Ilopango Lake Basin**

This area is quite hilly, has many slopes and is severely eroded. Therefore, to conserve the environment of the lake, soil conservation measures and reforestation (including agroforestry) shall be introduced.

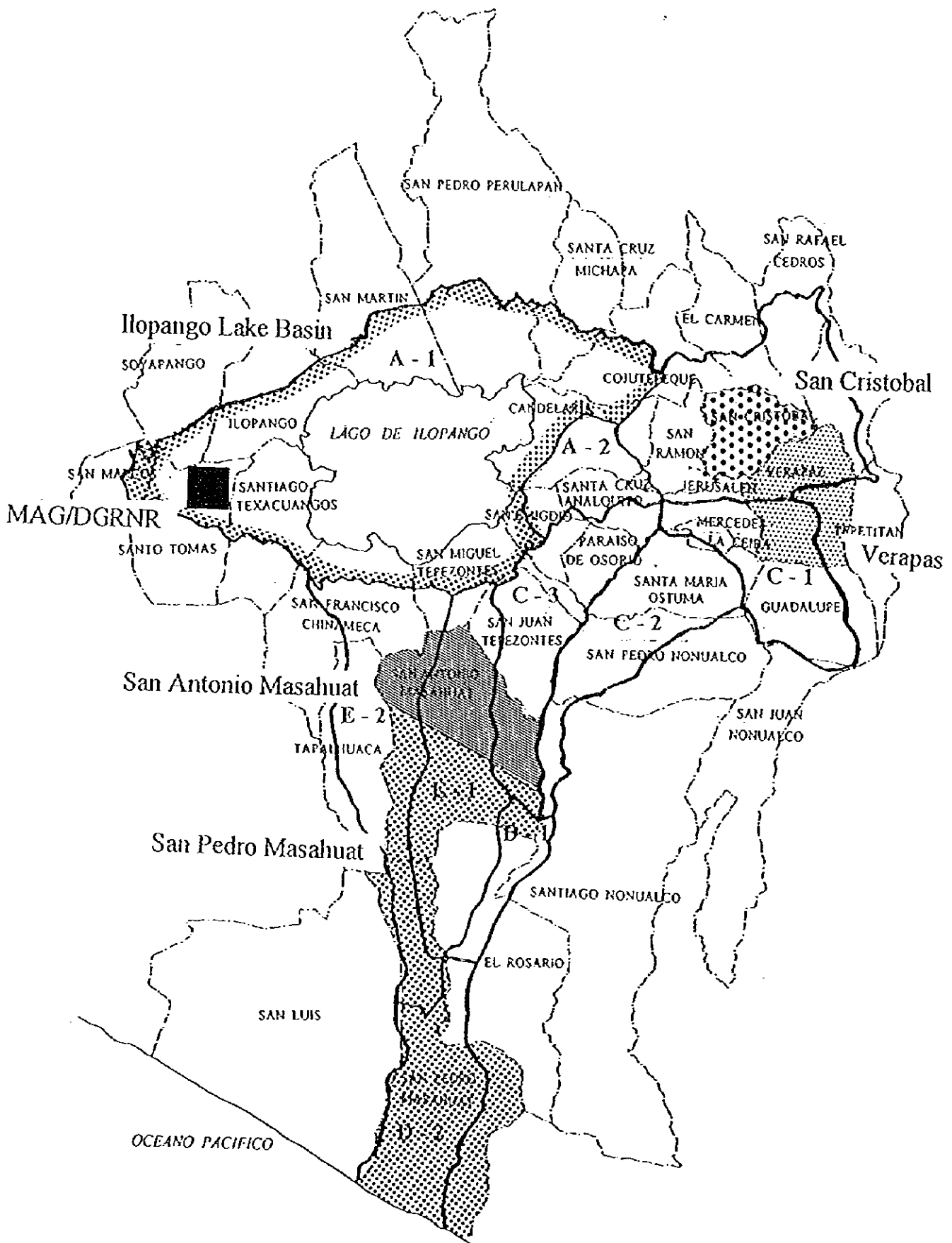
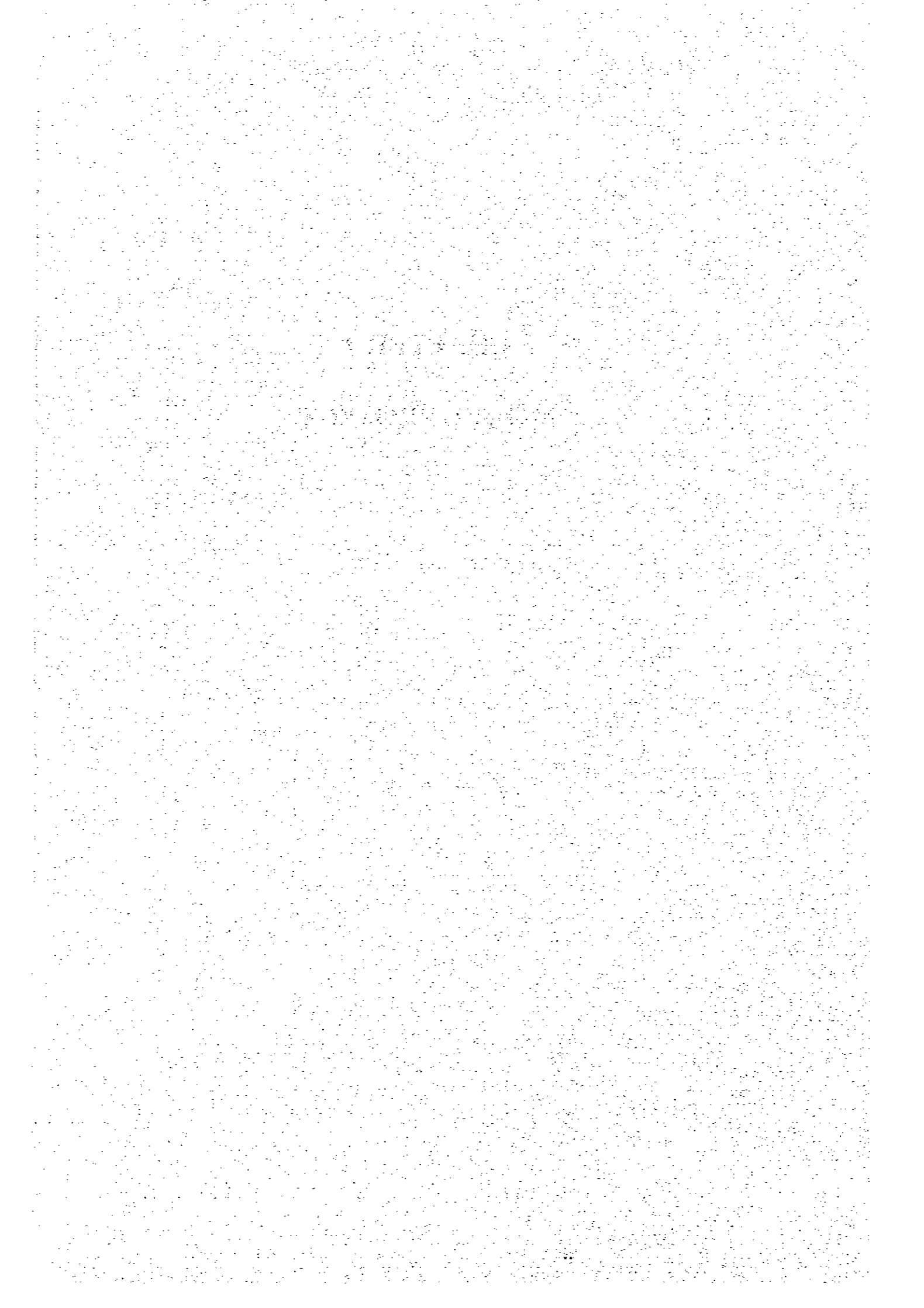


