

## **CHAPTER 5**

# **PROPOSAL FOR SECTORIAL DEVELOPMENT**



## CHAPTER 5: PROPOSAL FOR SECTORIAL DEVELOPMENT

### 5.1 AGRICULTURAL AND LIVESTOCK DEVELOPMENT

#### 5.1.1 Land Utilization

##### (1) Lands suitability

It is important that land utilization must be planned based in the suitability of the soils. At present, the land utilization in the Department of Jutiapa most of the lands suitable for agricultural and livestock purposes are already being occupied, so it is necessary to consider the possibility of improving the productivity capability of the soils. In the present study, the factors related to the suitability of the land utilization were selected according to the characteristics and topography of the soils. Those lands suitable for agriculture located on dry soils are dedicated to diversified crops, agriculture in wet soils are dedicated to cultivate rice, pastures, fruit trees, and coffee. The high priority attached to the development of agriculture on dry soils (soils classification: S2, S2-S3, N1(W), S3-N1) has been taking into account; total extension of those soils is 829.5 Km<sup>2</sup>.

At present, the area used for agricultural purposes surpass the surface of the suitable lands making it possible to say that there is an inadequate utilization of them. To improve agricultural productivity it is necessary to make good use of the land resources in order to exploit the lands in an optimal and efficient way. On the other hand, those non-suitable lands will be used for soils conservation.

##### (2) Determination of objectives for lands utilization

The objectives for lands utilization are focused on agricultural lands taking into consideration both the actual utilization of the land, mainly used for dry-soil agriculture, and the intensive use of lands in the future. The priority order adopted is as follows:

1. Dry-soil agriculture
2. Wet-soil agriculture (prone to suffer from floods)
3. Pastures
4. Fruits and coffee growing

##### 1) Dry-soil agriculture

Because dry-soil agriculture is the foundation of agricultural activities of the Department, land utilization for dry-soil agricultural purposes must be given a high priority; as a consequence, the soils classified as S2 and S2-S3 with a surface of 379.0 Km<sup>2</sup>

will be used for that purposes. However, diversification of agricultural activities should be also considered.

In the unit S3-N1(T,P) which included lands which are unsuitable for dry-soil agriculture, where possible an intensive exploitation for development of dry-soil agriculture and suitable will be planned by making equipment works with a production infrastructure.

Regarding dry-soil agriculture which has been partially carried out at present inland considered as unsuitable like unit N1-N2(T,P), actual surface will be kept. But, in areas with piedmonts like units S3-N1(T,P) and N1-N2(T,P) measures for soils conservation must be taken.

Also, one part of unit N1(W) where installation of an adequate irrigation and drainage system is possible, dry-soil agriculture is planned.

The actual surface dedicated to dry-soil agriculture is larger than the surface of lands suitable for that purpose. Thus, it can be said that in practical terms, there is no chance of widening that surface; instead, more importance must be given to an intensive lands exploitation by means of introduction of irrigation systems, improvement of the cultivation patterns, introduction of new crops, etc.

2) Wet-soil agriculture (prone to suffer from floods)

Lands suitable for wet-soil agriculture are considered to be within unit N1(W) with a surface of 106.5 Km<sup>2</sup> which is the total surface of this unit according to the topographic factors. Specially, during the rainy season, the lands of this unit are not suitable for other purposes but for wet-soil agricultural purposes due to a deficient drainage caused by the presence of compacted clay. For that reason, one part of the mentioned unit utilized for pastures and is not used for agricultural purposes, will be developed for wet-soil agricultural purposes. But drainage improvement must be carried out in the areas most prone to suffer from floods.

3) Pastures, fruits, and coffee

Lands for pasture, fruits and coffee will be planned for those land areas unsuitable for dry-soil agriculture like units S3-N1(T,P) with a surface of 344.0 Km<sup>2</sup> and N1-N2(T,P) with a surface of 1,270 Km<sup>2</sup>. However, for diversification of the agricultural activities some parts of units S2 and S2-S3 will be used for those purposes.

Also, because the units S3-N1(T,P) and N1-N2(T,P) are mainly lands prone to suffer from erosion, soils conservation must be carried out combined with agricultural methods for conservation through the introduction of permanent crops.

#### 4) Forests

From the forestal coverage of the Department only 145 Km<sup>2</sup> remain; these area represent only 4.5% of total surface of the Department. The presence of forest is extremely important for the conservation of the biological diversity, prevention of soils erosion, formation of water sources, etc. That is why it is necessary to preserve the still existing forest and those forestal lands must be kept to be used for that sole purpose even though they may be suitable for other purposes. Specially, the mountainous rain forests and mangrove forests which are targeted to be used for forests conservation in order to protect the ecosystem.

Also, unit N2 with a surface of 937.0 Km<sup>2</sup> corresponding to unsuitable land for dry-soil agriculture and unit N1-N2(T) with a surface of 161.0 Km<sup>2</sup> which is unsuitable for other purpose but fruits and coffee growing will be planned within the land utilization for forests. On the other hand, reforestation for firewood production, construction wood, etc., will be promoted in units S3-N1(T,P) and N1-N2(T,P). However, when these types of land can not be found around the towns, unit N1-N2(T) will be used. For its implementation, it will be necessary to consider what measures must be taken for prevention of soils erosion.

#### 5) Distribution of Lands According to their Utilization

The planned distribution for each land classification unit is as follows:

Land Unit	Dry-land agriculture	Wet-land agriculture	Pastures	Fruit trees and coffee	Forests
Surface					
S2 38.5Km <sup>2</sup>	85 %		10 %	5 %	
S2-S3 340.5Km <sup>2</sup>	85 %		10 %	5 %	
S3-N1(T, P) 344.0Km <sup>2</sup>	40 %		40 %	10 %	5 %
N1(W) 106.5Km <sup>2</sup>		50 %			
N1-N2(T, P) 1,270.0Km <sup>2</sup>	5 %		35 %	5 %	5 %
N1-N2(T) 161.0Km <sup>2</sup>					100 %
N2 936.5Km <sup>2</sup>					100 %

Note : - In the land surface of unit N2 lands for other uses like urban uses, lakes, rivers, etc. is not included.  
 - Where the distribution percentage is lower than 100%. it means that the rest of the land is covered by bushes and is unusable.

### (3) Planned surface to be utilized

The planned surface to be used according to their utilization is as follows:

Land Utilization	Actual Km <sup>2</sup>	%	Pro- jected Km <sup>2</sup>	%
Agricultural lands	1,212.0	37.7	1,313.4	40.8
Dry-soil agriculture (with irrigation)	503.8 (33.5)	15.7 *(6.6)	523.2 (190.2)	16.2 *(36.4)
Wet-soil agriculture	13.2	0.4	53.3	1.7
Pastures	660.0	20.5	620.1	19.3
Fruit trees and Coffee	35.0	1.1	116.8	3.6
Forests	145.0	4.5	1,178.2	36.6
Bushes and w/o use	1,840.0	57.2	705.4	21.9
Other uses	22.0	0.7	22.0	0.7
<b>Total</b>	<b>3,219.0</b>	<b>100.0</b>	<b>3,219.0</b>	<b>100.0</b>

Note : - Lands for other uses like urban uses, ponds, rivers, etc., are estimated that have no effect on the plan from the socioeconomic point of view

- The symbol "\*" means the proportion in the total agricultural lands

### 5.1.2 Agricultural and Livestock Production Plan

The agricultural and livestock production which is the nucleus of the departmental economy is vulnerable and farmers in general have very low incomes.

Due to the fact that restricting factors related with the agricultural and livestock production are entwined in a complex way, it is critical to take into consideration physical and socioeconomic conditions when planning an improved agricultural and livestock production system.

#### (1) Agricultural exploitation

It is a basic fact that sowing is made according to the suitability of the land. In this sense, the pivot of the agricultural production is basic grains. Also, in order to diversify agricultural production and improve the farmers' income level, it is being planned the introduction of vegetables and fruits.

1) Production

From the point of view of securing the supply of food products and cattle feed, cultivation of basic grains will be developed centered in similar crops being cultivated at present. Also, considering the conservation of agricultural soils, coffee and fruits will be introduced for their cultivation on the hill sides. Because the introduction of these crops will take long years before good yields can be obtained, the agricultural exploitation scheme and support to be given during the non-crop period will be analyzed.

To improve the soils productivity, it is not only necessary to introduce inputs but it is also important to improve the productive capability of the agricultural lands. In consequence, an increase in the unit yield must be achieved by actively introducing the crops rotation system and soils conservation practices.

2) Crops selection

Because there are antecedents of cultivation and exportation of vegetables, this is also a promising sector in the future. Introduction of crops will be analyzed considering not only Guatemala City as a market but also El Salvador and the United States. In the same way, exploitation of fruits must be carried out having in mind the same aims as with vegetables.

3) Crops rotation

As much as it is possible, irrigation will be introduced in order to intensify the utilization of agricultural lands and achieve the conversion towards commercial/exportable crops during the dry season. Also, it is important to propose a crops rotation which fit within the topographical conditions of the Department.

On the hill sides, due to their topographic conditions it is really difficult to irrigate, that is why sowing is made only during the rainy season. Associated crops like corn, kidney beans, and sorghum are very common in these areas. Within the plan, besides these basic grains, the introduction of fruit trees is being considered as a way to prevent erosion of the soils and to provide farmers with a stable income.

On the plains, lands are potentially irrigable and the agricultural and livestock production is established in both case of lands with and without irrigation.



At present, in these irrigated areas the cultivation system consists in the production of basic grains during the rainy season and vegetable during the dry season. In the future, in order to increase income levels, production of improved seeds of corn and kidney beans is being proposed.

To optimize the utilization of irrigation waters, the production of seeds must respond to the market conditions. Also, rotation cultivation of vegetables is also recommended to prevent exhaustion of the soil resources and improve the natural fertility of the soil.

On the other hand, single-crop farming of basic grains is very common in areas without irrigation and vegetables growing after harvesting the kidney beans is proposed.

Additionally, coastal zones which run between the Central American Highway 2 and the Pacific Ocean shore show different climatological conditions from the rest of the Department and cattle raising is very extended. In those zones, another type of crops rotation is proposed.

In the development areas with irrigation, the diversification of crops is proposed by cultivation of vegetables in order to obtain a higher income level for farmers, so long as their production responds to the ever changing market conditions; in those areas without irrigation, where single-crop farming of corn and sorghum is common, introduction of fruits trees cultivation in pastures is recommended as they are not productive during the dry season.

#### 4) Types of agricultural exploitation

Most of the small farmers raise cattle like cows and pigs, but extensive exploitation predominates. Therefore, a rational exploitation of the labor force will be recommended trying to introduce the joint exploitation of dry soil agriculture and cattle raising.

The farm model has been selected considering size and tenancy of the land within the Project Area, taking as a reference the records of DIGESA and ICTA.

The following four model types have been formulated:

<u>Model</u>	<u>Farm Land (ha)</u>
1	2.0
2	5.0
3	10.0
4	20.0

Model 4 is applied only to the plain coastal area.

5) Institutional services

To achieve an increase in the agricultural production, the institutional agencies have carried out cooperation programs for technical and financial assistance. Taking into consideration these on-going programs, measures for improving agricultural and livestock production will be proposed. In particular, considering that the improved seeds become the base for increasing agricultural production, emphasis is given on research and extension of technologies for reproduction of certified seeds and distribution of them to the farmers.

(2) Livestock exploitation

Adequate supply of milk is targeted for the Department together with a significant increase in meat production. Special attention will be given to the rational lands exploitation by small and medium farmers.

1) Milk production

In order to achieve a self-sufficiency in the production of milk, the promotion of reproduction of improved cattle varieties will be encouraged. Because there is a low productivity of milk and limited land resources, the local number of cattle heads existing at present should not be increased. However, local cattle raising within the Department has helped the small and medium farmers because cattle is quite resistant to adverse conditions.

