

4.1.2 Meteorology and Hydrology

(1) Available Data

The hydrometeorological stations in the Quindio Basin may be summarized as follows:

Type of Observation	No.	Responsible by
Meteorology	10	CRQ (4), HIMAT (3), CENICAFE (3)
Rainfall	40	CRQ (16), HIMAT (1), CENICAFE (23)
Hydrology	1	HIMAT (Alambrad)

These stations have been in operation for 3 - 30 years, and most of them are located in the central and northern parts of Quindio. The river discharge has been observed since 1974 at the point of the Alambrado bridge installed over the La Vieja river.

(2) Meteorology

The climate of the Department of Quindio may be classified into 5 zones as follows:

Classification	Altitude	Proportion by Area	Annual Rainfall	Mean Temperature
Warm subhumid	900 - 1,200 m	17%	1,900 mm	22°C
Warm humid	1,200 - 1,700 m	31%	2,600 mm	20°C
Semiwarm humid	1,700 - 2,300 m	21%	2,200 mm	15 - 18°C
Cold humid	2,300 - 3,000 m	17%	2,000 mm	10 - 14°C
Highland cold drizzly humid	over 3,000 m	14%	1,800 mm	3 - 10°C

Approximately 2,000 mm of the average annual rainfall is assumed and two dry periods (January - February and June - August) and wet periods (April - May and October - November) are observed in the annual rainfall pattern of Quindio in general. Depending on altitude, mean temperatures vary from 3 to 22°C. The relative humidity is generally high, with an annual average rate of approximately 80% without any regional deviation. The evaporation in this area is estimated at approximately 900 - 1,000 mm/year, calculated roughly using river discharge and rainfall data.

(3) Hydrology

1) Rainfall Analysis

14 stations were selected for rainfall analysis, considering the location, accuracy of data, etc. The results of the analysis for the average of total area in Quindio are as follows:

ANNUAL RAINFALL PATTERN IN DROUGHT YEAR (mm)

Month	Return Period							
	1/2		1/4		1/5		1/10	
Jan	136	(94)	114	(86)	109	(84)	98	(78)
Feb	133	(93)	112	(86)	107	(83)	96	(77)
Mar	180	(103)	151	(99)	144	(97)	129	(93)
Apr	230	(105)	194	(103)	186	(102)	167	(99)
May	199	(104)	167	(100)	160	(99)	144	(96)
Jun	116	(88)	98	(79)	94	(77)	84	(71)
Jul	80	(69)	67	(60)	64	(58)	57	(52)
Aug	106	(84)	89	(75)	85	(78)	76	(67)
Sep	137	(97)	115	(89)	110	(86)	98	(81)
Oct	256	(106)	215	(105)	206	(105)	184	(102)
Nov	246	(103)	208	(103)	199	(102)	179	(99)
Dec	168	(100)	142	(94)	136	(92)	122	(87)
Annual	1,987	(1,146)	1,670	(1,077)	1,601	(1,057)	1,433	(1,001)

Note: Figures in parentheses represent effective rainfall.

ANNUAL MAXIMUM 24-HOUR RAINFALL (mm)

Return period	1/2	1/5	1/10	1/20
Rainfall	76.7	95.8	107.7	118.6

The rainfall intensity was estimated using the maximum 24-hour rainfall because no hourly rainfall data were available.

2) Runoff Analysis

The low flow analysis was carried out by using data collected at the Alambrado bridge station (mean discharge: 34.5 lit/s/km²), and the droughty discharge was estimated by using the specific discharge.

DROUGHTY DISCHARGE (ALAMBRADO STATION)

Return Period	1/2	1/5	1/10	1/20
Discharge (m ³ /s)	11.6	8.3	6.9	6.0
Specific Discharge (lit/s/km ²)	7.14	5.08	4.25	3.68

The flood analysis was carried out for each point by using the Rational Formula, considering the rainfall and catchment area.

FLOOD DISCHARGE (PEAK SPECIFIC DISCHARGE: $\text{m}^3/\text{s}/\text{km}^2$)				
Return Period	1/2	1/5	1/10	1/20
Catchment area				
over 500 km ²	0.521	0.614	0.668	0.714
200 - 500 km ²	1.170	1.444	1.610	1.736
under 200 km ²	3.967	5.004	5.650	6.249

3) Sediment Runoff Analysis

The analysis on data collected at the Alambrado bridge station revealed that approximately 2.6 million tons/year of suspended sediment is observed and the sediment runoff is estimated to be 1,500 m³/km²/ year.

4.1.3 Geology and Hydrogeology

(1) Geology

The geological outline of Quindio Department is shown in Fig. 4.1.1. Paleozoic metamorphic rocks comprise the basement in the broad mountains in the east and a part of the plains in the west, Quindio Department, including phyllite, amphibole schist, gneiss, graphite schist, calcareous schist and chlorite schist. They are penetrated by intrusive rocks. Basaltic lavas, greywacke, limestone and chert of Mesozoic age are interbedded with the basement in the marginal part.

Tertiary conglomerate and greenish sandstone are distributed in the plains. In the northern part of the mountains, they are overlaid by lavas, volcanic mud-flow deposits and volcanic ashes, which were thickly accumulated during the time interval from the latest Tertiary to the Quaternary.

Pleistocene glacial moraine beds cover the upper portion of the Nevado del Quindio. Along individual rivers are minor terraces of fluvial origin.

(2) Hydrogeology

Hydrogeological conditions of Quindio Department differ from the northern part of the mountains, the southern part of the mountains and the plain part.

1) Northern part of the mountains

It is made up of the hard and compact metamorphic rocks and overlying thick volcanic products of the Armenia Formation. The former mainly consists of crystalline schists, giving poor expectation for recharge reserves. High recharge storage can be expected from the unconsolidated volcanic products.

2) Southern part of the mountains

The high-grade metamorphic rocks, which underly in this region, have been deeply weathered due to abundant faults and fracture zones. Volcanic material is scarce. Large-scale landslides have occurred at many sites, resulting in high recharge reserves.

3) Western plain part

The basement consists of the hard Paleozoic to Tertiary rocks with low recharge reserves. The overlying volcanic ashes, volcanic mud-flow deposits, lavas and agglomerates derived from the Nevado del Quindio have a thickness of more than 200 m in places, and recharge reserves are therefore high.

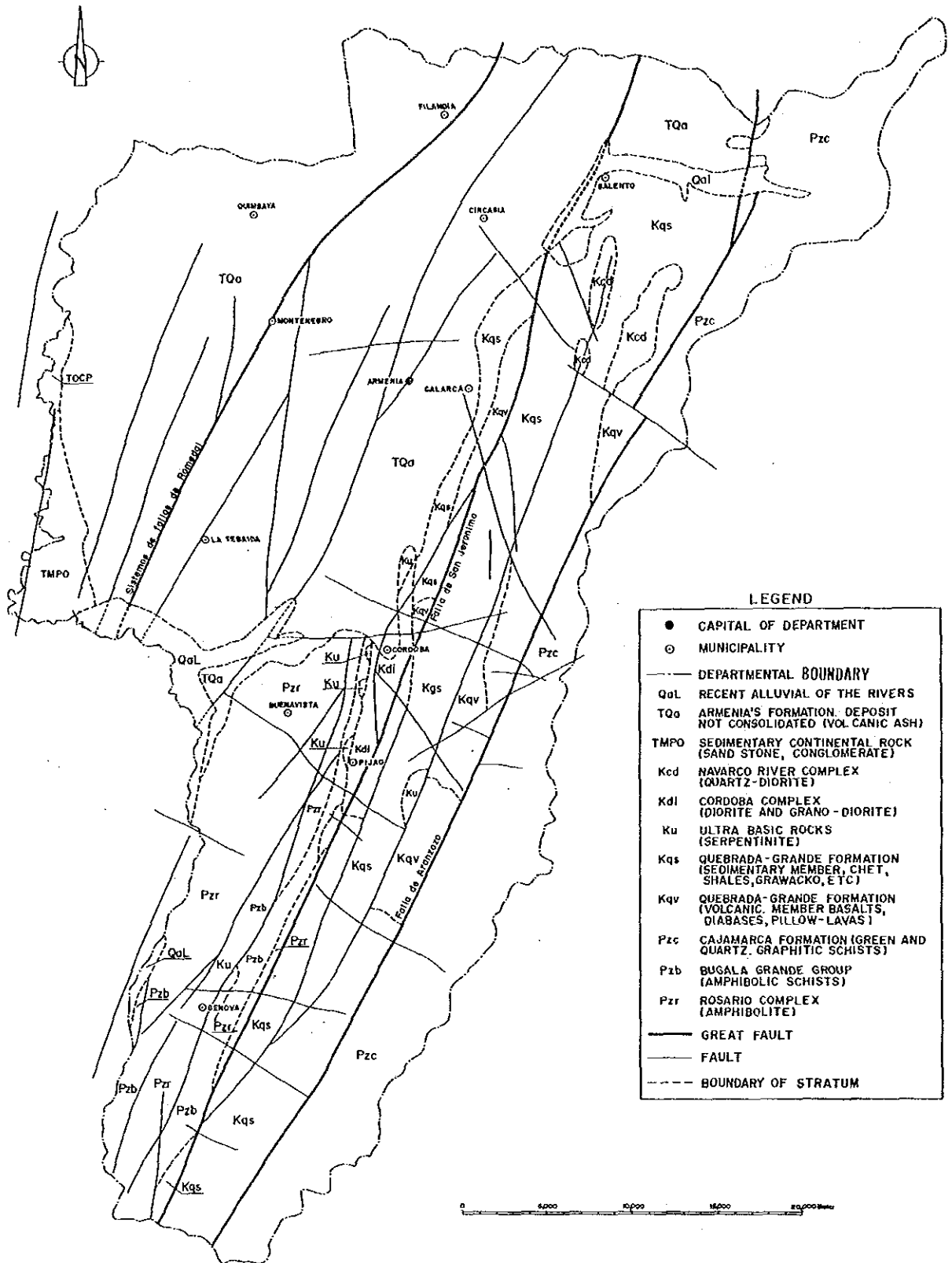


Fig. 4.1.1 GEOLOGICAL MAP IN QUINDIO

4.1.4 Soil

The soil map with a scale of 1/100,000 covering the whole study area has been prepared by the Study Team based on FEDECAFE'S map.

According to the map, soil in the study area is classified into 17 units. Soil analysis of main soil unit of the area was entrusted to IGAC and ICA to verify existing soil data. Using soil analysis data collected from IGAC, FEDECAFE, and ICA, the Study Team disclosed the physical and chemical properties of each soil unit as shown in Table 4.1.1.