Fig 63.1. Pilot Area of Model Projects

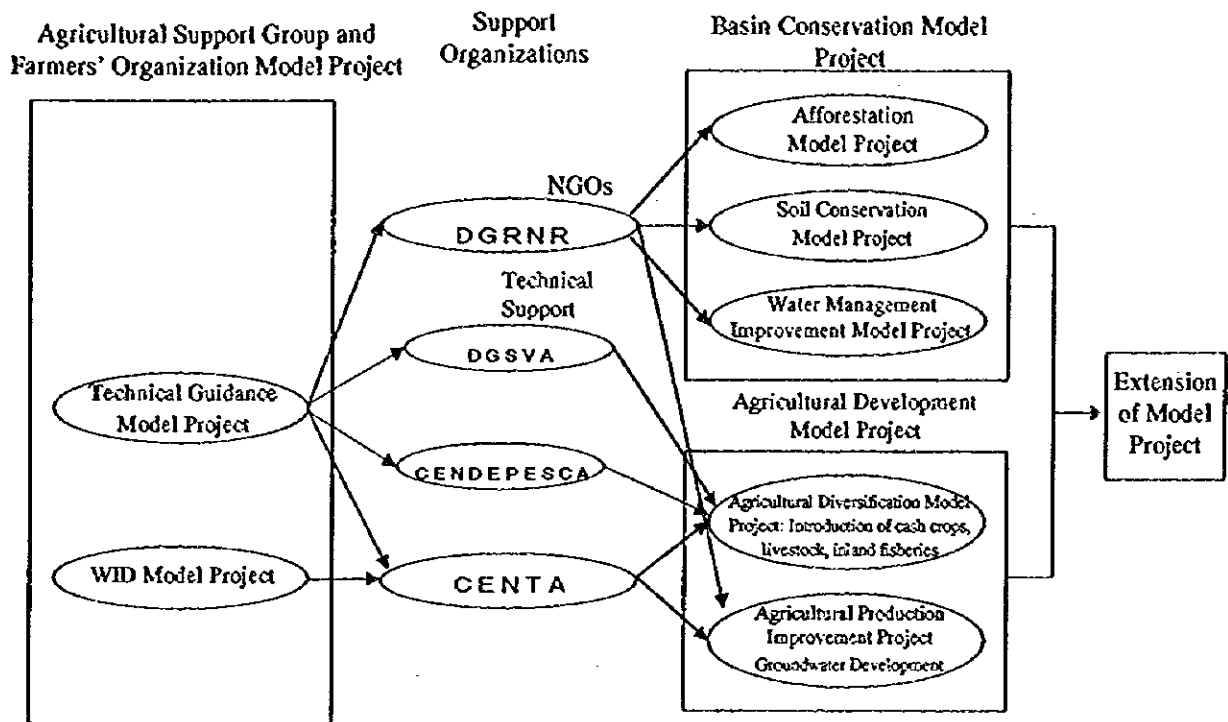
**CHAPTER 7**

**MODEL PROJECT**



## CHAPTER 7 MODEL PROJECT

The model projects are basin conservation, agricultural development, and agricultural support group and farmers' organization formulation. These model projects are respectively made up of projects or programs which shall be formulated for the selected pilot areas specified in Chapter 6.



### 7.1 Basin Conservation Model Project

#### 7.1.1 Afforestation Model Project

##### (1) Afforestation Technology Development Model Project

###### 1) Objective

This plan aims to conserve the basin environment by aggressively promoting reforestation through afforestation and agroforestry. By teaching the residents of the area sapling production techniques, it intends to make the area a base for the production of tree saplings. The plan shall provide excellent seedlings and extend whatever guidance is necessary in seedling production and reforestation activities.

###### 2) Contents

The nursery within the DGRNR compound shall be improved and expanded by constructing the following:

a) **Facilities:**

Administration building (chief room, office, laboratory, meeting, research and training rooms, library, storage, lavatory) garage, water supply system, nursery, germination floor, green house, potting shed, seed disposal area, storage, fertilizer house, irrigation system, generator house.

b) **Equipment and Materials:**

Equipment and materials for management, laboratory and research materials and equipment, equipment for survey, equipment and materials for tree seedling production, materials and equipment for extension activities.

**(2) Afforestation Extension Model Project**

1) **Objectives**

Reforestation shall be carried out to conserve the environment in the Ilopango Lake vicinity which is mostly made up of slopes and seriously eroded, and the Sepaquiapa and Tilapa river basins. The diffusion of afforestation and agroforestry techniques, as well as guidance in seedling production and planting shall be conducted.

2) **Contents**

A nursery shall be constructed and seeds suited to the characteristics of the area shall be provided for the production of tree seedlings.

a) **Equipment and Materials:**

Tree seedling production equipment and materials, materials and equipment for extension activities, and reforestation tools.

**7.1.2 Soil Conservation Plan**

**1) Soil Conservation Technology Development Model Project**

1) **Objectives**

This project aims to control soil erosion and conserve the environment in the basin. To be able to realize a stable agriculture, soil conservation techniques shall be developed, applied and diffused in the area.

2) **Contents**

The rehabilitation of the Analquito experiment and demonstration farm within the DGRNR property.

a) **Facilities**

Analquito demonstration farm: office, leveling of the land, construction of terraces, drainage canals, sabo dam, test facilities.