Therefore, improvement of the local cattle must be considered aiming to increase milk production, while keeping the natural favorable characteristics. To improve the productivity of local cattle, it must be substituted by breeding it with other varieties.

2) Meat production

When intensifying agricultural and livestock production, rational and efficient exploitation of

limited land resources must be taken into consideration; within this context, in the future Livestock Development Plan, raising cattle for meat production must be present. As a consequence of intensive meat production, there will be a need to compensate the total deficit in the meat supply in the Department. Additionally, such increment in the meat productivity must be adjusted to the conditions of the small and medium-scale producers. With this purpose, the idea of a swine industry as meat production activity is introduced as the most promising idea for the Department.

### 3) Development concepts

To improve the livestock production in the Department, the following measures must be taken:

- Program for diseases and health control for cattle. Ideally the extension services must be given through DIGESEPE; also, veterinarian laboratories and DIGESEPE staff must be strengthened.
- Improve the quality of the varieties in the Department through the Reproduction Centers to be established in the Department. In these centers, appropriate breeding systems can be used in order to obtain good varieties.
- Establish livestock markets operating on a regular basis with scales at the municipalities heads. This would stimulate livestock producers to raise healthy animals of good quality.
- Small mills for the production of cattle feed should be established at the municipalities heads. These mills should use the raw material available locally, in such a way as to reduce feeding costs and, as a consequence, reduce the prices to the consumers.
- Promotion of intensive feeding systems which should be part of the strengthening program for extension services of DIGESEPE.
- A special emphasis should be given to the development of low income farmers by means of the promotion of the cooperatives activities.

By establishing the Breeding and Reproduction Improvement Center, the following projects will be implemented for small and medium scale producers. These projects will be easily administrated by

DIGESEPE, because they already have the "Bolsas Avícolas" Project.

- a. Integrated Swine Production Project
- b. Double-Purpose Goats Project
- c. Expansion of the existing "Bolsas Avícolas" Project
- d. Rabbits Promotion Project
- e. Promotion of the Cultivation of Mojarra-fish Project

### 5.1.3 Agricultural and Livestock Infrastructure

In the Department of Jutiapa where there is a clear distinction between the dry and rainy seasons, crops cultivation depends on the rainfall and the agricultural and livestock production varies according to the distribution of the rainfall.

In the lands without irrigation, cultivation during the dry season is not practiced allowing them to become deserts. In such circumstances, an stable irrigation water supply is an important factor for expansion of the agricultural and livestock production. A special emphasis will be given to the equipment of the irrigation system within the development of the agricultural and livestock infrastructure.

#### (1) Development concepts

With the exception of the municipality of Asunción Mita and the costal zone of the Pacific Ocean, most of the lands cover mountainous zones with significant undulations. From that fact it can be deduced that the irrigation method must be established based on basic studies of topography, climatology, hydraulic, soils characteristics and mechanics, and cost/benefit ratio.

#### 1) Direct catchment from rivers and conduction by gravity

From the point of view of minimizing the initial investment and the works' operation and maintenance expenditures, the most adequate method is the direct catchment of the rivers waters and their conduction through gravity. The restraining factor for the utilization of this method is the scarce availability of water resources; among the river systems, only the Paz, Ostúa, and Atescatempa rivers and some of their tributaries have enough water flows to be used for irrigation purposes. From these river systems, the Ostúa river, and its tributary the Pululá river, and the Atescatempa river have diversion dams of the state

managed irrigation unit. Thus, there is not any other alternative but develop the Montúfar sector (catch irrigation waters from the Paz river) and the Alto Mongoy sector (catch irrigation waters from the Mongoy river). For both sectors, DIRYA has formulated irrigation (and drainage) projects with the construction of facilities for the former and rehabilitation for the latter.

2) Dams and reservoir construction according to local characteristics

The construction of dams and reservoirs will be made in the rivers basins of low water flow during the dry season but offer the possibility of effective water storage during the rainy season. The locations proposed will be limited by the conditions of topography, soils mechanics, distance to the benefitted zones, etc. The initial investment is more costly than the intake and pumping works, but its advantage is on the operational and maintenance side due to its distribution system by gravity.

3) Catchment of underground waters by pumping

In general terms this method is disadvantageous due to its elevated costs for operation and maintenance of the pumps; before using this method it is required to carry out an economic analysis to assess the benefit and costs and make a survey among the farmers about its acceptability. Being lower the initial cost for the works, this method can be recommended to be used in lands where the pumping height is lower. This method is being used in the state operated irrigation unit of Atescatempa and the mini-irrigation units.

4) Small scale irrigation

The development of small scale irrigation systems looks promising in Jutiapa, and, at present, there are enough projects and ideas concerning mini-irrigation and construction of small reservoirs. In the irrigation system, the direct catchment of the waters from the rivers or streams and their distribution by gravity is more economical than the one using underground waters by pumping.

5) Multiple-use dam

In the "Irrigation and Drainage Master Plan" elaborated by DIRYA it is proposed the construction of a multiple-use dam. After analyzing the economic aspect, the irrigation system will be included as a component of the multiple-use dam.

(2) Proposed areas for agricultural and livestock development and selection of the water catchment method

An adequate planning of the irrigation system will be prepared at a local level for lands included within the 46,000 ha suitable for agricultural and livestock development.

A revision of the irrigation system for each zone according to their topography, soils mechanics, soils characteristics, land utilization, water flow availability, agricultural and livestock practices, and level of infrastructural equipment. Table 5.1.1 shows information about the areas with potentiality for agricultural and livestock development and the irrigable area of each zone.

(3) Irrigation and drainage projects

1) Direct catchment from the rivers

The projects which catch groundwater from the rivers are more viable from the point of view of the low cost of the civil works and their operation and maintenance, besides the technical aspects like catchment and constant supply of irrigation waters. Thus the following projects are presented:

- a. Santa Catarina Mita Irrigation Project
- b. Asunción Mita (I) Irrigation Project
- c. Atescatempa Irrigation Project
- e. Montúfar Irrigation and Drainage Project
- f. Alto Mongoy Irrigation Project

2) Dam and reservoir construction

Due to the scarce availability of ground waters during the dry season, it is necessary to apply other methods to compensate the water deficit for irrigation purposes, by means of the construction of dams and reservoirs assuming that there is always enough rainfall and water runoff during the rainy season.

- a. Asunción Mita (II) Irrigation Project
- b. Comapa and Moyuta (Coastal Plain) Irrigation Project
- c. Amayo Ingenio Irrigation Project

TABLE 5.1.1 LAND WITH POTENTIALITY FOR DEVELOPMENT WITH IRRIGATION

ZONES	AREAS WITH POTENTIALITY FOR AGRICULTURA DEVELOPMENT	IRRIGABLE AREA WITH DIFFERENT CATCHMENT METHODS					T O T A L
		DIREC CATCHMENT	BY PUMPING	D A M S	RESERVOIR	UNDER - GROUND WATER	
(Dry Land)							
Quezada	3,850	-	-	-	-	1,000	1,000
Santa Catarina Mita	750	-	(300)	-	50	-	350
Retana	1,250	-	-	-	-	1,000	1,000
Acequia	2,050	-	-	-	350	-	350
North Jutiapa	450	-	-	-	100	-	100
Amayo Ingenio	750	-	-	600	-	-	600
Asuncion Mita(I)	8,050	(1,000)	-	-	-	-	1,000
Asuncion Mita(II)		100	-	4,000	-	-	4,100
Atescatempa	1,600	(70)	-	-	(170)	-	240
Yupiltepeque	950	-	-	-	-	-	-
Tempisque	600	(550)*	-	-	-	-	550
Coastal Plains	15,350	2,600	-	1,000	-	-	3,600
Jalpatagua	1,950	-	-	-	-	1,000	1,000
Sub-Total	37,600	4,320	300	5,600	670	3,000	13,890
(Wet Land)							
AguaBlanca	1,900	-	-	-	-	1,000	1,000
South Jutiapa	1,850	-	-	-	-	1,000	1,000
Coastal Plains	4,650	-	-	-	-	-	-
Sub-Total	8,400	-	-	-	-	2,000	2,000
Total	46,000	4,320	300	5,600	670	5,000	15,890

NOTE : The Number in Brackets Show The Areas Suitable For Rehabilitation  
\* : Montufr Project

Apart from the projects above mentioned, the construction of ponds or small lakes for irrigation in the Acequia and north of Jutiapa sectors are also considered.

3) Catchment of underground waters by pumping

In the case that there is no possibility of utilizing ground waters provided by rivers or constructing dams or reservoir as in the Quesada, Jalapatagua, Agua Blanca, south of Jutiapa, and Retana sectors, the possibility of develop them through mini-irrigations with pumping facilities will be studied.

(4) Establishment of a system for rational use of the waters

The state operated irrigation units of Asunción Mita, Atescatempa, Tempisque and Santa Catarina Mita have been being operated in such a way that the areas actually irrigated are below half of the potentially irrigable areas. Many factors can be considered as causes for this situation, but it can be mostly attributed to the absence of data about catchment amount, conduction, and distribution of waters. In fact, the operation and maintenance of the facilities is not been adequately performed.

On the other hand, DIRYA is responsible for the planning, design and construction of the civil works for irrigation, but the task of operation and maintenance is in charge of DIGESA. The problem is the lack of technical staff with enough experience in operation and maintenance, as DIGESA has few personnel with experience in the field of irrigation.

Thus, it is important, before doing anything, to capacitate the engineers and technicians in the specialty of irrigation. The agricultural and livestock public sector intends to transfer the task of operation and maintenance of the state-operated irrigation units to the users association in a not so distant future. In the transition period of this transfer, it is important that the staff of the public organization takes care of the training and technical assistance about the methodology and practices of operation and maintenance of the irrigation facilities. In that sense is necessary to increase the number of technical staff.

#### 5.1.4 Agricultural Soils Conservation Plan

(1) Soils Conservation Plan

In the Department of Jutiapa, there are areas easily prone to be affected by the erosion of soils in an extensive way. When maintaining and improving the agricultural and livestock



productivity which will allow to use the renewable natural resources such as lands, water, forests, etc. in an optimal and efficient way, it is necessary the conservation of agricultural lands and soils.

The "Soils Conservation Project" which has been carried out by DIGESA, i having positive effects in the recuperation of the productivity in the agricultural lands. The farmers have a strong interest in this activity, and DIGESA continues this project with a subsidy and own efforts of the farmers. It is extremely important to keep and improve the agricultural and livestock productivity. A plan considering the resources and methods of financial support to the farmers will be considered.

To promote this project in a more efficient way, a development study for the conservation, adequate to the natural conditions of the Department, will be done using the agricultural methods, crops systems and patterns, organic fertilizers, structures, etc. Concerning agroforestral and pasture methods, a research team with the ICTA will be planned. Also, an structure to prevent the sedimentation in those places where is notorious this problem will be planned.

## (2) Forests Conservation Plan

Even though the soils erosion is caused mainly by the irrational use of the lands and the inadequate maintenance of the soils in the agricultural lands, the effects of the deforestation are also big. The existence of forests is indispensable for the conservation of the biological diversity, the prevention of soils erosion, formation of water sources, etc.; that is why it is necessary to preserve the existing wet forests in the mountains and the mangrove forests must be preserved forests, from the point of view of the ecosystem.

In the Department the forestal fires are quite frequent during the dry season, being one of the main reasons of the deforestation. Thus, at DIGEBOS a section in charge of the a permanent vigilance will be established, at the same time that the population will receive instruction concerning prevention of forestal fires. Also, a firemen brigade will be formed in Jutiapa and they will receive instruction of how to fight the fires.