Most of soils in the area are affected by volcanic ash. According to the U.S.D.A.'s Soil Taxonomy, Dystrandept is the most dominant great group in the area, which covers more than 60% of the area and is mainly distributed in the undulating hills and the mountain areas. The second greatest soil group is Hapludoll, which covers about 15% of the area and distributed mainly in Genova and Pijao.

Soils are generally categorized by such prevailing conditions as climate, vegetation and topography, and parent materials. Therefore, soils in the area can be classified into 7 greatest groups as given below:

SOIL CLASSIFICATION

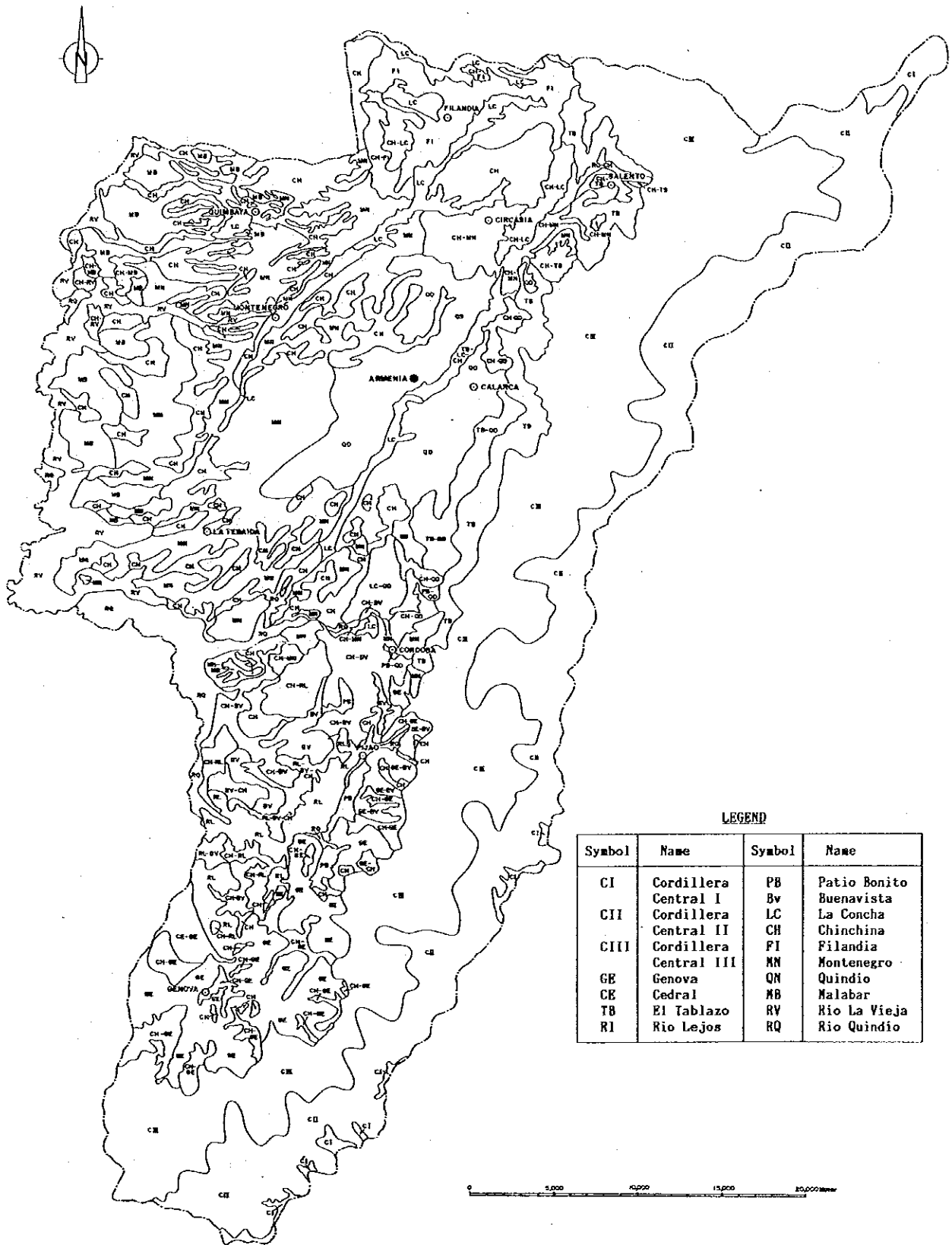
Groups	Soil Unit	Classification	Prevailing Features	Coverage (%)
Undulating to rolling area along river	LC, RV	Dystrandept Hapludalf Hapludoll	Low pH, Moderate drainage, Thin soil layer, Low fertility	5.9
Almost flat area	MB	Dystrandept Tropudalf	Medium pH, Slightly poor drainage, Thick soil layer, Medium to high fertility	3.3
Flat area	RQ	Tropofluent	Medium pH, Poor drainage, Thick soil layer, Medium to high fertility	2.0
Undulating hill area	QD, MN, FI, CH	Dystrandept	Medium to low pH, Moderate drainage, Thick soil layer, Medium to high fertility	30.1
Undulating to steep area	GE, BV, TB, RL, PB, CE	Hapludoll Dystrandept Dystropept	Medium pH, Moderate drainage, Thick soil layer, Medium to high fertility	20.2
Mountain area	C II, C III	Dystrandept Dystropept	Low pH, Moderate drainage, Thin to thick soil layer, Medium to high fertility	37.6
No vegetation area	C I	Cryorthent Cryopsament	Consist of lava	0.9

Table 4.1.1 SOIL CHARACTERISTICS AND DISTRIBUTION

Soil Unit	Parent Material	Soil Characteristics						Soil Distribution	
		ph	CEC	Texture	Drainage	Soil Depth	Fertility	Altitude(m)	Slope(%)
CI	L	---	---	---	---	---	---	>3,500	>55
CII	V,M	M	H	M	M	S-P	M-H	>3,000	>20
CIII	V,M	M	H	M	M	M-P	M-H	2,000-3,000	>20
GE	V,M	M	M-H	M	M	S-M	M-H	1,000-2,000	10-55
CE	V,M	M	M-H	M	M	S-M	M	1,850-2,000	25-55
TB	V,M	M	M-H	M	M	S-P	M	1,500-2,000	15-25
RL	V,M	M	H	M	M	S-M	H	1,200-2,000	10-25
PB	V,I	M	M	M	M	S-M	M	1,800-2,000	20-55
BV	V,I	M	M-H	M	M	S-M	M-H	1,200-2,000	20-55
LC	V,I	M	L-M	M	M	VS-M	M	1,100-1,500	6-25
CH	V	M	M-H	M	M	M-P	M-H	1,100-2,000	2-10
FI	V	M	H	M	M	M-P	M	1,800-2,200	4-6
MN	V	M	M-H	M	M	P	M-H	1,100-1,700	2-6
QN	V	M	H	M	M	P	M-H	1,200-1,700	2-6
MB	V	M	M-H	M	P-M	P	M-H	1,000-1,200	2-4
RV	S	M	L-M	C-M	M	VS-S	L-M	950-1,200	6-15
RQ	A	M	M	F-M	P	M-P	M-H	950-1,200	0-4

Parent Material: I: Igneous Rock L: Lava M: Metamorphic Rock V: Volcanic Ash
 pH : L: Low >5.0 M: Moderate 5.0-6.0 H: High 6.0<
 CEC : L: Low <10meq/100g M: Medium 10-20meq/100g H: High 20meq/100g<
 Drainage: P: Poor M: Moderate H: High
 Texture: F: HC,SiC Coarse: S,LS Medium: Others
 Soil Depth : VS: Very Superficial <25cm S: Superficial 25-50cm M: Medium
 Profound 50-90cm P: Profound 90-150cm
 Fertility: See Soil Fertility Evaluation
 Source: Study Team,IGAC,FEDECAFE
 Soil Symbol and Name :

Symbol	Name	Symbol	Name
CI	:Cordillera Central I	PB	:Patio Bonito
CII	:Cordillera Central II	Bv	:Buenavista
CIII	:Cordillera Central III	LC	:La Concha
GE	:Genova	CH	:Chinchina
CE	:Cedral	FI	:Filandia
TB	:El Tablazo	MN	:Montenegro
RL	:Rio Lejos	QN	:Quindio
		MB	:Malabar
		RV	:Rio La Vieja
		RQ	:Rio Quindio



LEGEND

Symbol	Name	Symbol	Name
CI	Cordillera Central I	PB	Patio Bonito
CII	Cordillera Central II	BV	Buenavista
CIII	Cordillera Central III	LC	La Concha
GE	Genova	CH	Chinchina
CE	Cedral	FI	Filandia
TB	El Tablazo	MN	Montenegro
RI	Rio Lejos	QN	Quindio
		MB	Malabar
		RV	Rio La Vieja
		RQ	Rio Quindio

Fig. 4.1.2 SOIL MAP IN QUINDIO

4.1.5 Water Quality

Rivers in the Study Area receive the coffee treatment water from about eight thousand coffee farms and domestic sewage from the cities of Armenia, Calarca, etc. These waste water flows into the Quindio river basin without any treatment. Consequently, the water quality in this area is getting worse year by year.

The water sampling from a total of 33 points located in rivers and streams in Quindio was performed between February and September, 1987 and the results of laboratory analysis on the sampled water, are summarized below (detailed information on this matter is presented in Annex G).

(1) Domestic Sewage and Waste

The water pollution in rivers of the Study Area is mainly caused by the coffee water and the domestic sewage and waste; the latter has major influence on water pollution. The water at all sampling points was beyond the limit of coliform groups set as 2,000 MPN/100 ml. In particular, the following rivers were in excess of the limit of standards as indicated in parentheses.

- Medium and Lower Stream of the Espejo River (Coliform Groups, A.B.S., BOD, DO)
- Medium Stream of the Quindio River (Coliform Groups, A.B.S., BOD)
- Medium Stream of the Santo Domingo River (Coliform Groups, A.B.S., BOD)

(2) Coffee Waste

As for the coffee waste, the three major wastes from the processing of coffee bean are pulp, pulping waste and fermentation waste water.

The pulp waste is the one that is potentially the most troublesome, but it is generally recovered and used for fodder or fertilizer. Therefore, the pulp is not a direct cause of water pollution. But, when it rains, the pulp used for fertilizer is washed away and it becomes highly pollutant.

The fermentation wastes, on the other hand, flow directly into rivers and streams without treatment, therefore it can be said that these wastes are the main causes of water pollution.

Coffee wastes have an especially harmful effect on water quality in April, May, October and November which correspond to the months of coffee harvest. The following four rivers are largely affected by coffee wastes.

- The Cristales river
- The Roble river
- The Buenavista river
- The Barragan river

As for the water used in washing, the coffee farms that take their water directly from small streams cause no problem, but those located in the central part without small streams take their water from such rivers as are affected by the coffee waste. Generally, coffee farms around La Tebaida suffer from seriously poor water quality. Classification of water quality is shown in Fig. 4.1.3.