**b) Materials and Equipment**

Survey instruments and apparatus, rainfall gauge, triangular and rectangular weirs, soil runoff survey instruments and apparatus, mapping instruments, vehicles.

**(2) Soil Conservation Technology Extension Model Project (Ilopango Lake Vicinity)**

**1) Objective**

The soil conservation project in Cojutepeque River basin was used as a model for the conservation of the Ilopango Lake vicinity, which is mostly made up of slopes and seriously eroded. Soil conservation works, torrent works, and afforestation are planned for San Agustín where projects conducted by American NGO's are currently ongoing. By providing the necessary extension materials and equipment, soil conservation techniques shall be diffused in the area.

**2) Contents**

Facilities: Soil erosion prevention works (hillside ditch)

**7.1.3 Meteorological and Hydrological Observation System Improvement Model Project**

**1) Objective**

The equipment and instruments of the existing meteorological and hydrological observation stations shall be rehabilitated and some observation stations shall be constructed where necessary. All observation stations shall be installed with telemetry to monitor the conditions in Ilopango Lake and Jiboa River, reinforce the water management functions (in relation to groundwater use, floods, and drought) and the water quality analysis functions of the stations. The latter shall be improved by repairing the instruments of the existing water quality analysis laboratory to conduct the required boron and arsenic tests.

**2) Contents**

a) Meteorological Station : 7 (2 to be repaired and 5 to be constructed)

b) Hydrological Station : 6 (2 to be repaired and 4 to be constructed)

c) Groundwater Observation Station : 8 (all new)

d) Materials and Equipment : flow velocity gauge, data transmitter, personal computer for data management, groundwater monitoring instruments, water quality analysis equipment, vehicles

## **7.2 Agricultural Development Model Project**

### **7.2.1 Agricultural Diversification Model Project**

One of the important concerns of this project is the actualization of the policy involving the application of measures that would lead to an increase in the revenues of small scale farmers. And this can be achieved by establishing a diversified agricultural structure through the introduction of cash crops (vegetables and fruit trees), livestock raising and inland fisheries. Accordingly, the area shall be divided into hills and plains, and agricultural diversification shall be carried out in harmony with area characteristics.

Small scale swine production, inland fisheries and poultry farming are planned for the hilly areas upstream and midstream, while improvement of animal (mainly cattle, pigs, chicken) health services shall be promoted in the downstream plain.

Given this viewpoint, the following districts in the hilly areas upstream were selected for this model project:

- Swine production shall be introduced to the agricultural production association in San Cristobal where agricultural diversification is highly important;
- Inland fisheries shall be introduced in Verapaz where water use conditions are good and the demand for agricultural diversification is high;
- Poultry raising shall be introduced in San Antonio Masahuat.

In the downstream plain, an office shall be established for the much needed improvement of animal health services.

#### **(1) Agricultural Diversification Model Project Upstream**

##### **1) Swine Production Model Project (San Cristobal District)**

###### **a) Objectives**

Swine production shall be introduced as a second source of income to improve the living conditions of subsistence farmers, provide them with a stable supply of protein, and to effectively use the limited land resources in this slope farming area where productivity is low.

###### **b) Contents**

Introduction of swine production to produce piglets and meat for sale.

###### **• Facility Plan:**

- To improve the existing poultry farm (approximately 180m<sup>2</sup>): improvement of the feeding area, the installation of water supply and feeding facilities, excreta disposal facilities, and the drainage ditch.
- Introduction of swine production (100 pigs: thoroughbreds of Duroc and Landrace)



- 1 truck (4WD, 3 tons, diesel engine)

• **Technology Guidance Plan:**

The extension office of CENTA in Cojutepeque covers this area and shall provide technology guidance and extension activities.

• **Production and Marketing Plan**

Establish a 6 month fattening period and twice a year shipment; an annual production of 200 heads. The animals shall be taken to Cojutepeque City, which is 6 km away from the area, and to the San Salvador metropolitan area.

c) **Present Conditions in the Pilot Area**

The San Francisco district is 3 km southeast of San Cristobal and in the southwest upstream basin area of the Jiboa River. It is located on a hilly area where the slopes are planted with maize and beans. The agricultural cooperative (32 members) in San Francisco failed in its attempt to establish poultry farming. Studies are currently being carried out on how to effectively re-use the poultry farm the cooperative has established. The farm has electricity and the water supply facilities installation works were scheduled to be completed in January 1997.