At present DIGESA is implementing a project to introduce an improved stove which will allow to save firewood. For the conservation of the forests it is important to keep and promote this project. Also, with the diffusion of the alternate energy which may substitute the firewood, it will allow to reduce its consumption and, as a consequence, the deforestation process will be slowed down. Thus, a sales channel for alternate energy will be arranged and its utilization will be promoted. Also a study on new energy sources, utilization of bio-mass products and agricultural waste, etc.

On the other hand, a project for the plantation of an "Energetic Forest" will be planned having in mind the production of firewood. In the realization of this new project, new job opportunities will be generated and will allow to cover the reduction in income coming from the firewood extraction which is limited due to the regulation of areas of preserved forests. Also, when the production of firewood starts, the income will increase due to the sale of surplus firewood from the domestic consumption.

### (3) Plan for Promotion of Environmental Education

In the Department, diverse environmental problems have been detected, such as deforestation, extinction of flora and fauna species, soils erosion, contamination due to agrochemicals, black waters, waste, etc. Most of it is originated by the scarce knowledge on the surrounding environment that the habitants have in the area. Thus, environmental education must be carried out, not only at schools, but also outside of that system. Specially, the activities of technological transfer of DIGESA and DIGEBOS, will promote the orientation on environmental problems.

#### 5.1.5 Institutional Services and Farmers Organization

##### (1) Study, research, and extension of agricultural and livestock technology

Having taking into account the actual condition of the agriculture, which mostly depends on the production of basic grains, it is necessary an agricultural production using an advanced technology and generating the crops diversification to develop and raise the level of life conditions of the farmers.

In order to reach these goals, it is necessary to develop agricultural techniques which are optimal and adequate for the Department of Jutiapa, with the corresponding technological extension given to the producers by means of the strengthening of the institutional organization as main support.

The institutions related to study activities, research, and extension works like ICTA, DIGESA, DIGESEPE and DIGEBOS, have their regional offices in Jutiapa and have obtained good results in their daily activities.

For the future agricultural development in the Department of Jutiapa, the consolidation and strengthening of the support institutions (institutional services) must be planned, promoting the development of agricultural technology and implementing the agricultural extension, in such a way that the technology is transferred to the producers and applied in the development area.

The projects related with the institutional services are detailed as follows:

1) Strengthening of the ICTA Station in Jutiapa

Within the Department of Jutiapa, the condition of semi-arid climate is amply generalized, which is one of the biggest limitations and restrict the agricultural production. Within these circumstances, it is necessary to strengthen the ICTA station in Jutiapa, for the study of production systems in semi-arid soils which include climatology, agricultural practices, cattle raising, etc..

2) Agricultural Education Center

It is indispensable the education and extension of agricultural technology to the producers, in order to increase the agricultural products. This center will promote the training of the producers and the educational activities for the rural communities through the audio-visual methods and printed materials.

3) Improvement of the level of life conditions

It means to improve the social and housewives activities and implement the use of solar energy. This project aims to research and introduce the use of alternate sources energy, using other renewable resources which satisfy the requirements of each household. Among those sources, materials like methane gas and manure provided by animals excrement, solar energy, wind energy, water energy at a small scale, etc.

4) Strengthening of vegetal health

With the purpose of increasing the fruits and vegetables export, it is important to strengthen the system for the control of diseases in accordance with the legal norms of quarantine in the importing countries. On the other hand, the prevention of plagues and insects brought into the country by means of fruits and vegetables will be made through the strengthening of the quarantine system at the borders.

(2) Plan for development of the farmers organization

The farmers organization is a vital factor to achieve the development of the non traditional products. The farmers who try to cultivate non-traditional products are not familiar with the cultivation practices, do not have efficient resources for the buying of inputs, and have almost null information concerning markets for their products. In such situation, the producers organization will be a source for overcoming the above mentioned conditions.

The development proposal for the farmers organization within the present study of the Master Plan is oriented towards the promotion of the production of vegetables with small and medium scale farmers in an organized participation and tending to improve the commercialization of their products.

### (3) Agricultural Credit

The banking entities tend to hesitate to grant agricultural credit to the small and medium farmers who carry out their agricultural and livestock activities in the mountainous zones, where the value of the farm as a collateral is not highly regarded. The loan oriented to agricultural infrastructure will not be granted to the farmers without a guarantee based on a stable agricultural and livestock productivity and marketability to be achieved through the intensive utilization of the before mentioned infrastructure.

On the other hand, in the case of the short term loan (for temporary crops) a collateral is required as the desire of someone to become a farmer is not a good enough collateral. The base of the competitiveness of the commercial capital is the capacity of collecting reliable and timely information; thus, only those who provide a good collateral capacity will be evaluated.

In summary, the public sector will be able to lend its financial services to the cooperatives with entrepreneurial spirit who have an information network on agricultural and livestock forecast, input prices, modern technologies, marketing, etc.

### (4) Participation of women in the rural development

Most of the women in the rural areas do not have the opportunity of having their own income, except at the time of seasonal crops when they can employ themselves at the big-scale farms. A possibility to get one is the retail sales of agricultural products coming from the surplus of the sales to the intermediaries and self-consumption. As productive activities performed by women, the handicraft works can be mentioned. On the other hand, the participation in the sales activities in the regular market that are carried out in the center of recollection and distribution of agricultural products can be considered as another alternative. Additionally, women could find employment opportunities in the commercialization center of agricultural products proposed in the present Master Plan.

## 5.1.6 Commercialization of Agricultural and Agroindustrial Products

### (1) Development Objectives

The development of the system for commercialization of

agricultural and agroindustrial products has as basic objectives the channeling of the interests of the farmers and consumers, reducing the unnecessary intermediation, promoting the participation of the framers in the marketing of their products and promote the activation of the regional economy and encourage the productive behavior of the farmers aiming to increase the demand of raw materials for industry. This development also has a general objectives to create new employment sources, raise the income level at a departmental level, secure a stable supply of food and generate foreign exchange at a national level. Additionally, the following objectives will be established:

- Organize the small and medium scale farmers for a better marketing of their products and increase the profit margin in the process of commercialization.
- Simplify and make more transparent the commercialization channels.
- To call attention to the public and private sectors to invest in the agroindustry.

## (2) Commercialization of agricultural products

The basic grains as corn, kidney beans, and sorghum are the main food staple of the Guatemalan population, thus, from the point of view of the food security, the improvement of the commercialization system is an essential factor. In such sense, the immediate reorganization of the INDECA is expected.

The Department has enough benefits by producing rice (the municipality of El Progreso is the axis of the rice industry at a national level); also, besides increasing its production, rice marketing will be encouraged.

Due to its low price, both at the international and domestic markets, coffee growing is an activity which does not show great profitability. To face this situation, it is recommended that the coffee growers become part of the cooperatives with the main purpose of having a mill (cleaner and drier) to commercialize the coffee directly to the toasters or exporters.

It is expected a dynamic growth in the production of vegetables accordingly with the expansion of the lands with irrigation. The main market for the vegetables produced in Jutiapa is El Salvador, but the demand in that market fluctuates a lot year from year. With the purpose of searching other stable markets apart from El Salvador, decrease the post-harvest losses, and contribute to raising the interest of the producers and consumers, the development of the vegetables commercialization center is very important within the integrated agricultural and livestock development plan of Jutiapa.

The fruits represented by the mango and melon will be commercialized in foreign markets (USA and Europe) and the success in those markets will depend on the thermal treatment and freezing, on passing the quarantine tests, and keep the nutritional quality. On the long run when the number of fruits producers increase, it is proposed to install the necessary plants for thermal and freezing treatments, but on the short run, the existing plants in Guatemala city will be used for those purposes.

(3) Proposal for improving the commercialization system

According to the development opportunities presented above, the following proposals concerning the improvement of the commercialization system are shown below.

DEVELOPMENT ITEM	IMPROVEMENT PROPOSAL
Infrastructure	<ol style="list-style-type: none"> <li>1. It is recommended the efficient use of the existing facilities in INDECA for drying and storage of basic grains. (To carry out it, is advisable to privatize the facilities of INDECA)</li> <li>2. Construct Vegetables Commercialization Centers in El Progreso, Asunción Mita, and Santa Catarina Mita; apart from these centers, others for recollection of products will be installed in each village or town where vegetables production is predominant.</li> <li>3. Develop the installation of processing plants and fruits dehydrated fruits (tomato, mango, jocote, marrañon, etc.) and vegetables in Jutiapa.</li> <li>4. Install coffee mills in the municipalities of Atescatempa, Yupiltepeque, Moyuta, and San José Acatempa.</li> </ol>
Market organization	<ol style="list-style-type: none"> <li>1. Facilitate the organization of small-scale farmers dedicated to the production of vegetables and coffee.</li> </ol>

DEVELOPMENT ITEM	IMPROVEMENT PROPOSAL
Marketing information	<p>2. It is recommended the formation of a fruits producers association.</p> <p>1. Recommend the strengthening of the organization of INDECA so that appropriate and timely information is provided to the producers.</p>
Research and capacitation	<p>1. This services item is provided mainly by PRODAC and great results have been achieved thanks to the official in charge. In spite of the fact that the human resources of PRODAC are limited and it is not possible that the staff at present could attend the increasing demand of its services, which is forecasted to grow with the implementation of the agricultural diversification program. In that sense, PRODAC needs to hire more staff.</p>
Credit	<p>1. It is recommendable create new lines of credit oriented exclusively to the marketing activities of small-scale farmers and cooperatives; it is desirable that coverage of this credit will include use of working capital on a long run basis (until the enterprise is stabilized).</p>

#### (4) Development of agroindustry

The opportunities of the agroindustry presented in the Table above were examined with the idea of putting them into practice in the Department of Jutiapa. The criteria used for this purpose were:

- Quantity and seasonality of available raw materials
- Geographical location of the Department of Jutiapa
- Necessary technologies for the agroindustry development and qualification and availability of labor force
- Required investment

- The development level of similar industry to other regions of the country
- Proposed market for the processed product
- Agroindustrial development programs and plans at a national and regional level
- Perspectives of agricultural and livestock production in the near future

As a consequence of this evaluation, the following facilities will be proposed to be developed in Jutiapa.

1. Processing plant of tomato (El Progreso)
2. Dehydrating plant for vegetables (Santa Catarina Mita)
3. Thermal and freezing treatment plant for mango and melon (Jutiapa and Jalpatagua)
4. Processing plant for jocote and marañon (Moyuta)

## 5.2 DEVELOPMENT OF THE RURAL INFRASTRUCTURE

Within the item of rural infrastructure the road system, water supply, communication, electric energy, public health, education, etc., were included. From these sectors, the development of communications, electric energy, public health, and education will be trusted to the ministries responsible of each sector. Thus, in the present Master Plan, planning of the development of the rural infrastructure will not cover all but only the sectors of road system and water supply which are more strongly related with the agricultural and livestock development and improvement of the rural life conditions.

### 5.2.1 Improvement of Farm Roads

Improvement of farm roads will be accomplished with the aim of facilitate the transport of agricultural inputs and products and make possible a more enjoyable rural life conditions.

The roads which are improvement targets were selected for being located within the zones where the irrigation and drainage projects will be implemented together with the integrated rural development projects ; these roads have a total length of 145.1 Km with 25 routes. Stretches with a width above 6.0 m which are considered as trunk roads are 59.8 Km. The works foreseen for the improvement constitute the rehabilitation of existing roads and do not contemplate the construction of a new road system. The improvement level is described as follows:



<u>Category</u>	<u>Width</u>	<u>IMPROVEMENT WORK</u>
Trunk roads	6.0 m	Ballaster
Lateral roads	4.0 m	idem

The standard section of the roads will be designed according to the design norm of the Ministerial Department of Roads (DGC).

The executing agencies of the program will be DIGESA and DGC. An office for the program where the assigned staff will render the required services will be established.

### 5.2.2 Rural Water Supply

This program has as an aim to improve the rural living conditions through the constant supply of drinkable water to the rural zones. With the finality of catching waters of improved quality and economizing on the purification cost, more emphasis on the development of underground waters has been put up.