4.1.6 Water Resources

(1) Characteristic Features of Water Resources in Quindio

All rivers in the Department of Quindio belong to the La Vieja river system. From the viewpoint of water resources, the Department may be divided into 2 zones (the eastern part with a catchment area of 1,365.9 km² and the western part with that of 580.8 km²) by the division of the right bank of the Quindio river (see Fig. 4.1.4).

The characteristic of the eastern part is such that all main rivers originate from the Central Range of the Andes, at over 2,000 m of altitude, annual rainfall of 1,500 - 1,800 mm is expected, and approximately 800 km² of the watershed which is 40% of the whole area of Quindio is covered.

The characteristic of the western part, on the other hand, is such that sources of the main rivers are located at highland with land elevation below 2,000 m, and an annual rainfall ranges between 2,600 - 2,900 mm, and approximately 200 km² of the watershed is existing.

(2) Surface Water

A total of 2,150 million m³ (1.10 million m³/km²) of water is discharged yearly in Quindio, of which 1,490 million m³ (1.09 million m³/km²) is from the eastern part and 660 million m³ (1.13 million m³/km²), from the western part.

In connection with the seasonal pattern of the runoff, it is quite a low discharge in three months of July, August, September; 11% of the total annual runoff in the eastern part and 15%, in the western part. This seasonal pattern is one of the major constraints in Quindio. However, with the construction of a water reservoir, it would be possible to supply more water in the dry season.

(3) Groundwater

It is roughly estimated that the groundwater is annually replenished in the range of 50 - 100 thousand m³/km² (1.5 - 3.0 l/s/km²), although more detailed study is essential to calculate more accurately the amount of reserve of groundwater. Despite there is no comprehensive information available, it is supposed that some portion of groundwater is pumped through a number of wells for rural water supply purpose. Therefore, groundwater may be utilized for a small-scale water supply project.

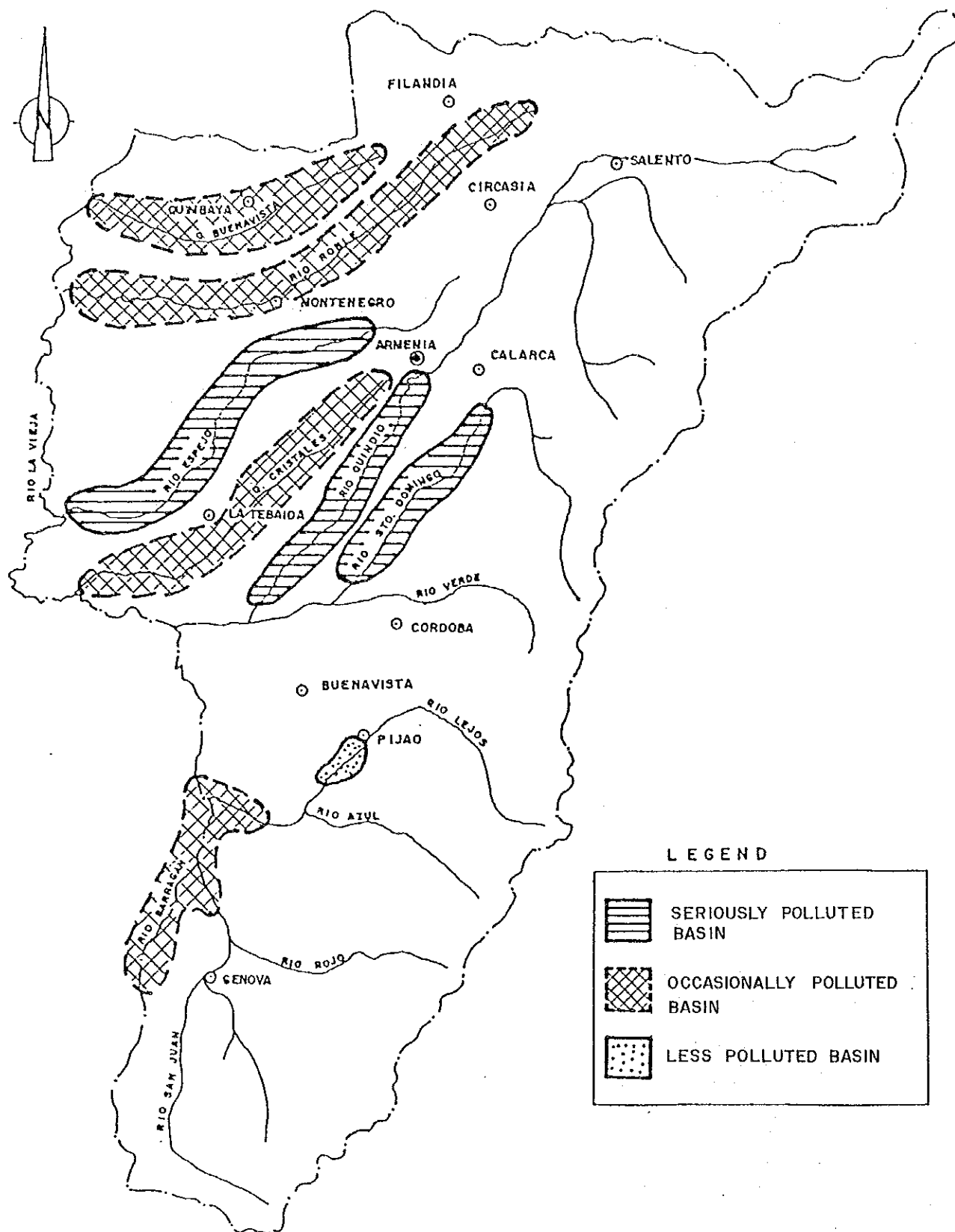


Fig. 4.13 CLASSIFICATION OF WATER QUALITY IN QUINDIO

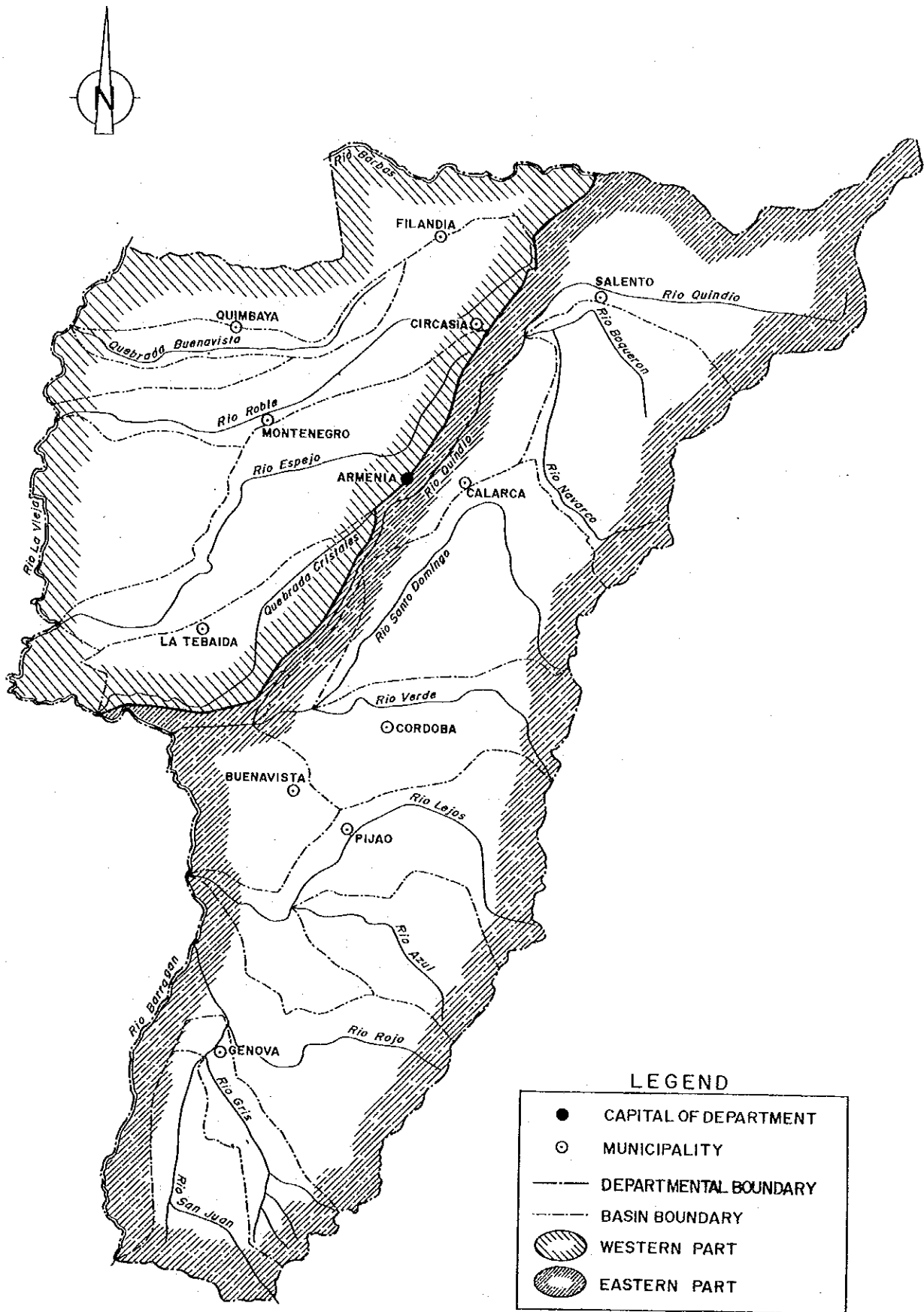


Fig. 4.1.4 CATCHMENT AREAS OF RIVERS IN QUINDIO

4.2 SOCIO-ECONOMIC FEATURES

4.2.1 Administrative Organization and Local Government

(1) Regional Autonomous Corporation of Quindio (C.R.Q.)

C.R.Q. is an autonomous body established in December, 1964 and existing under the jurisdiction of DNP. The principal objective of the corporation is to promote an economic development of the Department by taking care of conservation and administration of all kinds of natural resources.

The organization of C.R.Q. is composed of natural resource and electric divisions; the former is taking charge of conservation and development of natural resources, reforestation, promotion and administration of livestock and plants, etc. and the latter is responsible for electric supply services in rural area of the Department. Besides the present Master Plan Study, C.R.Q. is currently implementing programs as titled below:

- Integrated Rural Development (DRI) Program
- Pisciculture Development Project
- Experimental Center for the Study and Reproduction of Bamboo (Guadua)
- Establishment of Measures for the Management of Soils under Cultivation of Cassava

The 1986 budget allocated to C.R.Q for investment totaled Col.\$210 million including Col.\$9 million for procurement by itself.