2) **Poultry Farming Model Project (San Antonio Masahuat District)**

a) **Objectives**

This project intends to eliminate forced cultivation on slopes and to introduce broiler poultry farming as a second source of income, to improve the living conditions of subsistence farmers and provide residents with a stable supply of protein.

b) **Contents**

• **Facility Plan:**

- Construction of a poultry house (total floor area: 140 m<sup>2</sup>, feeding area: 20 m<sup>2</sup>)
- Electrical installations (300 m)
- Water supply construction works (600 m)
- Pick-up trucks

• **Technology Guidance Plan:**

The extension office of CENTA in El Rosario shall fully extend guidance from the supply of chicks to the marketing of the products.

• **Production and Marketing Plan**

A total of 3200 birds shall be marketed annually (8 times), mainly to the surrounding area.

c) **Present Condition of the Pilot Area**

This project shall be conducted in El Socoro, which is 2 km north of San Antonio Masahuat. This district is located in a jagged mountainous area forming steeply sloped valleys on the eastern

and western sides. The farmers belonging to the "Cooperative 30 de Octubre", which is made up of 64 members, farm on the hill across the valley. A soccer field exists before the hills that encloses the valley, and afforestation shall be conducted on the northwest side of this area. The farmers of the agricultural cooperative cultivate grains on the slope which are not very productive. To help alleviate the tight economic conditions of the farmers due to low grain production, the project intends to introduce poultry farming.

### 3) Inland Fisheries Model Project (Verapaz District)

#### a) Objectives

This project intends to improve the economic conditions of the subsistence farmers in the area by introducing inland fisheries (fresh water fry) as a second source of income. This is also seen as a means of establishing a stable supply of protein.

#### b) Contents

- Model Fry Breeding Facilities Plan
  - Consolidation weir for the sand spillway of Verapaz River (1.2m high, 15m long)
  - Pumping facilities (diesel engine, 200 l/min pump capacity, 5 m pumping depth)
  - Breeding pond (2000m<sup>2</sup>, gravity drainage system directed toward the Verapaz River)
  - Administration office cum storage (floor area of 20m<sup>2</sup>)
- Technology Guidance Plan

Technology guidance shall be extended to the area through the extension staff of the fisheries development center of CENDEPESCA. The technology involved in the breeding of Tilapia and fresh water shrimps shall be introduced in the area.

#### c) Present Conditions in the Pilot Area

The pilot area, Los Encoentros, is located about 2 km northwest of Verapaz, at the confluence of the Verapaz and Borbollon rivers. Verapaz River has a stable discharge all year round and water quality is considered to be safe in view of the crabs and shrimps that exist in the river. The farms on the site for the construction of a breeding ground, which is on the left bank of the Verapaz River, belongs to ADESCO which is made up of two communities: El Carmen (35 households) and El Limon (30 households).

### (2) Agricultural Diversification Model Project Downstream

#### 1) Animal Health Services Improvement Model Project

##### a) Objectives

This project is intended for the middle and small scale cooperative farms in the downstream basin of Jiboa River. By improving the health services for livestock (mainly cattle, chicken and pigs), the plan aims to improve livestock production.

Although the extent of the services vary, large scale farms independently receive livestock health services from NGOs. On the other hand, the adverse conditions in the medium and small scale farms are brought about by the absence of health services and the farmers' ignorance of measures to control livestock epidemic as well as artificial insemination. It is therefore very important to improve the health services for livestock in these areas to improve productivity.

**b) Contents**

• **Operation and Maintenance of Facilities**

This project shall be implemented by the DGSVA. The agency shall introduce vaccination, artificial insemination, and the techniques involved in examining and diagnosing animal diseases. The money gained from these activities shall be partly used to cover the operation and maintenance cost.

• **Operation of this Project and Required Number of Staff**

• **Operation**

- Education and training of farmers into livestock raising on livestock health control
- Provision of excellent semen and training on artificial insemination
- Livestock diagnosis
- Organization of a workshop to train farmers to extract samples from infected animals, and to send the samples to the DGSVA laboratory in Matazano.

• **Personnel Disposition**

- 1 veterinarian or technician qualified to conduct artificial insemination
- 1 janitor

Negotiations shall be conducted with the cooperatives (Achiotala Cooperatives Farm) in the lower river basin for the use of a part of their farm. The negotiation shall be proposed during the cooperative general meeting.