The criteria employed in the planning of the water supply program is as follows:

Target year projected for the benefitted population:	2003
Per capita consumption	80 liter/habitant
Daily average supplied water amount (DAS):	80 liters/habitant x forecasted population
Pump capacity:	DAS X 1.5
Capacity of the distribution tank:	DAS x 1.2 x 35% (pump use)

Planning of the water supply system will be made according to the physical conditions, distribution of the population, and administrative capacity (payment capacity and technological level) of the beneficiaries. Also, within the present planning a proposal for operation and maintenance of the water supply system is proposed, including the adequate establishment of water fees and payment method.

### 5.3 INTEGRATED RURAL DEVELOPMENT

The development plans of each development sector, if implemented independently one from each other, could yield positive results, but, if executed jointly and in a coordinated way with the plans of other sectors, it could be expected even better results. Thus, if the development plans of some sectors are integrated, the results could be even more satisfactory than those resulting from independently developing some sector. In this way, the main goal of the plan as Rural and Agricultural and Livestock Development Project will be fulfilled.

Concerning the restricting factors for the agricultural and livestock and rural development in the Department of Jutiapa, they can be classified as follows: 1) agricultural and livestock production under unstable conditions and with a deficient productive infrastructure; 2) non-satisfactory living conditions due to an inefficient infrastructure (see Section 4.1). With the priority and integrated development of the sectors related with the restricting factors for development there is the possibility of generating a big impact.

#### 5.3.1 Development Focused on the Improvement of the Agricultural and Livestock Productivity

The most important restricting factor and the one with the most relevant potentiality for development of the agricultural and livestock productivity in the Department is the water resource. The implementation of the agriculture with irrigation by developing of the water resources together with a crops diversification, improvement of livestock activities, introduction of pisciculture, improvement of the conditions for commercialization of agricultural products, promotion of exportable products and an improvement of the rural infrastructure will make possible to expect a multiplier effect if an integrated development project is executed incorporating all these components.

The target area was selected taking into consideration the characteristics of the groups of the classification for agricultural exploitation (see Section 3.7.1), choosing the group with possibilities to be a potential agricultural area within the Department (Group B/C-I/II). Within this, the areas where it would be possible the agriculture with irrigation (see Section 5.1.3), the best results to be obtained with the implementation of the integrated development would be in the representative areas of Santa Catarina Mita which is an area located among mountains, and Montúfar, which is an area located on the coastal plain.

The main infrastructural works for the projects are the following:

- Irrigation facilities
- Farm roads
- Facilities for agricultural soils conservation
- Vegetables commercialization center
- Small-size cattle insemination center
- Piscicultural facilities
- Rural aqueduct
- Community center, etc.

### 5.3.2 Development Focused n the Improvement of the Rural Life Infrastructure

The conditions of the social infrastructure in rural areas was classified in five groups according to the level of evaluation (see Section 3.10.6). Within these, the Comapa area can be considered as the only one whose social infrastructure is in the most absolute underdevelopment. Specially, the underdevelopment of the water supply facilities for rural areas and farm roads is quite acute. Also, from the point of view of the socioeconomic potentiality, the Comapa area do not satisfy the conditions of any item included in a socioeconomic evaluation, and can be judged as a municipality with a very underdeveloped basic social infrastructure (see Section 4.2.3).

In the Comapa area, where the conditions of the social infrastructure are underdeveloped in the Department, due to the implementation of the integrated rural development project which mainly includes the improvement of the rural infrastructure and the construction of a community center, improvement of the agricultural and livestock production, as well as construction of reservoirs, small-size cattle insemination center, etc., the regional socioeconomic differences may be alleviated in the Department.

Main infrastructural works for the projects are the following:

- Rural aqueduct
- Farm roads
- Community center
- Reservoir
- Small-size cattle insemination center, etc.

### 5.4 CLASSIFICATION OF SHORT AND LONG TERM PROJECTS

The projects formulated in each sector are classified accordingly to their execution period as short term (1994-1998) and long term (until 2003) (see Table 5.4.1).

TABLE 5.4.1(1) LIST OF PROJECT CLASSIFIED BY EXECUTION PERIOD

Development Sector	Goals of Each Sector	Description of Plans	Short Term		Long Term	
			Projects	Description	Projects	Description
I. AGRICULTURAL AND LIVESTOCK DEVELOPMENT PLAN 1. Agricultural Production	1) Establish the suitability for cultivation and increase added value to crops	Expand and strengthen the production and distribution of seeds of main products and technical extension of production	Produce and distribute seeds of basic grains (corn, kidney bean, rice, sorghum)	Strengthen the facilities, improve equipments and establish an irrigable field for genetic and certified seed production at ICTA station		
			Produce and distribute seeds of high quality potato	Install the equipments and establish an irrigable field for study, research and prod.		
	2) Introduce the agricultural products for national and foreign markets	Strengthen the production and distribution of vegetables seeds and fruit trees, and extension of production technology	Produce vegetable seeds and distribute them (I)	Construct the buildings, install equipments and establish an irrigable field for study, research and production	Produce vegetable seeds and distribute them(II)	Promote activities of production and distribution of vegetable seeds
			Produce fruit trees and distribute them (I)	Construct the buildings, install equipments and establish an irrigable field for research and prod.	Produce fruit trees and distribute them(II)	Promote activities of production and distribution of fruit trees
2. Livestock Production	1) Strengthen the conditions of animal health	Generalize the measures against contagious diseases and their control	Strengthen existing veterinarian laboratories	Improve equipment, strengthen staff	Improve sanitary inspection at the border zone	Implement equipment and strengthen the staff
	2) Improve the existing animal varieties	Promote and improve breeding to develop production	Construct Cattle Reproduction and Improvement Center	Establish breeding of all types of small and big size cattle and reproduce the best ones	Promote practice of artificial insemination	Implement equipment and strengthen the staff
	3) Technically train the farmers about breeding systems	Construct the facilities for agricultural and livestock training	Construct Training Center	Construct the facilities for the training center		
	4) Install livestock markets	Construct markets with scales installed	Install Equipment and elaborate manuals	Implement equipments, strengthen staff		
	5) Distribute concentrated feed	Develop and improve feeding patterns and production quality of animals	Construct facilities for Food Processing Industry	Implement equipments, strengthen staff		
	6) Generalize production of small size cattle	Secure the small and medium scale farmers	Construct Cattle Improvement Center	Strengthen the staff		
	7) Improve the meat markets	Construct meat markets in main departmental locations	Strengthen Meat Control Systems	Provide fresh and hygienic meat and strengthen the research staff		

TABLE 5.4.1(2) LIST OF PROJECT CLASSIFIED BY EXECUTION PERIOD

Development Sector	Goals for Each Sector	Description of Plans	Short term		Long Term		
			Projects	Description	Projects	Description	
3. Agricultural and Livestock Infrastructure	1) Rehabilitate and construct irrigation infrastructure	Rehabilitate and construct infrastructure for intake and water conduction (catchment and canal system)	Rehabilitate the irrigation unit of Santa Catarina Mita	Transfer the pumping station and construct trunk and lateral canals			
			Rehabilitate the irrigation unit of Asunción Mita (I)	Construct the water catchment system and rehabilitate and construct trunk and lateral canals			
					Rehabilitate the irrigation unit of Atescátempa	Rehabilitate and construct the catchment system and trunk and lateral canals and construct ditches	
					Rehabilitate the irrigation unit of El Tempisque	Rehabilitate and construct catchment system and trunk and lateral canals	
	2) Develop water intake for rivers for irrigation by gravity	Irrigate by gravity based on construction of intakes	Irrigate and drain Montúfar	Construct the intake and the trunk and lateral canals for irrigation and drainage			
			Irrigate and drain Alto Mongoy	Execute catchment works and canals			
	3) Construct dams, reservoirs, ponds, use underground water, adequate systems to characteristics of zone	Irrigation by gravity based on construction of dams & reservoirs			Irrigate and drain Asunción Mita (II)	Construct dams, reservoirs, trunk and lateral canals	
					Irrigate and drain Pasaco and Moyuta	Construct dams, reservoirs, canals, improve drainage	
					Irrigate and drain Amayo Ingenio and distribute water	Construct dams, reservoirs, canals and distribute domestic water	
		Irrigate by gravity based on construction of artificial ponds	Irrigate and drain Acegüa	Construct artificial ponds and canals			
			Irrigate and drain north of Jutiapa	Construct artificial ponds and canals			
		Irrigate by underground waters				Develop Quezada	Catch underground waters for irrigation
						Develop Jalpatagua	Catch underground waters for irrigation
						Develop Agua Blanca	Catch underground waters for irrigation
						Develop South Jutiapa	Catch underground waters for irrigation
				Develop Retana	Catch underground waters for irrigation		

TABLE 5.4.1(3) LIST OF PROJECT CLASSIFIED BY EXECUTION PERIOD

Development Sector	Goals for Each sector	Description of Plans	Short Term		Long Term	
			Projects	Description	Projects	Description
4. Agricultural Soils Conservation	1) Conservate soils	Maintain and improve agricultural and livestock productivity through soils conservation	Conservate soils (I)	Install infrastructure adequate for soils conservation and develop soils conservation methods	Conservate soils (II)	Install infrastructure adequate for soils conservation and apply the new soils conservation methods
	2) Conservate forests	Regulate preserved forestal areas to recuperate existing forests	Regulate forests for conservation	Maintain and conservate wet forests of mountains with 13,200 Ha and mangroves with 1,300 Ha	Conservate forests	Protect the wild-life living in the forests and the ecosystem
		Conservate forests preventing forestal fires	Prevent forestal fires (I)	Establish section in charge of forestal fires and firemen brigade	Prevent forestal fires (II)	Prevent forestal fires and implement education and extension for fire prevention
		Decrease deforestation using improved stove, saving firewood	Promote use of improved stove	Promote use of improved stove to make better use of firewood and lower household expenditure due to savings in firewood and avoid environmental contamination in house		
		Decrease deforestation substituting firewood by other energy resource			Promote and develop alternate energy to substitute firewood	Arrange sales channel of alternate energy to substitute firewood and promote its use
		Implement forestal plantation to secure future demand of firewood, preserve rural environment and increase rural employment opportunities			Plant forests for firewood	Plant the "energetic forest" for firewood production
	3) Environmental Education	Support environmental education in the educational system, technology transfer and agricultural extension	Promote environmental education (I)	Establish the organization and regimen of the environmental education	Promote environmental education (II)	Implement an environmental educational process at schools and promote and guide environmental problems in the technological transfer activities of DIGESA and DIGEBOS

TABLE 5.4.1(4) LIST OF PROJECT CLASSIFIED BY EXECUTION PERIOD

Development Sector	Goals for Each Sector	Description of Plans	Short Term		Long Term	
			Projects	Description	Projects	Description
5. Organization and institutional services	1) Strengthen Institute for Study & Research of Agricultural Technology	Strengthen agricultural station for study of semi-arid systems including climatology, agricultural practices, livestock, etc.	Strengthen ICTA station in Jutiapa	Strengthen facilities, implement equipment and provide an irrigable field for study and research		
	2) Strengthen services for extension of agricultural technology	Train technicians and producers and educate rural communities by using educational systems and printed matter	Install Center of Agricultural Center (I)	Strengthen the facilities, construct buildings and provide them with equipment of audiovisual systems and establish a field with appropriate irrigation system	Install Center of Agricultural Education (II)	Implement activities of education and agricultural extension
	3) Strengthen services to improve life level	Introduce use of alternate energy sources like biogas, solar, wind, water energy	Strengthen activities of clubs and women participation	Construct buildings and implement equipments for use of new energy sources		
	4) Strengthen services for plants quarantine	Establish a system to prevent diseases coming from importation of plants			Strengthen system of plants quarantine	Construct buildings and facilities and install equipments for inspection and research, and establish an experimental field
6. Commercialization of agricultural and agro-industrial products	1) Promote organization of producers cooperatives to commercialize their products	Group farmers for vegetables production and establish systems for buying, cleaning, classify, packing, storage, and distributing vegetables and install processing industry	Establish Vegetables Commercialization Center (I) in Santa Catarina Mita and Montúfar	Construct buildings and install equipments for reception, cleaning, packing, storage, and elaboration	Establish Vegetables Commercialization Center (II) in Asunción Mita and El Progreso	Construct buildings and install equipments for reception, cleaning, packing, storage, and elaboration
		Group small coffee growers and install coffee mills in the cooperative lands	Install coffee mills	Organize small coffee growers and install coffee mills in cooperative lands		