(2) Departmental Office of Quindio

The Department of Quindio was founded in January, 1966 separated by the Old Caldas and its constitution has been effective since February, 1966. At present, there are twelve (12) municipalities and five (5) special districts called "corregimiento". The Departmental office is situated in Armenia and it consists of Governor's office, directorate of departmental planning and five bureaus (general affairs, finance, public works, education and agriculture). In addition, the following institutions are organized under the jurisdiction of the Departmental Office.

- University of Quindio
- Departmental Institute of Traffic
- Lottery of Quindio
- Social Insurance Fund of Quindio

(3) Local Offices of Central Government

Local offices of the Central Government operating in Quindio are as given below:

- National Social Welfare Fund
- Ministry of Public Work (Regional Office No. 23)
- National Travel Bureau

- Electricity and Communications Bureau
- National Fund for Rural Roads
- Exportation Promotion Fund
- Colombian Institute of Agriculture and Livestock (ICA)
- Colombian Institute of Family Welfare
- Colombian Institute of Foreign Trade
- Colombian Institute of Agriculture and Livestock Markets (IDEMA)
- Social Insurance Institute
- National Geographic Institute
- Colombian Institute of Agrarian Reform (INCORA)
- National Apprenticeship Service
- Agrarian, Industrial and Mining Credit Bank (Caja Agraria)
- National Institute of Health

4.2.2 Population

The total population of the Department of Quindio, shown in the previous census carried out in 1985, is 378 thousand. The number of households is 82 thousand (4.6/household). Population growth averaged 1.2% a year during the years between 1973 and 1985. 81% of the population was living in the urban areas in 1985; the trend of rural exodus has slowed down recently.

Between 1983 and 1985, the number of farmers' households increased by 2.6% yearly, whereas the rural population decreased by 2.5% yearly. The population of Armenia is 187 thousand for the same year.

4.2.3 Labour Force and Employment

The economically active population reached 137,811 in 1985, and unemployment rate was 5.0%.

Sector-wise classification of the labour force is given in the following table.

LABOUR FORCE BY SECTOR

Sector	Number	Participation (%)
Agriculture	60,418	46.1
Livestock	2,048	1.6
Manufacture	7,356	5.6
Tertiary Industry	59,276	45.3
Not Classified	1,864	1.4
Total	130,962	100.0

Source: SENA, 1986

4.2.4 Income Level

Average monthly salaries and wages of workers in Quindio who join the social security program in December 1986 are as follows. They are classified into 32 categories.

The average of 15 lower categories is Col.\$17,790. 72.4% of the total beneficiaries of the program are in these categories. The average of 6 categories (27 - 36) is Col.\$123,210. 1.6% of them are in these categories.

The minimum daily wage set by the Central Government at the beginning of 1987 was Col.\$683, rose by 22.0% over the previous year. Enquiry made by the Study Team reveals that the farm hands are earning around Col.\$1,000 a day.

4.2.5 Welfare and Education

(1) Welfare

There were 18 public hospitals or clinics and 62 health centers with around 1,000 beds in Quindio as of 1985. Every municipality has at least one hospital or clinic in its urban area. The rural areas of Salento, La Tebaida, Cordoba, Buenavista and Genova have neither health center nor health post.

The medical services of these public health institutions are maintained by 142 medical doctors, 40 dentists, 30 professional nurses and 30 bacteriologists.

The scale of the number of medical practitioners per 1,000 of population is highest in Armenia, which is 1.89; the lowest in the rural areas of Salento, Filandia, Quimbaya, La Tebaida, which are between 0.0 and 0.19. 88 rural public health care promoters were filling the gap of the service.

Thanks to all these efforts, the infant mortality rate in the Department stood only 19 per 1,000 of population, which was one of the lowest in the country. Social workers are also suffering the problem of poverty, especially in child nutrition.

(2) Education

The illiteracy rate in Quindio is the second lowest after Valle del Cauca in the country. The base of this achievement lies in the efforts on the part of administration to increase the number of school teachers and buildings, though there is still room for improvement.

The table below shows their numbers.

EDUCATIVE CENTER AND EDUCATIONAL LABORS
FOR THE DEPARTMENT OF QUINDIO, 1985

	Total (school/teacher)	Urban (school/teacher)	Rural (school/teacher)
Pre-school	66/106	64/100	2/6
Primary school	342/1,962	261/1,565	101/397
High school	69/1,714	61/1,623	8/91

Source: Secretaria de Educacion

As for superior education institutions, there are two universities; University of Quindio and University of Gran Colombia. There is one Scholastic Fund for Administration and Marketing of Quindio. The established educational period for universities is five years and that for the Scholastic Fund is three years. The University of Quindio has four faculties (medicine, engineering, education and public accounting), which are further divided into 10 sections in total and the University of Gran Colombia comprises three faculties (law, economics and agricultural industry).

4.2.6 Regional Economic Activities

In the valley of Quindio, animal husbandry is predominant, especially in the northern and southern parts. Coffee growing dominates in the middle part where the small patches of meadows, which also accommodate farm yards, seem to be trapped by the expense of the healthy green leaves of coffee trees, of old and new varieties.

In the urban area, while products from these two industries are processed, other economic activities center on their inputs and incomes.

Gross Regional Product (GRP) at factor cost in 1980 is Col.\$2,128.9 million at constant price of 1970, with an average yearly growth rate of 2.72% since 1960, while the GDP had been growing at the average rate of 5.52%.

Production from the agricultural sector contributes 27.1% to the total GRP; the manufacturing sector, 12.9%, and commerce, 14.8%. Domination of the agricultural sector has been constantly diminishing; in the 1960's, the ratio of contribution was 43%.

4.3 INFRASTRUCTURE

4.3.1 Transport Facilities

According to the Directorate of Planning of the Departmental Office of Quindio, the rate of development for transport facilities as of 1983 is as summarized below:

SUMMARY OF ROADS IN QUINDIO				(Unit: km)
Road classification	Paved Road	Unpaved Road	Total	Remarks
National Roads (1)	154	60	214 (8.2%)	*
National Roads (2)	0	317	317 (12.1%)	**
Departmental Road	5	780	785 (29.9%)	***
Private Road	0	1,305	1,305 (49.8%)	
Total	159 (6.1%)	2,462 (93.9%)	2,621 (100.0%)	

Source: Plan Vial 1983

Note: * Ministry of Public Works and Communications
** National Fund for Rural Roads
*** Bureau of Public Works, Departmental Office in Quindio

All the trunk roads linking Armenia with major municipalities of the surrounding departments are completely paved with adequate maintenance service, while a large portion of secondary roads connecting municipalities within the Department is not paved. The traffic volume is registered at 8,000 vehicles/day at the maximum level in the road between Armenia-Calarca, at 3,000 - 1,500 vehicles/day in major secondary roads, and fewer than 1,000 vehicles/day in other secondary roads. The network within the Department is shown in Fig. 4.3.1.

Transportation system in Quindio is represented by bus and taxi and 8 bus companies and 18 taxi companies are operating for rendering services. The National Railway has a round trip service a day between Armenia and Cali. In addition, jet planes land to Bogota twice a day from Armenia Airport located 15 minutes away by car from the central area. Besides, an international airport is found in Pereira, one hour away from Armenia by car.

4.3.2 Telecommunications

In accordance with the National Development Plan, telecommunication services have been developed although its rate of development is a little behind schedule. The number of services within municipality is 16,680 in Armenia, 4,060 in Calarca, 1,040 in Quimbaya, and 840 in Montenegro. Furthermore, 60 lines are in service for long distance calls from the Department.

4.3.3 Electric Power

A greater portion of the electric power consumed in the Department is supplied from the Caldas Hydro-electric Power Station (CHEC) and the total amount of consumption reached 240 million kWh per annum. Despite six power plants are provided in Quindio, only one (La Union Station) is actually operating, the remainder being out of order with outworn equipment. Rehabilitation is to be planned in the near future for El Bosque Station.

FEATURES OF POWER STATIONS

Power Station	Rivers	Volume of Water (m ³ /s)	Water Head (m)	Capacity (kWh)	Institution
Comestres	Quindio	1.7	60	1,200	EPC*
Bayona	Quindio	3.2	35	1,200	EPC
La Union	Quindio	1.4	54	900	EPC
El Bosque	Quindio	2.6	80	2,280	EPA**
Pijao	Lejos	0.7	56	300	C.R.Q. & M. Pijao
Montenegro	Roble	0.4	50	250	M. Montenegro

Note: * Public Enterprise of Calarca

** Public Enterprise of Armenia

Fig. 4.3.2 indicates the location of above stations.

4.3.4 Water Supply and Sewage Treatment Systems

(1) Water Supply System

Water for domestic use is generally taken from rivers by gravity, but there are some cases where water is pumped from small streams or through wells. Water supply for urban areas is managed by Quindio Water Supply Enterprise (EMPOQUINDIO), Coffee Committee, National Sanitation Institute (INS), and municipal offices. Purification plants for water supply are adequately equipped.

Water for rural areas is supplied in its major portion by means of piping system without purification measures under the management of Coffee Committee, INS and municipal offices. According to the enquiry survey conducted by the Study Team, domestic water is short in supply in southwestern part of Circasia and western part of Armenia; the latter is also confronted by inferior water quality because its water is taken from the Espejo river.

(2) Sewage Treatment System

Although sewers are provided in urban areas of the Department, sewage from these sewers is discharged into the rivers without treatment, causing water pollution of the rivers. In rural areas as well, with the exception of some farms where sewage is simply treated by infiltration method, sewage is directly discharged into the rivers.