• **Required Facilities and Equipment**

• **Land (500m<sup>2</sup>)**

Most of the small and medium scale farms in the lower basin have agreed to contribute a plot of land for the conduct of the project. This agreement, however, must be approved officially by the general assembly.

• **Buildings and Facilities**

- office and training room (room capacity: 20 - 30 persons)
- storage room for medicinal supplies
- crushpen (simple structure)

• **Required Materials and Equipment**

- large refrigerator, cattle and pig castration instruments, medicine cabinet

## **7.2.2 Agricultural Production Improvement Model Project**

### **(1) Production Improvement Model Project Upstream**

#### **1) Slope Farming Improvement Model Project**

##### **a) Objectives**

- Improvement of transportation measures for agricultural implements and products
- Introduction of poultry farming to improve the income of subsistence farmers in slopes
- Improvement of farm management techniques with due consideration of soil conservation measures
- Creation of job opportunities
- Stable supply of protein to the local farmers

##### **b) Contents**

- Construction of a road within the agricultural cooperative's site
- Construction of side ditches and conduct of soil conservation works
- Introduction of poultry raising model project

##### **c) Present Conditions in the Pilot Area**

This project shall be conducted in El Socoro, which is 2 kilometers from the upper northern side of San Antonio Masahuat. This district is located in a jagged mountainous area forming steeply sloping valleys on the eastern and western sides. The farmers belonging to the "Cooperative 30 de Octubre", which is made up of 64 members and owns 400Mz (only half is actually utilized), farm the hill across the coast over the valley.

The agricultural cooperative was established in 1994 to help the farmers with financing, the construction of houses, and the introduction of poultry farming. The farmers of the agricultural cooperative cultivate grains on the slopes which are not very productive. To help alleviate the tight economic conditions of the farmers due to low grain production, the project intends to re-introduce poultry farming.

### **(2) Production Improvement Model Project Downstream**

#### **1) Groundwater Irrigation Model Project**

Agriculture in the area is heavily reliant on rain water. To improve agricultural conditions, groundwater resources shall be utilized for irrigation. The irrigation of cultivated areas in the dry season shall improve production and product quality, and increase yield.

##### **a) Objectives**

The development of the Jiboa River shall be difficult both in terms of water quality and quantity. Sepaquiapa River, a tributary of Jiboa River, flows southwards from the western part of this area. The flow of this river in the rainy season is estimated at 2.4m<sup>3</sup>/sec, and only 170 l/s in the dry

season. However, the mountain area in the Sepaquiapa basin, south of Ilopango Lake, is estimated to be abundant in groundwater reserves.

Farmlands are not cultivated in the dry season due to the absence of irrigation facilities. Farmers owning these lands are compelled to work for other landowners during this time of the year as seasonal field laborers.

This model project will bring about the following:

- ① Shift to non traditional agriculture, agricultural diversification, and improved productivity through the introduction of irrigation technology and the installation of irrigation facilities.
- ② Improved standard of living as the farmers generate more income
- ③ Effective use of natural resources

b) Contents

The area covers about 120 ha and the project is estimated to benefit 49 farmers. The use of groundwater resources for irrigation would require the installation of groundwater production facilities, electrical and irrigation facilities. To effectively operate and maintain these facilities, the area shall be divided into 4 blocks, and each block shall be constructed with one well. Each block shall have the following facility layout:

- ① Groundwater Pumping Facilities  
Well construction:  
depth: 200 m  
diameter: 8"  
submersible motor pump (60HP)
- ② Electrical Facilities  
generator (60kw)  
control panel
- ③ Irrigation Facilities  
main pipeline (PVC  $\phi$  4" 2,500m)
- ④ 1 pump and generator house

c) Present Conditions in the Area

The district of El Carmen in San Pedro Masahuat was selected for the conduct of the small scale groundwater irrigation model project, to facilitate the effective diffusion of the techniques to other areas.

El Carmen is located 25km south-south-east of San Salvador, in between the national road CA2 and the by-pass road, on the plain on the left bank of the Sepaquiapa River (see Figure 5.1.6).

The project area is located in a tropical zone where the rainy season starts from May to October and the dry season from November to April. The cultivation of maize, beans and other basic grains are carried out in the rainy season, along with some vegetables for self consumption. Cultivation is not carried out in the dry season. There are 49 farming households in the project area, each owning about 1 - 3 ha of land.