TABLE 5.4.1(5) LIST OF PROJECT CLASSIFIED BY EXECUTION PERIOD

Development Sector	GOALS OF EACH SECTOR	Description of the Plans	Short Term		Long Term	
			Projects	Description	Projects	Description
II. RURAL INFRASTRUCTURE DEVELOPMENT PLAN  1. Habilitation of Farm Roads  2. Development of the water supply services	1) Improve Farm Roads	Strengthen the road network due to improvement of farm roads in the areas of irrigation and drainage areas of integrated rural development	Improve the Farm Roads (I)	Improve farm roads in areas of projects of irrigation and drainage and integrated rural development with short term goals	Improve the Farm Roads (II)	Improve the farm roads in the areas of the irrigation and drainage projects and integrated rural development with a long term perspective
	1) Raise coverage rate of rural water supply	Develop rural water supply systems in the areas of the projects of integrated rural development	Develop the Santa Catarina Mita, Montúfar and Comapa	Install distribution tanks and public faucets and construct simple water systems		
III. INTEGRATED RURAL DEVELOPMENT PLAN	1) Improve and raise the agricultural & livestock productivity	Strengthen the irrigation installation, diversify products, improve productivity and commercialization of agricultural and livestock products, improve farm roads, and develop water supply services	Develop the Santa Catarina Mita	Construct pumping station, main and lateral canals, commercialization of vegetables center, small size cattle insemination center and community center, improve farm roads, and develop water supply systems		
			Develop the Comapa Zone	Construct water intake, main and lateral canals, infrastructure for soils conservation, commercialization of vegetables center, small size cattle insemination center, install of pisciculture and community center, improve farm roads and develop water supply systems		
	2) Improve and raise the services in the rural communities	Improve farm roads, develop water supply services and improve irrigation system and livestock production	Develop the Comapa Zone	Improve farm roads, develop water service systems and construct ditches, canals, small size cattle insemination center and community center	Develop the Agua Blanca Zone	Improve the farm roads, develop the water supply services and construct ditches, canals, small size cattle insemination center, and community center



## CHAPTER 6

# FORMULATION OF THE MASTER PLAN



## CHAPTER 6 FORMULATION OF THE MASTER PLAN

### 6.1 SELECTION OF THE PROJECTS FOR THE MASTER PLAN

#### 6.1.1 Selection Criteria

To carry out the implementation of the different projects formulated for each sector, huge investments are required on a long term basis. therefore, it is necessary to make a careful selection of those projects to be included in the Master Plan in order to formulate an adequate Master Plan for an equilibrated agricultural and livestock development and to facilitate its implementation.

To choose the most appropriate projects which will be part of the Master Plan, an evaluation made according to the following criteria is required:

- 1) Coordination with sectorial policies
- 2) Implementation schedule
- 3) Beneficiaries' characteristics
- 4) Technical aspects
- 5) Required investment and its financing
- 6) Maturity of the projects

Also, those projects already financed or those which their implementation is imminent will not be included in the Master Plan.

#### (1) Coordination with sectorial policies

It is important that the projects which conform the Master Plan should be compatible with the sectorial policies for development of Guatemala (agricultural policy, nutrition policy, social development policy); also, they must fulfill the following objectives, tightly related to the rural and agricultural and livestock development.

- Improve and increase the agricultural and livestock production and diversify the crops.
- Promotion of the non-traditional production aimed to the international market.
- Increase of the small and medium farmers' income and generation of more employment opportunities.

- Strengthening and modernization of the public sector.
- Improvement of the social conditions and enlivening of the social environment of the rural communities.

**(2) Execution scheme**

The organization and execution scheme of the Master Plan plays an important role, from the planning till the implementation of the Plan. Due to the fact that, in general, the development of the agricultural and livestock activities and the works related with the rural development acquire certain public character in most of the cases, the execution organization is assumed by the public organizations.

The organization of the works execution are divided into the existing organizations and the new organizations to be created, which evaluation will be judged according to the following elements.

- Technical knowledge and operation and maintenance capacity
- Human resources

**(3) Beneficiaries' characteristics**

The scope of the beneficiaries cover the surface, population, social classes, etc., and according to the object and details of the programs and projects, the beneficiaries could be individuals, groups or public organizations. Taking into account that most of the beneficiaries of the programs and projects of agricultural and livestock development are dwellers in the zone, it is desirable that for implementation purposes the needs of the targeted population must be verified and determined. Then, the capacity of the beneficiaries must be assessed concerning the acceptability of the project, achievement of the projected goals and capacity for operation and maintenance of the facilities after the execution of the project.

**(4) Technical aspects**

The planned technology in the projects must be applicable to the local conditions. On the other hand, the technological renovation and reform of the existing technologies become one of the most important factors for an integrated rural development.

Availability of machineries, materials and labor within the region is another parameter for prioritization when promoting development of the local industry and generation of employment opportunities.

Also, the expected benefits coming from the implementation of the project (improvement of the agricultural and livestock

productivity, renovated technologies, etc.) are accepted and inserted under adequate socioeconomical conditions, in other words, existence of a market in the case of agricultural products; acceptability of the technology in the case of technological renovation; and accessibility to the local society and the generality in the case of equipment of the social infrastructure.

Finally, environmental impact for the execution of the projects will be taken into account when selecting the projects with the highest priority.

#### (5) Required investment and its financing

It would be ideal for the implementation of a project that the highest benefits would be reached at the lowest costs; however, when increasing the number of beneficiaries or the benefits, the costs of the Project also increase. From the point of view of materialization of the Project, it would be easier to implement the projects if the costs were lower. Now, from the point of view of their financing, it can be said that those projects which could be implemented by using own financial resources of the country or regional autonomous organizations should be given the highest priority; however, judging the actual financial situation of the country, there are not enough resources to finance all the proposed projects, making it unavoidable to require external financial cooperation. Within the lines of external financial cooperation, there is the line of non-reimbursable financial cooperation. This type of financial cooperation takes a shorter time to get than the time it would take to be ask for a reimbursable loan.

#### (6) Maturity of the Projects

Among the planning stages of the projects, the following can be mentioned: master plan, pre-feasibility study, feasibility study, basic design, and final design. Projects which are in the final design stage (having concluded the study for technical and economic feasibility) are considered as matured projects and they have the highest priority.

### 6.1.2 Selection of the Development Projects

Based on the criteria mentioned above, the development projects by sectors were evaluated in Chapter 5, in order to identify those projects which would be part of the Master Plan. In the identification, those projects at a national level were discarded; those projects which harmonized with the rural and agricultural and livestock development of the Department of Jutiapa were included, mainly those projects which could work independently and offer bigger multiplier effects through the coordination of the other projects. Complementary analysis of the projects selected were also carried out.

### (1) Agricultural production

This sub-sector covers the programs of reproduction and distribution of seeds and seeding plants, as activities directly related to the agricultural production, and the programs of strengthening of the institutional services as activity indirectly related to agricultural production.

These programs could reach their goals with the extension and strengthening of the ICTA station in the Region IV; these programs can be summarized as strengthening programs for agricultural production, extension, and education. Also, it was decided that the program of reproduction and distribution of seeds of basic grains and potato seeds will not be included in the present Master Plan considering that those activities would be part of PROGETTA activities. Also, the strengthening program of plants health was decided not to be included as it is a program which scope covers all the country.

### (2) Livestock

Having in mind that farmers in this Department raise cattle in one way or another, the projects of strengthening of animal health and breeding and reproduction center were selected. Other programs or projects were not included in the Master Plan, as most of them could reach their goals through the implementation of the two projects already mentioned.

### (3) Agricultural and livestock infrastructure

Within the context of arrangement of the agricultural and livestock infrastructure, this Master Plan included the projects of irrigation and drainage, with direct catchment of ground waters and their distribution for irrigation by gravity. Such system was proposed taking into account the cost and convenience of operation and maintenance of the works. This Master Plan does not include the Asunción Mita (I) irrigation project as this is planned to be implemented by an international organization. About the Santa Catarina Mita zones, it was selected as it is considered the most suitable place to be included in the Integrated Rural Development Plan, covering other development sectors, even though there is the disadvantage that water catchment must be done through pumping.

The storage of waters in dams or reservoirs, even though the initial investment amount is relatively higher than the alternative of direct catchment of ground waters and pumping station, was proposed for the Amayo Ingenio zone within the present Master Plan taking into consideration the excellent conditions of location of the dam and the expected multiplier effects in benefit of other sectors beside the irrigation ones.

The characteristics of the Amayo Ingenio zone are: 1) High storage capacity yield and construction cost relatively low; 2) Proximity to the benefitted area, good transit access; 3) Enough water flow during the rainy season and excellent quality of the water; and 4) Abundant water storage capability. In virtue of these factors, there is the possibility of supplying water for domestic consumption in Jutiapa City.

In consequence, the irrigation and drainage projects included in the Master Plan are: Santa Catarina Mita, Atescatempa, Tempisque, Montúfar, Alto Mongoy, and Amayo Ingenio.

#### **(4) Conservation of agricultural soils**

To recover and maintain the productive capability of the agricultural soils in the Department, most of which are prone to suffer from erosion, the execution of the soils conservation project is necessary in the context of the present Master Plan.

It is also urgent to take countermeasures against the loss of forestal resources, which becomes one of the main reasons of the soils erosion and which is a problem for the Department. Even though many protection and preservation plans have been considered, those which cover the whole country were discarded and the forest fire prevention project was selected.

#### **(5) Institutional services**

About the development of this item, the project for expansion and strengthening of the ICTA station in Jutiapa was selected.

#### **(6) Commercialization of agricultural and agroindustrial products**

Through the execution of the irrigation projects,, the sowing of vegetables during the dry season will be possible and to face the corresponding increase in the agricultural production, it will be necessary to improve the present process of commercialization and to try to arrange the infrastructure for gathering, storage, and distribution of agricultural products. In the present Master Plan, it is proposed the development of a vegetables commercialization center in order to establish a commercialization infrastructure which at present do not exist. For its location, Santa Catarina Mita and Montúfar were identified, where in the future it can be expected an increase in the production of vegetables as a consequence of the introduction of irrigation facilities.

#### **(7) Rural infrastructure**

The programs for improvement of farm roads and supply of rural water will be considered within the present Master Plan, as a component of the Integrated Rural development Plan together

with the sub-projects of other sectors.

#### (8) Integrated Rural Development Project

The Integrated Rural Development Project will include the development sub-projects of many sectors in order to keep a balance, which may become the planning model for an integrated rural development project in the Department of Jutiapa. The present Integrated Rural Development Project included two different components judging by their goals (increase of agricultural and livestock productivity and improvement of the living conditions in the rural zones), and the inclusion of 3 zones within the Master Plan was decided.