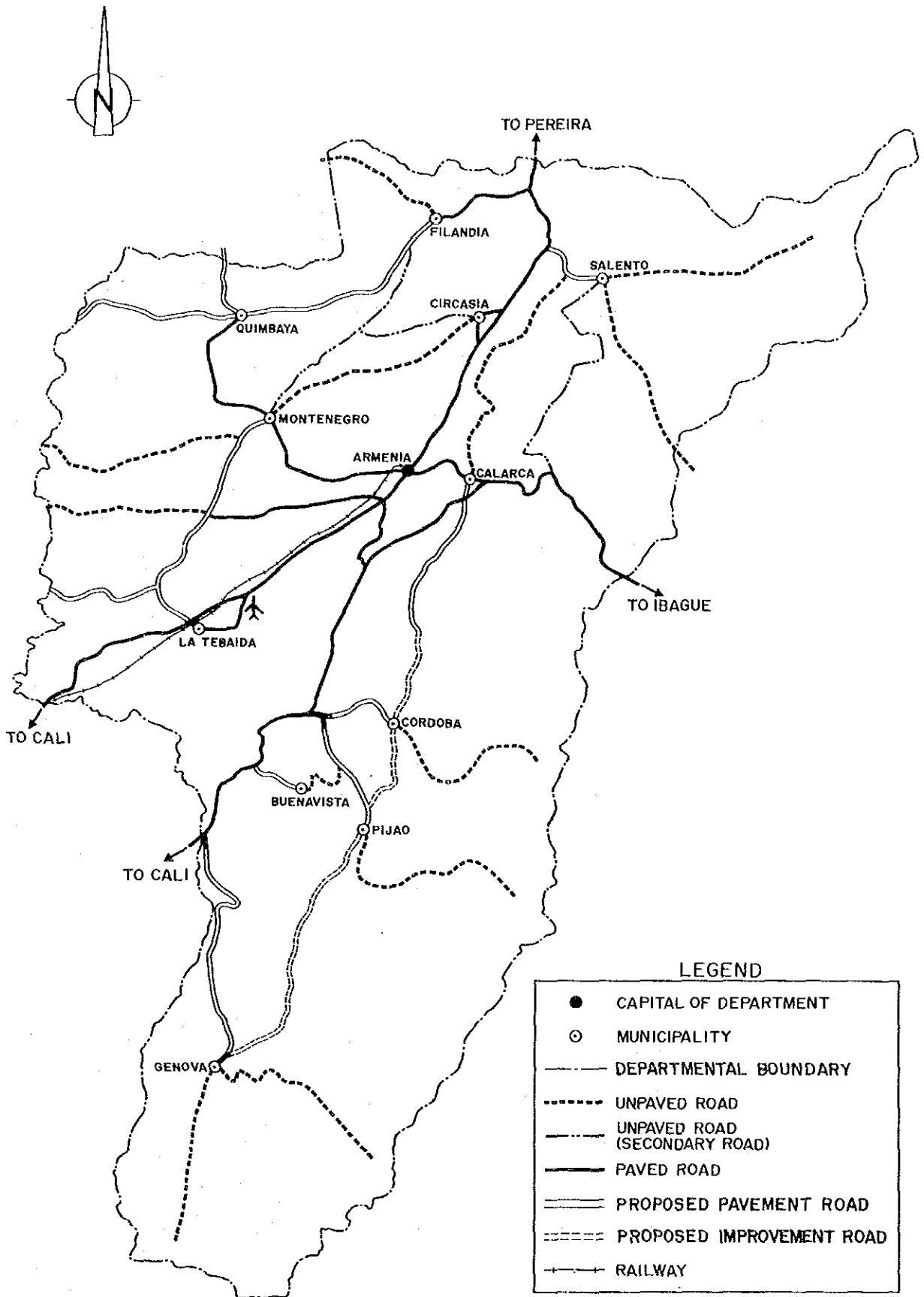


Fig. 4.3.1 TRANSPORTATION INFRASTRUCTURE NETWORK IN QUINDIO

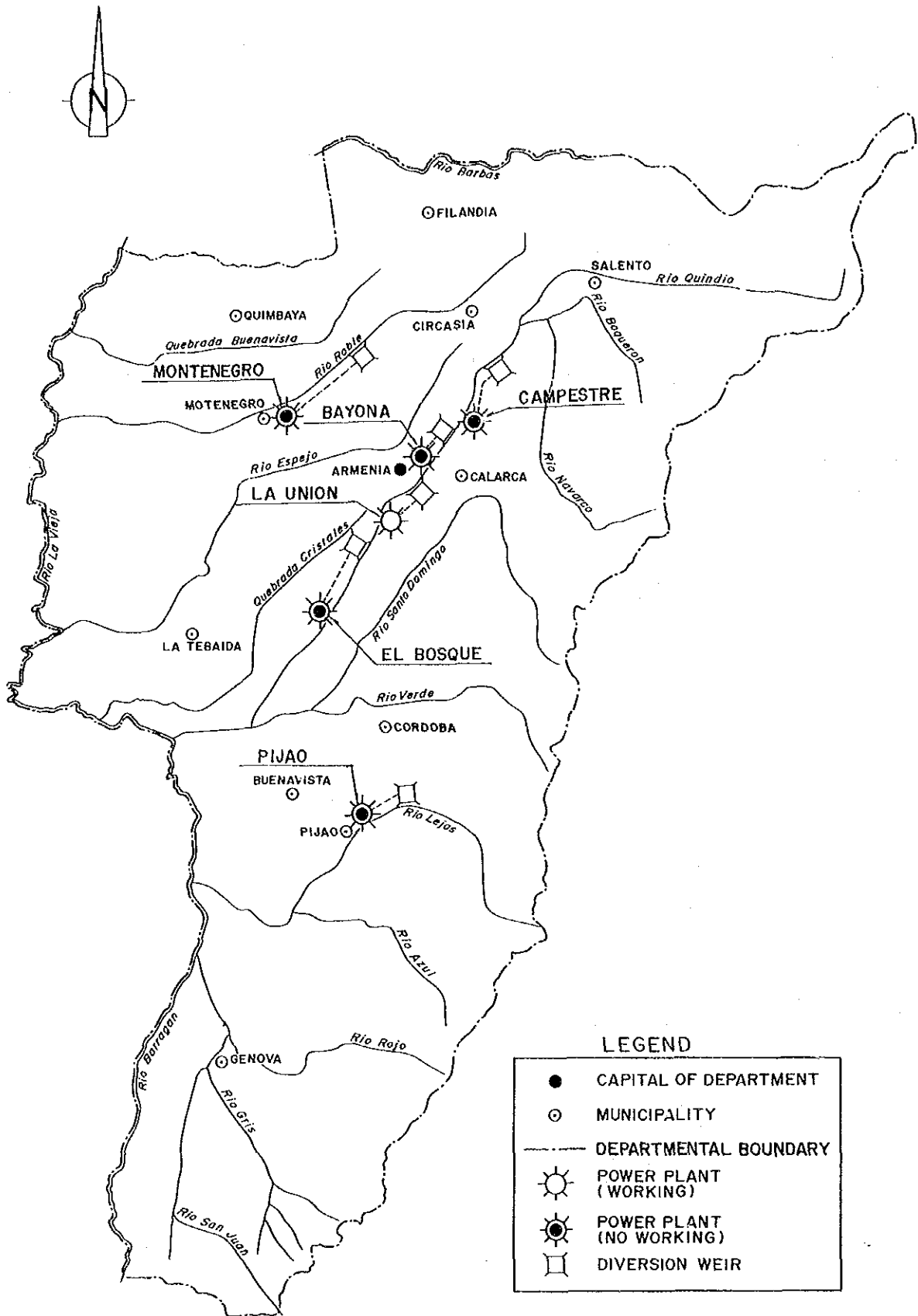


Fig. 4.3.2 LOCATION OF EXISTING HYDROELECTRIC POWER STATION IN QUINDIO

4.4 AGRICULTURE

4.4.1 Land Use and Land Tenure

(1) Land Use

A land use map of Quindio on a scale of 1/50,000 was prepared by the Study Team using a remote sensing technique and an outline of the map is shown in Fig. 4.4.1. Besides, the area by land use unit is presented in Table 4.4.1.

According to the land use map, the land of 139 thousand or 71.3 percent of the total area is utilized for agricultural purpose. Of the total area, pasture (35.5%), coffee cultivation (31.4%) and forest (26.4%) are by far the most dominant land use, covering 93.3 percent. By land elevation, these three landuses are mainly distributed: coffee in 1,000 - 1,800 m, forest in higher than 2,000 m and pasture in 950 - 1,200 m and higher than 1,700 m.

According to Fedecafe, the area suitable for coffee is between 1,300 and 1,800 m. However, information collected by Caja Agraria indicates that the coffee yield from the incapable area such as La Tebaida and Montenegro with land elevation lower than 1,300 m is almost the same or higher than the capable area. It is mainly attributable to the introduction of the Catura variety which is suitable for higher temperature in comparison with other varieties.

The Study Area has already expanded its farmland to almost the maximum level. Better development and maximum utilization of land should always go together with land preservation, therefore it is recommended that grazing land in the mountain areas should be reforested.

(3) Land Tenure

According to IGAC, a survey using a modern technology on the registration of land an average size per holding showed a decrease from 9.6 ha in 1983 to 8.1 ha in 1986. In 1983, it was equivalent to about two thirds of the national average (14.9 ha).

About 43 percent of the holdings in the area are less than 3.0 ha in size but they account for only 3.6 percent of the total cultivated area. On the other hand, about 6 percent of the holdings in the more than 50 ha category account for more than 53 percent of the total cultivated area. According to IGAC, this trend has shown no change since 1970.

A survey by FEDECAFE provides information that the average land size owned by 7,827 coffee growers is 12.0 ha, of which 8.3 ha is used exclusively for coffee production.