According to the results of the geology and groundwater study conducted in 1996, with a well depth of 100m, about 370 l/m of groundwater can be used. The geology of the area is formed, in a descending order, by the San Salvador Formation, Cuscatlan Formation, and the Balsamo Formation. The project area is considered fertile as its surface is overlain with black-brown loam.

### **7.3 Agricultural Support Group and Farmers' Organization Model Project**

#### **7.3.1 Agricultural Technology Extension Reinforcement Model Project**

For the smooth conduct of this model project, the 3 extension offices of CENTA (Cojutepeque, El Rosario, Santiago Texacuangos), which supervise the area, and the natural resources bureau shall be expanded and strengthened. These offices and the bureau shall have to work hand in hand for the conduct of the extension of agricultural techniques, the activation of the WID activities, and the promotion of the project.

##### **(1) CENTA: Extension Reinforcement Model Project**

###### **1) Objectives**

The 3 CENTA extension offices supervising the pilot area shall be expanded and strengthened for them to effectively diffuse agricultural techniques and soil conservation methods, and introduce cash crops (including livestock) and agroforestry, in order to activate the agricultural system. Also, through these offices, the model project intends to encourage women's involvement in the manufacturing of agricultural products, by the conduct of training programs and the provision of relevant facilities, equipment and materials.

###### **2) Contents**

###### **a) Facilities:**

Expansion of the branches in Cojutepeque and El Rosario; merge the branch office in Santo Tomas with the branch in Santiago Texacuangos and expand the area to include an office, a training room, a storage and a garage.

###### **b) Equipment and Materials**

Provision of machinery required for cultivation and the conduct of simple soil conservation measures (hand tractor, small bulldozer, small backhoe, truck) to farmers; provide the extension

staff with vehicles, motorcycle, micro-bus for training, baking utensils (using sorghum as raw material), jam and sausage processing equipment, and sewing machine.

**(2) MAG-DGRNR: Project Promotion and Extension Model Project**

**1) Objectives**

The promotion and implementation of this model project shall have to be conducted by the farmers themselves. With the guidance of the MAG-DGRNR and CENTA, most of the soil conservation works, the construction of the demonstration farm road, scale irrigation facility installation works, the acquisition of machinery and materials, can be carried out by the town or the farmers' organization themselves. Even with large scale projects which should be conducted by the government, the terminal works should be conducted and supervised by the residents. It is therefore important to lend the farmers' group the equipment and materials necessary for the conduct of the design, supervision and implementation of the project.

**2) Contents**

**a) Facilities**

Installation of an office, garage (the headquarters shall be built within the DGRNR compound)

**b) Equipment and Materials**

Survey equipment, mapping equipment, computer, planimeter, office supplies, bulldozer, backhoe, concrete mixer, crusher, grader, roller, compactor, handbreaker, dump truck, truck, mobile workshop, vehicles, others.

Table 7.1.1 MODEL PROJECTS AND MODEL AREAS

PROJECT NAME	MODEL PROJECTS	SUPPORTING ORGANIZATIONS				MODEL AREAS				
		DGRNR	CENTA	CENDEPESCA	DGSVA	San Cristobal	Verapaz	San Antonio Masahuat	San Pedro Masahuat	Ilopango
Basin Conservation Model Project	Afforestation Model Project									
	Afforestation Technology Development Model Project									
	Afforestation Extension Model Project									
	Soil Conservation Model Project Plans									
Water Management Improvement Model Project	Soil Conservation Techniques Development Model Project									
	Soil Conservation Techniques Extension Model Project									
Agricultural Development Model Project	Meteorological & Hydrological Observation Systems Improvement Model Project									
	Swine Production Model Project									
	Poultry Farming Model Project									
	Inland Fisheries Model Project									
	Upstream Basin: Diversification Model Project									
	Agricultural Diversification Model Project									
	Improvement of Farming Methods and Introduction of Cash Crops									
	Livestock Health Services Improvement Model Project									
	Downstream Basin: Diversification Model Project									
	Improvement of Farming Methods and Introduction of Cash Crops									
Agricultural Production Improvement Model Project	Upstream Basin: Slope Farming Model Project									
	Downstream Basin: Groundwater Irrigation Development Model Project									
Agricultural Supporting Group and Farmers' Organization Model Project	Agricultural Support Improvement Model Project (CENTA)									
	Project Promotion and Extension Model Project (MAC)									
WFO Model Project	Assistance to Women's Organization Model Project									