#### (9) Selected Projects

The selected projects for the present Master Plan are as follows:

- 1) Strengthening of the agricultural production, extension, and education project
- 2) Strengthening of animal health project
- 3) Breeding and reproduction center project
- 4) Irrigation and drainage projects
  - Santa Catarina Mita zone (include within the Integrated Rural Development Project)
  - Atescatempa Zone
  - Tempisque Zone
  - Montúfar Zone (included within the Integrated Rural Development Project)
  - Alto Mongoy Zone
- 5) Soil conservation project
- 6) Forest fire prevention project
- 7) Integrated rural development projects
  - Santa Catarina Mita Zone
  - Montúfar Zone
  - Comapa Zone



## 6.2 PROFILE OF THE PROJECTS

### 6.2.1 Strengthening of Agricultural Production, Extension and Education Project

#### (1) General description of the project

For expansion and diversification of the agricultural production, besides the development and improvement of an adequate technology, it is necessary to implement among the farmers the extension and education for the utilization of that technology. Also, in the Department of Jutiapa there are zones which belong to semi-arid soils due to lack of rainfall and the development of an agriculture suitable for those climatic conditions is urgent.

This project will be executed in the ICTA station in Jutiapa, being its goals to carry out researches on agriculture in semi-arid soils, develop and produce vegetable seeds and seed plants of fruit trees and promote the extension and education on agricultural and livestock technology. The fields to be strengthened and integrated are research, production, and extension and education.

#### 1) Research

- Agroclimatology:  
Research on the correlation between the meteorological conditions of the semi-arid soils and agricultural crops
- Plants health:  
Research on disease and insects plagues
- Soils and fertilizers:  
Research and development of soils and fertilizers in order to introduce the irrigation agriculture
- Irrigation method:  
Research and development of cultivation methods with water saving.

#### 2) Production (to be carried out simultaneously with research)

- Vegetable seeds:  
Tests for adaptability, production and distribution of seeds
- Seed plants of fruits trees  
Production and distribution of seed plants

### 3) Extension and education

- Education and training:  
For agricultural and livestock technicians and farmers
- Promotion and diffusion of informations:  
Activities of promotion and diffusion of technologies adequate for the rural society and farmers

Preferably the existing facilities of buildings and farms will be utilized, but additionally it is required the following facilities and materials.

Also, the project will be carried out by a division in a Stage I which includes the extension of facilities and supply of equipment and materials, and the Stage II which contemplates the activities of production, extension, and education utilizing those facilities, equipments and materials.

- Irrigation facilities: Farm extension - 10 ha (including water catchment works)
- Research building: 1 block
- Equipments and apparatuses for meteorological data record: 1 set
- Equipments and apparatuses for research: 1 set
- Equipments and apparatuses for audiovisual education: 1 set
- Agricultural machinery for training: 1 set
- Printing and binding machine: 1 set
- Vehicle for diffusion purposes: 1 unit
- Four-wheels drive vehicle: 3 units
- Motorcycle: 6 units

### (2) Executing agency

The executing agency of the project will be the ICTA station in the Region IV. However, in the production, extension and education sectors, the cooperation of DIGESA, DIGESEPE and DIGEBOS will be required.

### (3) Cost of the project

The cost of the present project, including the physical contingencies, for Stage I is 15,193,000 quetzales (US\$2,939 thousands) and for Stage II is 2,845,000 quetzales (US\$ 550 thousands), or a total of 18,038,000 quetzales (US\$ 3,489 thousands).

#### 6.2.2 Strengthening of Animal Health Project

##### (1) General description of the project

The Department of Jutiapa shares border with the Republic of El Salvador and are communicated by three Central American Highways. The Department is the base of transport to El Salvador, and is at the same time a crossing place for cattle coming from central American countries in route to Mexico and the United States. On the other hand, by c\number of cattle heads, the Department occupies the fourth place at a national level, for cows and swine and it is expected that its livestock production will increase in the future. However, the animal health organization is undeveloped in the border of the country and among the cattle raised within the Department there are many diseases native of the tropical zones.

This project has as goals the strengthening and integration of the animal health organization and the technical assistance of DIGESEPE, Region IV, through the supply of equipments and materials for the hygienic instruction and analysis allocated to its office and to the two livestock diseases diagnosis centers. Because for this project there are not problems related with the existing facilities and staff, the tasks will be concentrated on the supply of equipments and materials. The equipments and materials to be supplied area as follows:

- Office of the Region IV of DIGESEPE  
Equipments and materials for animal health to capacitate medium and small scale farmers
- Acequia cattle diseases diagnosis center:  
Equipments and materials for diagnosis of cattle diseases
- Alvarado cattle diseases diagnosis center:  
Equipments and materials for diagnosis of cattle diseases

##### (2) Executing agency

The executing agency of the project will be the DIGESEPE office, Region IV.

### (3) Cost of the project

The cost of the project including the physical contingencies is 9,473,000 quetzales (US\$ 1,832 thousands).

#### 6.2.3 Breeding and Reproduction Improvement Center Project

##### (1) General description of the project

The promotion of the diffusion of improved varieties is necessary in order to improve the livestock production. However, in the absence of public organization responsible for reproduction and diffusion of cattle varieties, the in-breeding practices is very common, affecting in a negative way the livestock productivity.

The project contemplates the installation of a new breeding and reproduction center for improvement and diffusion of cattle varieties in the DIGESEPE station in its chicken breeding center in Asunción Mita, in order to improve cattle varieties and carry out the training and education for implementation of modern technologies of breeding and artificial insemination.

##### 1) Cattle heads

- Bovine for reproduction (male): 10 heads
- Swine for reproduction (male): 10 heads
- Swine for reproduction (female): 200 heads
- Goats (meat and milk) for reproduction: 50 heads
- Chicken: 2,000 poultry
- Small cattle: Stallions, asses, rabbits for reproduction

##### 2) Facilities to be constructed

- Diverse types of cattle raising facilities
- Facilities for training of small and medium scale farmers
- Small scale ranch
- Small scale facilities for mixing of concentrated food
- Facilities for generation of biogas
- Facilities for pisciculture of mojarra fish

**(2) Executing agency of the project**

The executing agency of the project will be the DIGESEPE office, Region IV.

**(3) Cost of the project**

The cost of the project including the physical contingencies is 31,477,000 quetzales (US\$ 6,088 thousands).

**6.2.4 Irrigation and Drainage Project**

In the Department of Jutiapa where the rainy and dry season are clearly differentiated, agriculture is carried out depending on the rainfall during the rainy season and the productivity shows an instable pattern subject to the rainfall conditions of each year. Also, in the zone without irrigation, sowing is not almost carried out during the dry season.

Having in mind this background, and in order to obtain an stability and increase in agricultural production and improvement of the productivity, it is necessary to execute an irrigation system aiming to a constant supply of irrigation water during the rainy and dry seasons and to increase the area under irrigation.

**(1) Basic conditions**

**1) Catchment and conduction of the waters**

As water sources for irrigation there are: 1)direct catchment of ground waters; 2)storage of rainfall during the rainy season; and 3)catchment of underground waters.

On the other hand, the conduction method is divided in: 1)gravity; and 2)by pumping; there is also a combination of both systems depending on the conditions of the zone.

**2) Land utilization**

The land utilization within the project was considering: 1)productivity capability of the lands; 2)intensification of utilization by means of the introduction of irrigation systems; and 3)their present utilization. Priority was given to temporal crops, pastures and fruit trees. Also, it was actively attempted to convert bushy lands without use into agricultural lands and to convert them into lands suitable for the irrigation facilities.

**3) Agricultural and livestock production**

With irrigation it is expected that the production of

agricultural products during the rainy season and sowing during the dry season will be stable, achieving in this way the diversification and expansion of the agricultural and livestock production.

For the planning of the sowing, a cultivation scheme was selected in a way to allow for: 1) stable production of basic grains; 2) diversification of vegetables and fruits bounded for the external market; and 3) introduction of improved pastures for improvement of the livestock production.

#### 4) Requirement for irrigation water

The requirement for irrigation waters was estimated in the following way:

1. Calculation of the evapotranspiration by the Penman Method using climatological data for Asunción Mita which is the most complete and reliable data set in Jutiapa.
2. Calculation of the evapotranspiration value of crops multiplying the evapotranspiration value calculated before by the crop factor.
3. Multiply this crop factor by the effective rainfall with a return period of 5 years.

The monthly water requirement for irrigation is as shown below and the value of 1.28 l/sec/h/ha for February has been adopted as maximum value when planning the irrigation projects.

#### Monthly water requirement for irrigation

unit: l/sec/ha

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
0.93	1.28	0.71	0.3	-	-	0.54	0.44	-	0.18	0.59	0.83

#### (2) General description of the project

From here on, the profile of the irrigation and drainage projects included in the Master Plan are described except those of Santa Catarina Mita and Montúfar which are described in the integrated rural development project of numeral 6.2.7.

1) Atescatempa Zone

a) General description of the project

The project planned by DIRYA contemplated irrigation of an area of 260 ha. by means of catchment works located in the Atecatempa river and four pumps; however, the irrigated area at present is only 80 ha.

In the present Master Plan, the construction of a reservoir in the ravine located at the north of the Atescatempa zone is contemplated as well as the replacement of the existing conduction canals in order to implement the irrigation conducted and distributed by gravity in an area of 190 ha within the state operated irrigation unit.

a. Land utilization

The actual 150 ha of vegetable-cultivated areas (50 ha are with irrigation) will increase to 160 ha with total coverage by irrigation, while actual 50 ha of pastures will decrease to 30 ha. with irrigation. Also, 10 ha will be used as new lands for cultivation of fruits trees.

b. Agricultural and livestock production

With irrigation, the cultivable area for vegetables will be increased and, in accordance with this increase, the annual production of tomatoes and onions will be increased from 450 ton to 2,200 ton and 20 ton to 85 ton, respectively. At the same time it is expected that a new production of mango will reach 300 ton per year.

Livestock production will be also stable during the whole year by the introduction of irrigated pastures.

c. Farms to be benefitted: 100 farms

d. Irrigation systems

- Maximum catchment flow:  $Q = 0.307 \text{ m}^3/\text{sec}$

- Irrigation facilities

(1) Reservoir

Type: Uniform earth-fill dam

Height: 17.0 m

Length: 215 m  
Effective storage capacity:  
1.6 million m<sup>3</sup>

(ii) Main conduction canal: 6.3 km

b) Executing agency of the project

The executing agency of the project will be DIRYA. However, to procure an efficient and timely execution, it is necessary the cooperation of other organizations like DIGESA, etc.

c) Cost of the project

The cost of the project including the physical contingencies is 15,675,000 quetzales (US\$ 3,032 thousands).

2) Tempisque Zone

a) General description of the project

The project planned by DIRYA contemplated the irrigation of an area of about 440 ha by diverting a flow of 0.50 m<sup>3</sup>/sec from the Pulula river by the catchment works, but the area actually irrigated is only 100 ha.

In this Master Plan, it is proposed the renovation of the catchment works in order to catch the groundwater and replace the old ones and conduct and distribute the waters by gravity irrigating the 440 ha. The profile of the project is as follows.

a. Lands utilization

The lands utilization will be intensified by increasing the actual cultivated area of 320 ha (230 ha with irrigation) to 350 ha, all irrigated. In contrast, the pastures area will tend to decrease from 130 ha at present to 70 ha, but all of them will be irrigated. Also, 20 ha will be used as new lands for cultivation of fruit trees.

b. Agricultural and livestock production

Through the equipment of the irrigation system, the vegetable-cultivated area will be increased during the dry season and it is expected an annual production of 4,800 ton of tomato (750 ton at present) and 2,300 ton



of onion. Mango will be cultivated with an annual production of about 600 ton.

c. Benefitted farms: 180 farms

d. Irrigation system

- Maximum catchment flow:  $Q = 0.563 \text{ m}^3/\text{sec}$

(i) Reservoir

Type: Fixed dam (concrete)

Length: 30.0 m

Height: 2.0 m

(ii) Main conduction canal: 12.8 km

b) Executing agency of the project

The executing agency of the project will be DIRYA. However, to procure an efficient and timely execution, it is necessary the cooperation of other organizations like DIGESA, etc.

c) Cost of the project

The cost of the project including the physical contingencies is 21,564,000 quetzales (US\$ 4,171 thousands).