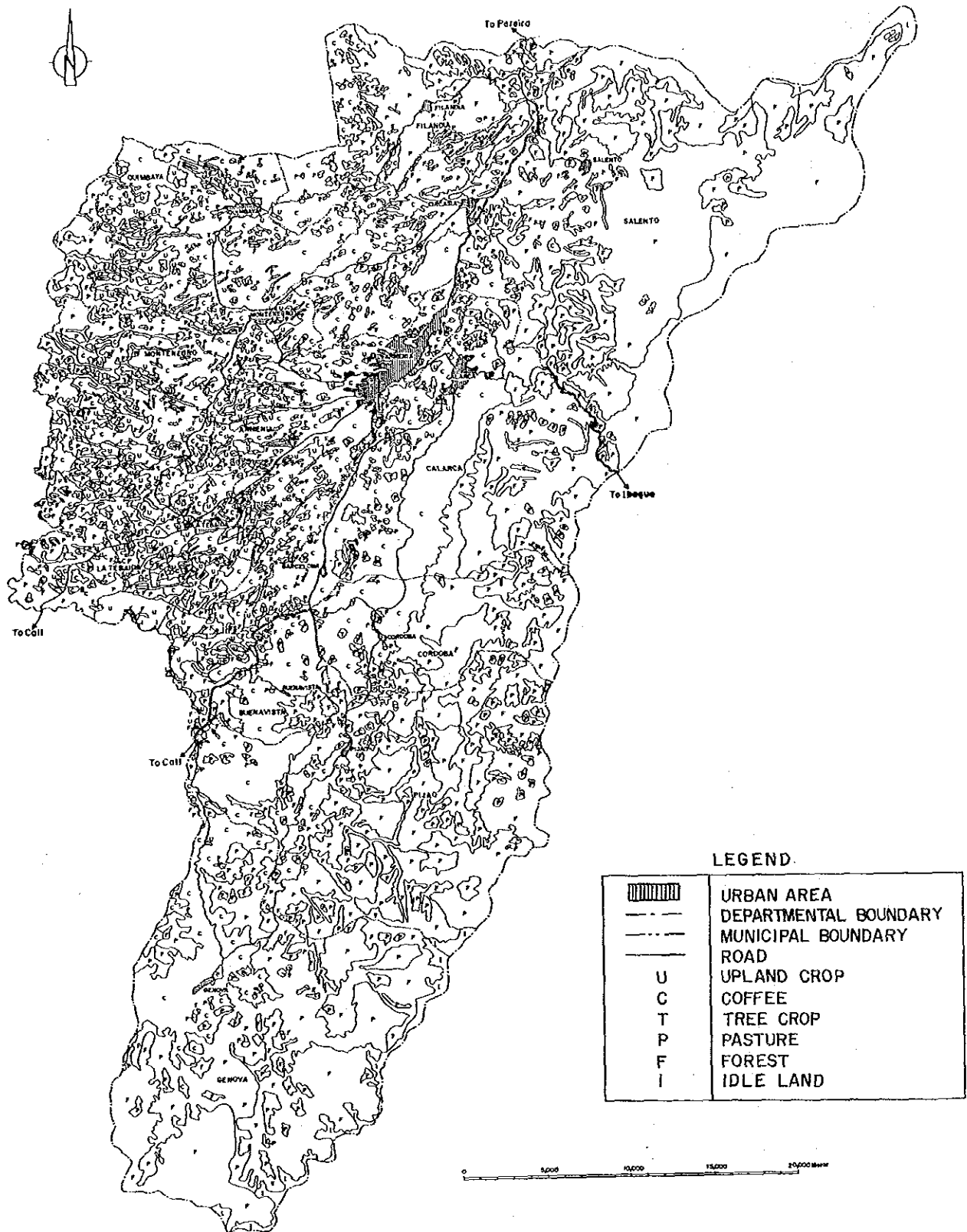


Fig. 4.4.1 EXISTING LAND USE MAP IN QUINDIO

Table 4.4.1 ACTUAL AREA AND PROPORTION OF LAND USE BY MUNICIPALITY

(1) Land Use Area

(Unit: km²)

Land Use Municipality	Coffee	Upland Crop	Tree Crop	Pasture	Forest	Urban 1/	Idle Land	Total	Ratio (%)
Armenia	72.7	15.9	0.3	11.1	5.5	8.1	0.9	114.5	5.9
Buenavista	26.7	0.6	0	9.0	2.5	0.1	0	38.9	2.0
Calarca	104.7	9.7	0.7	73.3	34.6	2.5	0.7	226.2	11.6
Circasia	46.3	0	0	33.3	8.6	0.7	...	88.6	4.6
Cordoba	33.7	0	0.4	41.5	34.4	0.2	0.1	110.3	5.7
Filandia	37.5	0.2	0	44.4	18.5	0.3	0	100.9	5.2
Genova	57.6	1.2	0	104.2	119.9	0.3	13.7	296.9	15.3
La Tebaida	27.8	18.5	0.8	26.5	6.5	0.9	1.0	82.0	4.2
Montenegro	74.5	19.3	0.4	36.3	17.1	1.2	...	148.8	7.6
Pijao	40.5	1.1	0	97.0	78.0	0.2	2.2	219.0	11.2
Quimbaya	74.6	14.4	1.2	19.8	7.5	1.1	0	118.6	6.1
Salento	13.7	1.6	0	195.8	180.1	0.4	10.4	402.0	20.6
Total	610.3	82.5	3.8	691.9	513.2	16.0	29.0	1946.7	
Ratio (%)	31.4	4.2	0.2	35.5	26.4	0.8	1.5		100.0

(2) Proportion by Land Use

(Unit: %)

Land use Municipality	Coffee	Upland Crop	Tree Crop	Pasture	Forest	Urban 1/	Idle Land	Total
Armenia	63.5	13.9	0.2	9.7	4.8	7.1	0.8	100.0
Buenavista	68.5	1.5	0	23.2	6.5	0.3	0	100.0
Calarca	46.3	4.3	0.3	32.4	15.3	1.1	0.3	100.0
Circasia	52.3	0	0	37.2	9.7	0.8	...	100.0
Cordoba	30.5	0	0.4	37.6	31.2	0.2	0.1	100.0
Filandia	37.2	0.2	0	44.0	18.3	0.3	0	100.0
Genova	19.4	0.4	0	35.1	40.4	0.1	4.6	100.0
La Tebaida	33.9	22.6	1.0	32.3	7.9	1.1	1.2	100.0
Montenegro	50.0	13.0	0.3	24.4	11.5	0.8	...	100.0
Pijao	18.5	0.5	0	44.3	35.6	0.1	1.0	100.0
Quimbaya	62.9	12.2	1.0	16.7	6.3	0.9	0	100.0
Salento	3.4	0.4	0	48.7	44.8	0.1	2.6	100.0
Total	31.4	4.2	0.2	35.5	26.4	0.8	1.5	100.0

1/ Includes airport

Source: Remote Sensing Group

AVERAGE LAND TENURE BY MUNICIPALITY

Area	ha
Armenia	3.8
Buenavista	5.9
Calarca	5.4
Circasia	3.3
Cordoba	12.7
Filandia	4.0
Genova	15.3
La Tebaida	17.9 ^{1/}
Montenegro	7.0
Pijao	16.0
Quimbaya	4.9
Salento	22.8
<hr/>	
Average in Quindio	8.1
<hr/>	
National Average	14.9 ^{2/}

^{1/}: 1985, ^{2/}: 1983
Source: IGAC 1986

4.4.2 Crop Production and Cultural Practices

(1) Situation of crop production

Total cultivated area of main crops was 117,800 ha (including areas intercropped) in 1984, of which 55.2% was occupied by coffee, 37.5% by plantain, and 4.2% by cassava. The production of coffee, plantain and cassava shared 13.1%, 11.6% and 6.4% of total production of Colombia

These three crops are also superior in quality and unit yield, and consequently, are regarded as the most important agroproducts for the Department. The table below summarizes the cultivated area, production, and unit yield of major crops produced in Quindio.

MAJOR CROPS IN QUINDIO

Crops	Cultivated Area (ha)	Production (ton)	Unit Yield (ton/ha)
Coffee	65,040	104,000	1.6 (0.79)
Plantain	44,200	265,200	6.0 (6.21)
Cassava	5,000	115,000	23.0 (9.15)
Kidney Bean	280	240	0.8 (0.73)
Sorghum	800	2,400	3.0 (2.48)
Maiz	1,280	2,600	2.0 (1.46)
Potato	300	2,700	9.0 (15.33)
Cacao	550	300	0.5 (0.47)
Sugarcane	330	2,300	7.0 (4.43)

Note: Figures in parentheses represent national average.

According to the trend of coffee production, a little of the expansion of coffee area was observed in 1970 - 1984. The coffee production in 1980 - 1984, however, was about twice that of the production in 1970 because of planting of a new variety (Caturra) with higher average yield, instead of "Tipica" and "Borbon" in 1970.

Among the cultivated area of other crops, areas of plantain, cassava and sorghum showed a tendency to increase yearly. Areas of maize and potato decreased from 1979 - 1984. About 93% of plantain area was mixed and row-intercropping area with coffee. There was a marked increase in monoculture area of plantain in 1979 - 1984.

(2) Cultural Practices of Main Crops

1) Coffee

Main varieties are the traditional varieties (Tipica and Borbon) and the improved varieties (Caturra and Colombia). Caturra can be planted at higher density than traditional varieties and gives higher average yield. Caturra is more adapted to the region with warmer temperature. Colombia variety with high resistance to leaf rust is multiplied at the present time.

Tipica and Borbon commence bearing in 24 - 26 months after planting and Caturra in 17 - 20 months. Coffee trees fully bear in 4 - 5 years. It is necessary to stump coffee tree, in 7 - 8 years because the vigor of coffee tree will reduce and then yield will decrease. Improved varieties can be stumped once, and after that, it can be planted newly. However, a few small farmers stump because of no income from coffee for about two years after stumping.

There are two harvesting periods for coffee in Quindio. In the lowland regions, the primary harvesting period is between October - November and the secondary harvesting period is between April - May, and vice-versa in highland regions.

More leaf rust and Mancha de Hierro are found in the regions lower than 1,200 m above sea level because of high temperature and humidity. More leaf rust appears in the traditional varieties. Serious damage by leaf rust causes reduction in the vigor of coffee trees and production in the next year. Coffee Committee recommended the application of a fungicide mixture five times a year. Pest-disease control in Quindio is to improve the resistance varieties to diseases and application of agricultural chemicals. Not enough agricultural chemicals are applied because of high price.

2) Plantain

The main variety of plantain is Dominico Harton which accounts for 85% of total area of plantain. Plantain is cultivated at 1,200 - 1,500 m above sea level (optimum altitude for Dominico Harton). Cropping season continues for 11 - 12 months. The growth of plantain in the areas at lower than 1,200 m is not so good because of high temperature, and the production (300 - 500 bunches/ha) is lower than that (1,000 - 2,500 bunches/ha) in the suitable areas.

Disease of Sigatoka is found in the plantain areas. Sigatoka Amarillo has influence on the growth of plantain. Heavy damage by Sigatoka Amarillo may cause a reduction in production. A fungicide mixture for Sigatoka control is applied at a few plantain areas because of high price. Improvement of pest-disease control is the important assignment to plantain plantation.

3) Cassava

Chiroza is the main variety of cassava and cultivated in more than 80% of the total area. It is good as a food. Cassava is grown at 1,000 - 1,400 m (optimum altitude) in Quindio. Cropping season continues for 11 - 12 months.

Cassava cultivation needs to be weeded three months after planting, and no more cultural operation is performed until harvesting.

Cassava is cultivated with poor fertilization. Yield of cassava decreases in the next year with degradation of soil fertility. Guide is given to farmers as to how to cultivate, plough by machine, make beds by machine on arable land with different slopes and soil texture. Some farmers cultivate cassava in a steep sloping land, which causes soil erosion.

4.4.3 Irrigation and Drainage

(1) Irrigation

The introduction of an irrigation system has not become the concern of most farmers in Quindio because 1) an annual precipitation of around 2,000 mm is expected and 2) an undulating topography of the area requires higher investment costs for the installation of irrigation facilities. As a result, crops are cultivated depending exclusively on rainfall, and farmlands are left without being effectively utilized in the dry season. Under such circumstances, the expansion of cropping activity has been constrained by the availability of water. The production of coffee is also carried out under the unstable condition that is subject to the reduction of yield and the deterioration of quality if a drought continues. It is therefore indispensable to introduce an irrigation system to farmlands, if one desires to realize a projected crop production to cope with the trend of market. At present, there are some farms performing irrigation and two of them are outlined as follows:

Coffee Farm in Armenia: In case rain is not expected for some consecutive days, the farm is irrigated with a view to eliminating a reduction in yield and the deterioration of grain quality. It is said that, in the past experience in drought (dry day continued for about 40 days), the yield of the farm was not reduced more than 10% and the quality was scarcely deteriorated with the provision of irrigation water, whereas the other surrounding farms were affected by 40% of crop reduction and 30% of deteriorated quality.