3) Alto Mongoy Zone

a) General description of the project

This project has been planned by DIRYA in such a way as to catch the water through an installation of works at the source of the Mongoy river and conduct and distribute the waters by gravity. The profile of the project is as follows.

a. Lands utilization

The area cultivated with transitory crops is 60 ha without irrigation at present, and will be increased to 70 ha with irrigation. Pastures will decrease from 20 ha at present (without irrigation) to 10 ha (with irrigation).

b. Agricultural production

Through the introduction of irrigation facilities it will be possible to cultivate vegetables during the dry season and it is forecasted a crop of about 1,500 ton of

tomato and 300 ton of onion. Also, through irrigation of pastures, it is expected to achieve an stable production of cattle during the whole year.

c. Farms to be benefitted: 30 farms

d. Irrigation system

- Maximum catchment flow:  $Q = 0.102 \text{ m}^3/\text{sec}$

- Irrigation facilities

(i) Catchment works: Made of concrete

(ii) Main conduction canal: 5.0 Km

b) Executing agency of the project

The project will be implemented by DIRYA as the main agency of the project, in collaboration with other organizations like DIGESA, etc.

c) Cost of the project

The cost of the project including the physical contingencies is 3,076,000 quetzales (US\$ 595 thousands).

4) Amayo Ingenio Zone

a) General description of the project

This project contemplates storage of the rainfall by constructing a dam at the Amayito river and conduct and distribute the waters by gravity to irrigate the lands of 480 ha located in he lower basin.

a. Lands utilization

The area cultivated with transitory crops is 310 ha without irrigation at present, and will be increased to 370 ha with irrigation. Pastures will decrease from 130 ha at present (without irrigation) to 80 ha (with irrigation). Also, 30 new hectares will be used for cultivation of fruits trees.

b. Agricultural production

The agricultural production expected with the introduction of irrigation is 5,600 ton per year of tomato, 2,500 ton of onion and 900 ton of mango.

- c. Farms to be benefitted: 200 farms
- d. Irrigation system
  - Maximum catchment flow:  $Q = 0.614 \text{ m}^3/\text{sec}$
  - Irrigation facilities
    - (i) Dam
      - Type: Uniform earth-fill dam
      - Height: 25.0 m
      - Length: 285.0 m
      - Effective storage capacity
    - (ii) Main conduction canal: 9.3 Km

b) Executing agency of the project

The project will be implemented by DIRYA as the main agency of the project, in collaboration with other organizations like DIGESA, etc. which will make possible an efficient and timely implementation of the project.

c) Cost of the project

The cost of the project including the physical contingencies is 46,169,000 quetzales (US\$ 8,930 thousands).

### 6.2.5 Soils Conservation Project

(1) General description of the project

This project has as a goal recover and maintain the productive capability of the soils. The targeted surface and beneficiaries are established as annual averages of 1,500 ha and 1,800 farms.

The soils conservation works will be performed with groups of farmers organized by the agricultural extensionists of DIGESA. The programming of activities for the project are as follows: a) identification of areas; b) selection of area; c) promotion to the farmers; d) formation of groups; and e) execution of the conservation works. For each executed hectare the farmer will receive 50% of the real expenditures of each work, and each beneficiary will have to execute one more hectare for each hectare financially supported. Adjusting the progress of the project, the cultural system and labor practices will be studied for the adequate conservation to the natural condition of the Department. Also, the construction of works to fight the sedimentation in the rivers.

The project will be divide in Stage I which will be executed in the short term and Stage II which will be carried out in the long term.

- Office: To be installed within the office of DIGESA, Region IV
- Four wheels drive vehicle: 5 units
- Motorcycles: 30 units
- Office equipment and materials: 1 set
- Equipment and materials for instruction and extension: 1 set
- Audiovisual equipment and materials: 1 set
- Equipment and materials for development and research: 1 set
- Facilities for prevention of sand sedimentation: in those rivers where sedimentation is notorious.

#### (2) Executing agency of the project

The executing agency of the project will be the office of DIGESA, Region IV. However, concerning research, cooperation from ICTA is expected.

#### (3) Cost of the project

The cost of the project including the physical contingencies is 6,832,000 quetzales (US\$ 1,312 thousands) for Stage I and 4,750,000 quetzales (US\$ 919 thousands) for Stage II, making a global amount of 11,582,000 quetzales (US\$ 2,240 thousands).

### 6.2.6 Forest Fire Prevention Project

#### (1) General description of the project

The areas covered with forests in the Department of Jutiapa are decreasing very fast in recent years. As one of the causes, it is mentioned the forest fires during the dry season. This project consists in the organization of forestal firemen for the prevention of forest fires and a campaign to prevent forest fires in order to protect the existing forestal resources which have an extension of 1,200 km<sup>2</sup> around the existing natural forests (145 km<sup>2</sup>).

The organization for prevention will be established within the DIGEBOS, and will be in charge of the permanent vigilance of the forestal zone and the campaign for fire prevention. Also, the fire brigade will be established in Jutiapa, the training of

the members of the fire brigade will be conducted and the activities of vigilance, prevention, fire extinction, and prevention of fire propagation will be carried. The main facilities, equipment and materials will be as follows:

- Office: To be installed within the office of DIGEBOS, Region IV
- Four wheels drive vehicle: 3 units
- Office equipment and materials: 1 set
- Equipments and materials for education and instruction: 1 set
- Audiovisual equipments and materials: 1 set
- Medicaments: 1 set
- Special vehicles for firemen:
  - Fire unit: 3 units
  - Tractor: 1 unit
  - Truck with trailer: 1 unit
- Equipments and materials: 1 set
- Station and storage: 1 set

(2) Executing agency of the project

The executing agency of the project is DIGEBOS, Region IV.

(3) Cost of the project

The cost of the project including the physical contingencies will be 8,511,000 quetzales (US\$ 1,646 thousands).

#### 6.2.7 Integrated Rural Development Projects

(1) Santa Catarina Mita integrated rural development project

The present project has as goals improve the agricultural productivity and raise the living conditions level through the execution of an integrated development with the main component of the irrigation system and including the farm roads and water supply in the rural zone of Santa Catarina Mita located on the hill side of the north-eastern part of Suchitán Mount.

1) General description of the project

a) Lands utilization

The area for vegetables cultivation will be increased from the present 160 ha (50 ha with irrigation) to 190 ha, all covered with irrigation. Pastures will decrease from the present 60 ha to 40 ha, but all covered with irrigation. Also, 10 ha will be used as new lands for fruits trees cultivation.

b) Agricultural production

Through the equipment of the irrigation facilities, the cultivable area for vegetables during the dry season will be increased in order to produce 2,800 ton of tomato and 1,360 ton of onion per year. Also, 300 ton of mango will be produced.

c) Irrigation

Irrigable area will be 300 ha from the right bank of the Ostúa river including the state operated irrigation unit (100 ha). Main facilities will be as follows:

Pumping station No.1 (existing):

Irrigation water requirement: 0.100 m<sup>3</sup>/sec  
Pumping charge : 20 m

Pumping station No.2 (new):

Irrigation water requirement: 0.207 m<sup>3</sup>/sec  
Pumping charge: 50 m (2-stage pumping)

d) Farm roads

Arrangement of farm roads consists in rehabilitation of existing roads in order to ease transportation and distribution of agricultural products, equipments and inputs. The level of arrangements will consist in riprapping the roads.

Trunk farm roads

(width of more than 6.0 m): 2.8 km

Branch farm roads

(width of more than 4.0 m): 10.8 km

e) Rural aqueduct

This sub-project includes installation of simple wells to catch underground waters of good quality

and distribute them in a stable way to the 6 towns located along the Departmental Highway No.4. The forecasted number of beneficiaries will be 8,233 persons (for the year 2003). The coverage of services to be rendered will be the installation of public-use faucets. In order to avoid contamination of the water, it is contemplated the possibility of installing sewage water treatment plants in the places where installation of the faucets is being planned.

f) Vegetables Commercialization Center

For a good commercialization of vegetables coming from an increase in production due to the introduction of irrigation, a Vegetables Commercialization Center will be installed near the Departmental Highway no.4. It will have an area of 7,000 m<sup>2</sup> and a constructed area of 1,300 m<sup>2</sup>.

g) Insemination Center of Small-Size Cattle

To encourage small and medium farmers to carry out agricultural and livestock activities at the same time and to improve the nutritional conditions of the population, an Insemination Center of Small-Size Cattle (swine and goats) will be installed. The cattle used for insemination will consist of 5 male swine for reproduction and 10 goats. A breeding place will be constructed.

h) Community Center

For the social intercourse of the regional population and as a place to carry out educational activities, a Community Center will be constructed. The Center will be used as the Project Office during the execution of the Project and as a Operation and Maintenance Office after finishing the civil works. The dimensions of the facilities will be as follows:

Plot area:	720 m <sup>2</sup>
Constructed area:	200 m <sup>2</sup> for offices 100 m <sup>2</sup> for meeting hall, 50 m <sup>2</sup> for warehouse

2) Executing agencies of the project

The executing agencies of the project will be DIRYA and DIGESA who will receive the collaboration of

organizations like MINDES, etc. In order to achieve an efficient and timely execution of the project, it will be required the installation of the Project Office with the participation of related organizations. The staff of the Project Office will be selected from the staff of DIRYA, DIGESA, MINDES, etc.

3) Cost of the project

The cost of the project including the physical contingencies will be 24,292,000 quetzales (US\$ 4,699 thousands).

(2) Montúfar Integrated Rural Development Project

This project aims to improve the agricultural productivity and raise the living conditions level through an integrated development. The main component of the project will be the irrigation and drainage system, and rural roads and water supply will also be included. The area of the project has a surface area of about 4,000 ha located on the coastal plain of the Pacific Ocean.

1) General description of the project

Because DIRYA has already elaborated the feasibility study, the present study will complement it on the following areas:

a) Lands utilization

Through the implementation of the irrigation and drainage works, the areas cultivated at present of 881 ha in non-irrigated lands will be transformed into 1,069 ha of potentially cultivable areas with irrigation and 103 ha without irrigation, increasing the cultivable areas to 1,172 ha. Concerning pastures, the actual 3,004 ha without irrigation will be transformed in 1,331 ha with irrigation and 933 ha without irrigation, making a total of 2,264 ha. As a consequence, the irrigable areas will be 2,400 ha including the areas for cultivation and for pastures.

b) Agricultural production

The irrigation system will make possible the cultivation of transitory crops (onion, okra, melon, etc.) during the dry season. An annual production of 2,100 ton of onion, 1,200 ton of melon, and 450 ton of okra is being estimated.



c) Irrigation and drainage

The irrigable area will be 2,400 ha and the area benefitted by the improvement of the drainage system will be 1,065 ha. Irrigation waters will be caught from the Paz river and a reservoir is planned in the El Tule Lake. Also, for floods prevention, an embarkment of 7,080 m will be constructed on the right bank of the Paz river.

d) Rural roads

Improvement of rural roads consists in the rehabilitation of existing roads, in order to ease the transportation and distribution of agricultural products, equipments and inputs. The length of the roads to be improved are shown below:

Trunk farm roads  
(width of more than 6.0 m): 17.0 km

Branch farm roads  
(width of more than 4.0 m): 2.5 km

e) Rural aqueduct

In four existing towns in the area benefitted by irrigation, the equipment of the water supply works will be implemented. The population to be benefitted by the project (in the year 2003) will be 8,105 persons.

f) Vegetables Commercialization Center

For a good commercialization of vegetables and fruits (onion, melon, okra, etc.) coming from an increase in production due to the introduction of irrigation, a Vegetables Commercialization Center will be installed near the Departmental Highway No.2. The facilities will be of the same scale as those of Santa Catarina Mita with an area of 7,000 m<sup>2</sup> and a constructed area of 1,300 m<sup>2</sup>.

g) Insemination Center of Small-Size Cattle

To encourage small and medium farmers to carry out agricultural and livestock activities at the same time and to improve the nutritional conditions of the population, an Insemination Center of Small-Size Cattle (swine and goats) will be installed. The cattle used for insemination will consist of 5 reproduction bulls, 5 male swine for reproduction and 10 goats. A breeding place will be constructed.

h) Sweet-water pisciculture

To encourage small and medium farmers to carry out agricultural and pisciculture activities at the same time and to improve the nutritional conditions of the population, the cultivation of the mojarra fish in the El Tule Lake will be encouraged. The administration will be in charge of the producers cooperative.

i) Community Center

For the social intercourse of the regional population and as a place to carry out educational activities, a Community Center will be constructed. The Center will be used as the Project Office during the execution of the Project and as a Operation and Maintenance Office after finishing the civil works. The dimensions of the facilities will be similar to those of Santa Catarina Mita with a plot area of 720 m<sup>2</sup> constructed area of 350 m<sup>2</sup>.