Coffee Farm in Montenegro: With the provision of an irrigation system, the coffee production in this farm came to be feasible, resulting in a unit yield of 2.2 tons/ha which is superior to the average unit yield (1.6 ton/ha) of the Department

Both the farms have a movable sprinkler which is the most common system in Colombia diffused in the Department of Valle del Cauca. In terms of plant physiology, the watering to coffee is required at every 8 and 12 weeks from the flowering, and the lack of water in this period affects the yield and quality of the grains. Furthermore, the undulating topography of the area has prevented farmers from saving farm labour such as for weeding and application of fertilizer. Consequently, the multi-purpose irrigation system for watering the crops as well as water supply for weeding, fertilization, soil conservation and coffee processing is envisaged.

(2) Drainage

No systematic drainage system is found in Quindio, because water is well drained due to soil properties and topographic conditions. Nevertheless, it is recommended to design measures to do better drainage in the sloping areas for preventing soil erosion. In addition, land with poor drainage is encountered in the plain located near the confluence of the Quindio river with the Barragan river. This land needs the improvement of the poor drainage so that an intensified crop production be realized.

4.4.4 Livestock and Inland Fishery

(1) General

On the basis of the 1983 statistics prepared by the Ministry of Agriculture, the population of livestock in Quindio is as given below;

Beef cattle	25,000	(0.1% of National share, ranked 24th)
Dairy cattle	35,000	(0.9% of National share, ranked 16th)
Swine	16,000	(0.7% of National share, ranked 22nd)
Sheep	470	(0.02% of National share, ranked 22nd)

According to the 1986 annual report of regional office of ICA, 443,839 poultry was raised in Quindio. The raising of dairy cattle and swine in Quindio is relatively high as compared with its land area and human population. Farming of dairy cattle, swine and poultry is comparatively modern, with rearing being carried out in intensive lots, while most of beef cattle are raised in open yards by large scale land owners. While Quindio is self-sufficient in poultry meat and eggs, self-sufficient rates of beef, pork and milk are low as most of the supply depends on other departments. In particular, there is a short supply of pork in Quindio.

(2) Cattle Farming

Dairy farming is mainly conducted at the middle to highland regions such as Armenia, Circasia, Filandia and Salento. On the other hand, beef cattle farming is the typical traditional practice of the low land and southern mountainous regions. The cattle breeds used for dairy farming are composed of pure breeds and crossbred of Holstein, etc., dual-purpose breeds such as Normandy, Brown Swiss and its crossbred, while beef cattle breeds include various crossbred with Zebu. Large differences are observed with regard to breed quality, management techniques and production levels between large and small scale farms. The large farms have a higher productivity level and profitability.

Most grassland is the improved one, but management of the grassland, including fertilizing, weed control and renovation, is less conducted at a higher altitude. The carrying capacity is relatively low at 1.05 heads per hectare. Although this figure does not indicate overgrazing, present grazing seems to be close to the carrying capacity due to an increasing dune deposit and a low palatability of grass caused by the lack of freshness of grassland and the trampling caused by continuous grazing. In particular, a gully erosion in some parts of the mountainous grassland can be seen at cattle passageways and places devastated by cattle trampling.

This is one of the many results of continuous grazing. Small erosion in the mountainous pastures occur in the grassland prepared by cleaning and tree felling while afforestation is seldom considered.

(3) Other Livestock Activities

The demands for pork and poultry products have been increasing in recently and, accordingly, the production of swine and poultry has been increasing with large scale contributions by large scale farms and/or poultry farms through investments from non-agricultural sectors. Most swine or poultry farms use modern improved breeds, and farming systems have been modernized in large scale farms. The raising of sheep and goats are still a minor trade, but Departmental Coffee Growers' Committee has started a promotion program for milking goats to the small scale farmers.

(4) Prices and Marketing

Marketing channel for livestock and its products including milk is not well organized. Selling is usually through middlemen. There are three main livestock markets (Armenia, Circasia and Filandia) which are opened regularly. Livestock sales transaction is made through price bargaining according to the external appearance only and not with regard to the weight. Most expensive are processed pork, secondly fresh pork, thirdly beef and poultry.

Every municipality has a public slaughterhouse for cattle and swine. In almost all slaughterhouses except one in Armenia, there is no meat inspection system. In addition, most slaughterhouses are located on riversides, and wastes and drain water are released directly into the rivers without any treatment, thereby causing river contamination. Tannery is located close to the main slaughterhouse. However, the facilities are not modern, and chemical treatment facilities are timeworn and the treated chemicals are released into the rivers, thereby causing river contamination, too.

There are two fresh milk processing plants, of which only one is under operation at present. In addition, there is one yoghurt plant. It is said that only one-third of milk produced in Quindio can be collected and the remainder is shipped to outside Quindio.

Commercial feeds are mainly obtained from other departments and/or small scale feed plants in Armenia and La Tebaida, they are producing only 500 tons per month. It is noted that there is a short supply and this makes prices of this feeds very high for small scale farmers.

As for meat processing, there are some factories for both cutting and processing but both of them are small scale, therefore, most processed pork products sold in Quindio comes from other departments.

(5) Supporting Activities

The extension and training services are provided by ICA, SENA, SENICAFE and Banco Ganaderos, etc. to the farmers. The extension is performed up to local levels and their major activities include artificial insemination, technical advice for livestock farming and disease control. Also there are some projects and programs, some

of these are under Artificial Insemination Program for Dairy Cattle (ICA), Broiler Production Program (Ministry of Agriculture) Vaccination Program for Cattle (ICA), Integrated Cattle Development Program (ICA), and Milking Goats Promotion Project (Departmental Coffee Committee). Due to the lack of sufficient facilities and equipment, the objectives of these activities have not been properly accomplished. At present, there are many credit programs being undertaken in livestock sector, but mostly are high interest rates for small scale farmers so that mostly have not been properly utilized.

(6) Inland Fishery

There are two rainbow trout culture farms; one managed by CRQ and another by private sector, along some mountain streams. The desire to engage in rainbow trout culture has been increasing along with a high demand. In lowland regions, some farms are tackling experimental culture of Tilapia, Carpa and Cachama.

4.4.5 Land Conservation and Disaster Prevention

(1) Soil Erosion

Soil erosion in Quindio is classified into the following three categories:

- Mountain area at an altitude of more than 2,000 m: the landslides and/or collapses of slopes can be observed.
- Middle area at an altitude between 1,200 m to 2,000 m: the gully erosion and/or small scale landslides can be observed in and around the grass land extending to this area.
- Low area at an altitude of less than 1,200 m: top-soil loss can be observed along the steep sloping land forming the boundary between the middle and low areas.

The major factors affecting the soil erosion mentioned above are as given below:

1) Rainfall

Rainfall has the most intensive influence on soil erosion. According to the results of field survey, the water amount of 30 - 50 mm/hr is estimated regarding the critical rainfall intensity which affects soil erosion. Said rainfall is supposed to occur mainly between October and December at intervals of five year return period.

2) Topography, Soil and Geology

The soil erosion in Quindio is closely related to the topography of steep slope and soil texture which consists of volcanic ash easily erodable by raindrops. Geological condition also affects soil erosion. Landslides are mostly located near the tectonic lines running from north to south and below the steep slopes at an approximate altitude of 2,000 m.

3) Land Use and Farming management

In and around the grazing land, the gully and rill erosion and/or small scale landslides can be observed. These are mainly due to insufficient farming management of the grazing land and unstable pasturage. Farming management is also liable for shifting cultivation and deforestation of the mountain area, and the cassava cultivation of the middle area.

(2) Flood Damage

In Quindio, flood damage mainly occurs around the typical points of rivers at which the gradient of the river bed changes from a steep slope of about 20% to a mild slope of about 2% at approximate altitude of 1,500 - 2,000 m. The cities of Pijao and Genova, located at such points, suffer damages every year due to the rising of the water level. Flood water includes the debris flow due to destruction of watershed caused by shifting cultivation and deforestation and generates the causes of stone, gravel and sand deposits at said typical points.

Near and at the confluence of the Quindio and Barragan rivers, the land is mostly flat. One cannot observe flooding damage, too.

4.4.6 Farmer's Economy

(1) Brief Diagnosis of Agricultural Situation in Quindio

Owing to the coffee economy which enjoys the highest productivity at the national level, the Department of Quindio is considered to be a socio-economically highly developed region within the context of the Republic of Colombia. Nevertheless, excessive dependence on the monoculture of coffee production associated with the negligence of diversification on cropping activity has caused the Quindian agricultural sector to be stagnated; the participation of the agricultural sector in the Gross Regional Product (GRP) decreased from 42.5% in 1960 to 27.1% in 1970, and the sectoral growth rate at current price of 1970 was as low as 0.39% per year in the period of 1960 - 1980. As for the period of 1975 - 1980, negative growth of -1.08% per annum was registered.

The perspective of coffee production in the future is by no means favorable; the domestic farm-gate price, correlated with the stagnation of price in the international market, has been maintained without being raised for more than one year since last October, and the profitability is at present affected by the rise in cost for the control of "rust leaf" and will be on the verge of being spoiled by the attack of insect called "Broca".

(2) Supply and Demand of Labour Force in the Agriculture Sector

According to the estimate of the SENA, the number of agricultural workers in the Department was 51,129 in 1985, which accounted for 37.1% of the total economically active population (137,811). The demand of labour force in the agricultural sector for the same year was estimated to be 62,466. Accordingly, approximately 11,000

workers were immigrated from other departments. Of the total demand for the agriculture sector, the crop production activity occupies 96.7% and the livestock, 3.3%. The share of demand for coffee cultivation was as high as 81% (50,611) of the total.

The distribution of agricultural labor force by status of employment in Quindio is as presented below:

1) Owner of Farm, and Employer	2.3%
2) Temporary Worker	83.6%
3) Permanent Worker	7.5%
4) Family Worker	6.6%

(3) Farmer's Economy

1) Coffee Production Farmers

This farmer's economy analysis is based on the field survey carried out by the Study Team. The number of farmers interviewed was 203 in total.

The average farm size of the interviewees was 12.4 ha, of which 9.2 ha of land was distributed to the production of coffee and its intercrops.

Normally, coffee is produced twice a year and the production level per grower is as high as 9.81 tons/year. Consequently, farmers produced crop yields up to 1.26 tons/ha per planted area and 1.07 tons/ha per harvested area.

The farmers sold their products to cooperatives, on the greater part, and to middlemen at the average price of Col.\$294.4/kg.