2) Executing agency of the project

The executing agency of the project will be DIRYA who will receive the collaboration of organizations like DIGESA, MINDES, etc. In order to achieve an efficient and timely execution of the project, it will be required the installation of the Project Office with the participation of related organizations. The staff of the Project Office will be selected from the staff of DIRYA, DIGESA, MINDES, etc.

3) Cost of the project

The cost of the project including the physical contingencies will be 111,982,000 quetzales (US\$ 21,660 thousands).

(3) Comapa integrated rural development project

This project aims to improve the rural living condition through the integral arrangement of the farm roads, water supply and the other components of the Comapa zone, the most underdeveloped zone within the Department.

1) General description of the project

a) Farm roads

The rehabilitation and arrangement of existing roads of the following 5 stretches with a length of 29 km will be carried out.

Stretch	Length (km)	Width (m)
Comapa - San Ixtan	16.0	6.0
Santa Bárbara - El Pinal	3.5	4.0
Comapa - San José	2.5	4.0
Comapa - El Carrizo	2.0	4.0
Comapa - San Miguel	5.0	4.0
Total	29.0	

b) Water supply to the rural area

As water supply facilities works, the existing water facilities will be arranged and underground waters will be utilized in the following 5 towns.

The population to be benefitted by the project will be 6,088 persons (year 2003).

Towns or Villages	Projected Population (Year 2003)	Water requirement (m <sup>3</sup> /day)	Distribution tank (m <sup>3</sup> )	Water faucets (quantity)
San José	1,876	150	60	30
El Carrizo	1,749	140	60	30
El Pinal	1,192	100	40	15
Santa Bárbara	671	60	25	10
San Miguel	600	50	20	10
Total	6,088	500	205	95

c) Reservoir

In this area where it is very difficult the direct catchment of the ground and underground waters, a much-awaited reservoir will be constructed. The reservoir will be divided in two types, one for water supply for irrigation purposes and the other one for watering of the animals. In both cases, pisciculture will be introduced in order to encourage the agricultural and pisciculture exploitation at the same time. The works will be carried out due to the express request of the producers cooperatives and private

producers; the lands to be used and the labor required will be provided by the beneficiaries.

Required equipment:

- 1 bulldozer tractor
- 1 truck with a trailer

Storage capacity:

- Irrigation:  $50\text{m} \times 50\text{m} \times 2\text{m} = 5,000\text{m}^3$
- Animals watering:  $30\text{m} \times 30\text{m} \times 2\text{m} = 1,800\text{m}^3$

Facilities locations:

- For irrigation: 20 places
- Animals watering: 20 places

d) Insemination Center of Small-Size Cattle

To encourage small and medium farmers to carry out agricultural and livestock activities at the same time and to improve the nutritional conditions of the population, an Insemination Center of Small-Size Cattle (swine and goats) will be installed. The cattle used for insemination will consist of 5 male swine for reproduction and 10 goats. A breeding place will be constructed.

e) Community Center

For the social intercourse of the regional population and as a place to carry out educational activities, a Community Center will be constructed. The Center will be used as the Project Office during the execution of the Project and as a Operation and Maintenance Office after finishing the civil works. The dimensions of the facilities will be as follows:

Plot area:	720 m <sup>2</sup>
Constructed area:	200 m <sup>2</sup> for offices 100 m <sup>2</sup> for meeting hall, 50 m <sup>2</sup> for warehouse

2) Executing agency of the project

The executing agency of the project will be DIGESA who will receive the collaboration of MINDES. In order to achieve an efficient and timely execution of the project, it will be required the installation of the Project Office with the participation of related organizations. The staff of the Project Office will be selected from the staff of DIGESA and other related organizations.

3) Cost of the project

The cost of the project including the physical contingencies will be 15,524,000 quetzales (US\$ 3,003 thousands).

**6.3 IMPLEMENTATION SCHEDULE OF THE PROJECTS**

The project included in the Master Plan will be implemented in a period of 10 years from 1994 to 2003 (the first 5 years will be denominated "short term" and the next 5 years as "long term"). The projects which their implementation is urgent and vital will be discriminated within the scope of the short term.

The implementation schedule of the projects has been prepared taking into consideration the execution priority, the financing, and budgetary distribution of the annual investment, and this schedule is shown in Fig. 6.3.1.

Concepts	Area/Stage	Short Term					Long Term					
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
1. Establishment of the Project Office		■										
2. Civil Works												
2.1 Project for Strengthening Agricultural Production, Extension and Education	Stage I Stage II			■	■	■	■	■	■	■	■	■
2.2 Project for Strengthening of Animal Health			■	■	■	■	■	■	■	■	■	■
2.3 Project for Breeding and Reproduction Improvement Center				■	■	■	■	■	■	■	■	■
2.4 Project for Irrigation and Drainage	Atescatempa Tempisque							■	■	■	■	■
	Alto Monroy							■	■	■	■	■
	Amayo Ingenio							■	■	■	■	■
2.5 Project for Soils Conservation	Stage I Stage II	■	■	■	■	■	■	■	■	■	■	■
2.6 Project for Forestal Fire Prevention states				■	■	■	■	■	■	■	■	■
2.7 Project for Integrated Rural Development	S. Catarina M. Montúfar Comapa	■	■	■	■	■	■	■	■	■	■	■
3. Rural Education and Organization		■	■	■	■	■	■	■	■	■	■	■

Note : ■■■■ : Construction ===== : Operation and Maintenance

FIGURE 6.3.1 EXECUTION SCHEDULE OF MASTER PLAN

## 6.4 REQUIRED INVESTMENTS

### 6.4.1 Assumptions for the estimation of the investments

#### (1) Unit price

The basic unit prices of the corresponding works were established considering the unit prices used in the executed and planned projects in the Department of Jutiapa and the Republic of Guatemala. Specially, regarding the irrigation and drainage works, the data used in the "Montúfar Irrigation and Drainage Project" formulated by DIRYA was used as a reference. Also, the basic unit prices were transformed into current prices taking August of 1992 as a base.

#### (2) Exchange rate

The exchange rate utilized for calculation of the required investments is as follows:

US\$1.0 = 5.17 quetzales

US\$1.0 = 125 yens

#### (3) Engineering services cost and physical contingencies portion

The engineering services cost has been fixed in 10% of the total cost of the civil works and a 15% for physical contingencies has been considered to cover possible variations in the amount of the works and modification of factors related to the project.

### 6.4.2 Total Investment

Total investment for the projects of the Master Plan including the physical contingencies is around 317,000,000 quetzales (US\$61.3 millions). The short and long term investments are 226,000,000 quetzales (US\$ 43.7 millions) and 91,000,000 quetzales (US\$ 17.6 millions), respectively. The breakdown of the investments by project and the disbursement schedule by year is described in Table 6.4.1.

### 6.4.3 Operation and Maintenance Cost

The operation and maintenance cost include the personnel cost, office expenditures, energy and fuel expenditures, replacement and repairs costs, etc., plus a 10% for physical contingencies. The annual cost will be 4,805,000 quetzales (US\$ 929 thousand) at current prices. The breakdown of the annual cost is detailed in Table 6.4.2.

TABLE 6.4.1 DISBURSEMENT SCHEDULE FOR THE MASTER PLAN

(Unit: 1000Q)

Concepts	Short Term										Long Term				Total
	1994	1995	1996	1997	1998	Sub-total	1999	2000	2001	2002	2003	Sub-total			
1. Project for Strengthening Agricultural Production, Extension and Education	0	0	575	3,950	10,668	15,193	569	569	569	569	569	2,845	18,038		
2. Project for Strengthening of Animal Health	0	4,671	4,802	0	0	9,473	0	0	0	0	0	0	9,473		
3. Project for Breeding and Reproduction Improvement Center	0	0	575	18,108	12,794	31,477	0	0	0	0	0	0	31,477		
4. Project for Irrigation and Drainage															
4.1 Atescatempa Zone	0	0	0	0	0	0	0	1,150	7,075	7,450	0	15,675	15,675		
4.2 Tempisque Zone	0	0	0	0	0	0	1,150	10,207	10,207	0	0	21,564	21,564		
4.3 Alto Mongoy Zone	0	0	0	575	2,501	3,076	0	0	0	0	0	0	3,076		
4.4 Amayo Ingenio Zone	0	0	0	0	0	0	0	2,300	12,246	14,862	16,761	46,169	46,169		
4.5 Sub-total	0	0	0	575	2,501	3,076	1,150	13,657	29,528	22,312	16,761	83,408	86,484		
5. Project for Soils Conservation	2,289	1,693	950	950	950	6,832	950	950	950	950	950	4,750	11,582		
6. Project for Forestal Fire Prevention	0	1,335	7,176	0	0	8,511	0	0	0	0	0	0	8,511		
7. Project for Integrated Rural Development															
7.1 S. Catarina Mita Zone	2,300	12,562	9,430	0	0	24,292	0	0	0	0	0	0	24,292		
7.2 Montufar Project	0	3,450	36,199	40,498	31,835	111,982	0	0	0	0	0	0	111,982		
7.3 Comapa Project	0	0	1,150	8,418	5,956	15,524	0	0	0	0	0	0	15,524		
7.4 Sub-total	2,300	16,012	46,779	48,916	37,791	151,798	0	0	0	0	0	0	151,798		
8. Total Cost	4,589	23,711	60,857	72,499	64,704	226,360	2,669	15,176	31,047	23,831	18,280	91,003	317,363		



Table 6.4.2 ANNUAL COST OF OPERATION AND MAINTENANCE OF THE PROJECTS

Projects	Amount (Q)
1. Strengthening of agricultural production, extension and education	96,000
2. Strengthening of animal health	141,000
3. Breeding and reproduction improvement	151,000
4. Irrigation and drainage	
4.1 Atescatempa	98,000
4.2 Tempisque	227,000
4.3 Alto Mongoy	41,000
4.4 Amayo Ingenio	248,000
Subtotal	<u>614,000</u>
5. Soils conservation	180,000
6. Forestal fire prevention	150,000
7. Integrated rural development	
7.1 Santa Catarina Mita	1,026,000
7.2 Montúfar	1,864,000
7.3 Comapa	583,000
Subtotal	<u>3,473,000</u>
<b>Total</b>	<b>4,805,000</b>

## 6.5 ORGANIZATION FOR THE EXECUTION OF THE PROJECTS AND OPERATION AND MAINTENANCE PROGRAM

### 6.5.1 Organization for the Execution of the Projects

The general coordination for the execution of the projects will be in charge of the public sector responsible for the agricultural and livestock and nutrition sectors, but it will be important to have the cooperation of related governmental organizations because the projects cover other sectors outside the agricultural and livestock sector like roads, water supply, etc. Thus, it will be important to establish the executing agency of the Master Plan who would be responsible of the coordination among the different sectors and to supervise the timely and efficient execution of the projects. As organizations