The major portion of coffee production was incurred from labor cost, which represented 85% of the total cost. The rest of the production cost is distributed to inputs (9.6%) interest for farming loan (4.4%), and others (0.5%).

The table below summarizes gross and net returns to farmers on coffee production, net returns to them from other farm and off-farm activities, and farmer's surplus.

1. Coffee Production

Production Volume	9.81 ton/year
Farm-gate Price	Col.\$294.41/kg
Gross Return	Col.\$2,888,000/year
Cost	Col.\$2,250,000/year
Net Return	Col.\$638,000/year

2. Net Return by other

Farming Activities	Col.\$91,000/year
--------------------	-------------------

3. Net Return by Off-farm Activities	Col.\$347,000/year
4. Total Net Return	Col.\$1,076,000/year
5. Living Cost	Col.\$540,000/year
6. Farmer's Surplus	Col.\$536,000/year

2) Other Farmers

The survey by the Study Team was also addressed to farmers engaging in crop production other than coffee. The result of the survey is summarized as follows:

PRODUCTION AND COST OF MAJOR CROPS IN QUINDIO

(Unit: Col.\$1000)

	Cacao	Cassava	Orange	Plantain	Potato	Sorghum	Soybean	Tomato
1. Planted Area (ha)	6.48	11.14	12.22	4.47	9.95	60.13	16.67	2.61
2. Output (ton)	3.23	146.64	241.08	6,900 1)	91.33	221.25	47.34	3,200 2)
3. Unit Yield (ton/ha)	0.50	13.15	19.72	1,543 1)	9.19	3.68	2.84	1,226 2)
4. Price	380	35	24	238 3)	39	51	99	810 4)
5. Gross Return	1,227	5,121	5,786	1,642	3,562	11,284	4,687	2,592
6. Production Cost	488	1,949	2,879	553	1,671	10,136	4,253	1,080
7. Net Return	739	3,172	2,907	1,089	1,891	1,148	434	1,512
8. Net Return per ha	114	284	238	244	190	19	26	576

Note: 1) Cluster, 2) Box, 3) Col.\$/cluster, 4) Col.\$/box

4.4.7 Agricultural Markets and Prices

(1) Introduction

Among the agro-products which are produced in Quindio, coffee has the international markets, and plantain, cassava, orange and tomato have national markets. So their respective market systems are established, though less organized in the cases of citrus and tomato. Citrus is one of the plants chosen under the Diversification Program of the National Federation of Coffee Producers. Grains, beans, and vegetables with the exception of tomato and some fruits are brought from other departments; wheat and apple from abroad.

The Agricultural Marketing Institute (IDEMA) buys grains and beans from the producers at the fixed prices set at the beginning of each half of the agricultural year.

The following are the prices per ton of the second half of 1987.

<u>Agro-product</u>	<u>Price (Col.\$)</u>
Rice	52,440
Kidny Bean	218,500
Sorghum	46,200
Barley	63,000
Maize	57,000
Wheat	68,000
Soy Bean	94,000
Sesame Seed	160,000

The producers of vegetables, and especially of citrus and other fruits, have been at the mercy of market price manipulation, the products being seasonal and due to a lack of processing facilities and of market information.

The market situations of the major products are given in the following sub-sections.

(2) Coffee

Coffee exportation has been carried out by the National Federation of Coffee Growers (FNC) and the private exporters which are registered with the Colombian Foreign Trade Agency (INCOMEX).

Generally speaking, FNC handles the shipments to Europe (west and east); the private exporters, to the USA. FNC's operation is financially supported by export duties on coffee. Its basic objective is to regulate the marketing of coffee; it guarantees the purchase of the coffee brought to it, and has the power to intervene when the market cannot maintain the official purchasing price. In the field of marketing, FNC operates a warehousing company (Almacafe S.A.), inspects the quality of coffee for export, invests in a shipping company (The Flota Mercante Grancolombiana) and in another warehousing company (Almadelco) and in a manufacturing factory of frozen dried coffee.

In the Department of Quindio, 70% of the products are sold to Almacafe and the Cooperative de Calicultores (member company of the FNC group) and to many threshing factories (mostly members of the FNC group); and 30% goes to Deposito de Cafe (a private coffee broker).

Coffee is an international commodity; prices are at the mercy of the market, though the International Coffee Organization has tried to stabilize them, and has succeeded, up to the third quarter of 1985 when production in Brazil failed. In the first quarter of 1986, it was about Col.\$240/lb, and it is now below the floor price of Col.\$120/lb.

(3) Plantain

It has a nationwide market; above all, the "Harton Quindío" is famous. The distribution channel is given in Fig. 4.4.2. 3-ton trucks transport the plantain. According to an investigation, some 30% of the load deteriorates in quality due to mal-handling. In 1981, it costed Col.\$2.76/kg on an average at the farm gate, and Col.\$15.19/kg in retail shops.

(4) Cassava

It also has a nationwide market. Chirosa Armenia is a well-known variety. The distribution channel is given in Fig. 4.4.3. As in the case of plantain, citrus loses its quality during transport. Sacks of roots which weigh 110 kg (with an extra 10 kg of waste) are carried by 6-ton lorries.

An interesting aspect of the production is that 55% of the production is carried out by the capitalist farmers who rent farm land.

In 1981, it costed Col.\$5.86/kg on an average at the farm gate, and fetched Col.\$27.13/kg in retail shops.

(5) Citrus

Citrus has a promising nationwide market, and probably an international one, too.

Varieties of oranges like Valencia and Tangelin are for juice, mandarin for fresh fruits; lemons are also available. Orange Armenia is known to the consumer centers. In 1981, buyers paid the growers Col.\$2.5/kg, and on the counters of retail shops it was priced at Col.\$14.7/kg.

The distribution channel is given in Fig. 4.4.4.

Producers being small, and the network being new and not well-developed, the system has been colliding with the existing networks of plantain and cassava.

One exception is a wholesaler whose base is in Barranquilla. He sells the products in the cities located along the Caribbean Coast.

(6) Grains and Vegetables

Rice mostly comes from Tolima. Average consumer price of rice in Armenia in February 1987 was Col.\$93.7/kg.

Colombia produces less than 20% of its demand of wheat, so it is imported.

The Department gets sugar coming from Valle; potatoes from Cundinamarca and Valle. Quindío produces such vegetables as cabbage, lettuce and carrots; they only satisfy 10% of the demand. They are brought from Cundinamarca, Tolima, Valle and Antioquia.

(7) Market Situation of Foodstuffs in Armenia

1) Wholesale Market:

There were 57 wholesalers who handled foods and related goods in Armenia in January 1984. Out of the 57, 50 have their operating centers in the vicinities of "Plaza de Mercado Gabriel Mejia". They handled 591 tons of foodstuffs weekly, which was 37% of the total commodities which were brought into the city. The following table is the breakdown.

	Total City (ton)	Galeria zone (ton)	G/T (%)
Processed Grain	444.43	113.97	25.6
Vegetables	117.65	102.37	87.0
Plantain, Cassava Potatoes	619.32	195.50	31.5
Fruits	244.94	153.03	62.4
Meat, fish, chicken	138.58	19.99	14.4
Egg	29.05	5.82	20.0
Total	1,593.97	590.68	37.1

Source: Fundacion para el Fomento de la Investigacion Cientifica, March 1984

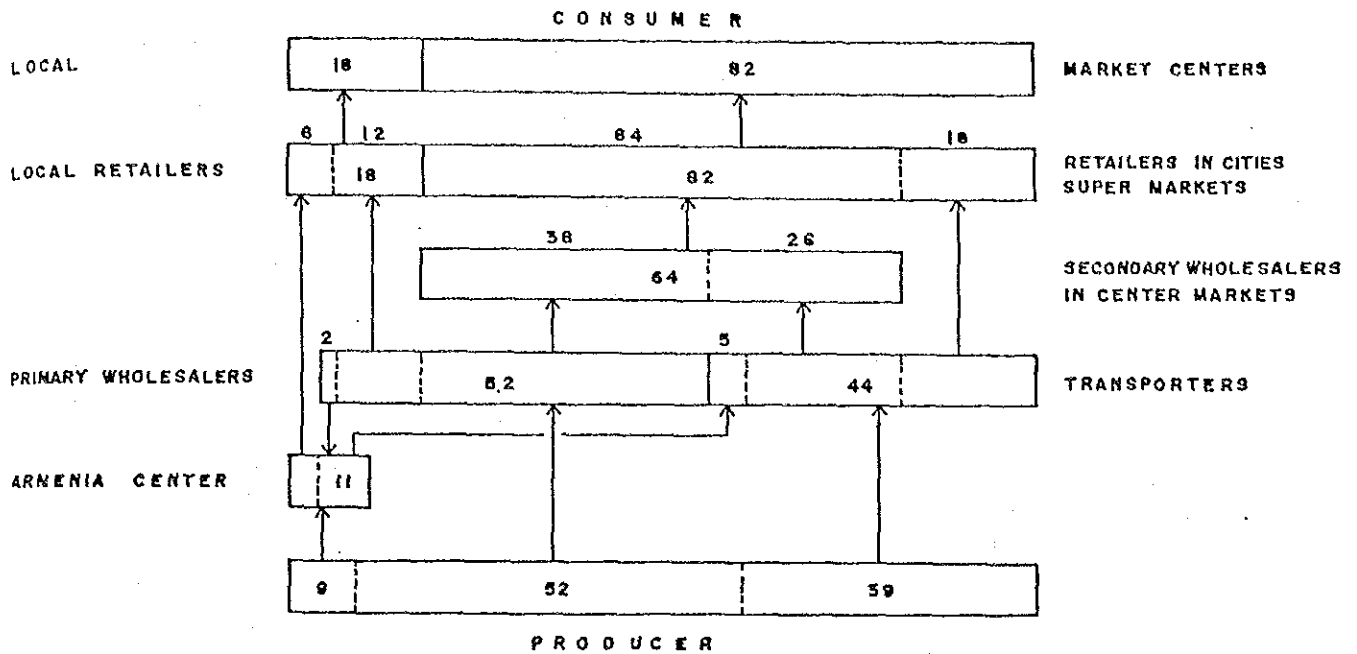
2) Retail Shops

According to the field study of "Noriega Restrepo & Associates" in 1984, there were 260 retailers in "Galeria de Mercado", 43% of which dealt in meat, fish, milk products and chicken; 26% in grains and beans and 31% in vegetables, fruits and edible roots. Besides, it accommodated 13 florists. There were 98 shops in "Gabriel Mejia". There were about a score of supermarkets in the city. In the informal sector of retailers, there were 217 "caseta", "mostador", "carretilla" and others which handled foodstuffs. Each of them is tiny; their contribution to the public significant none the less.

The studies carried out in 1984 before the establishment of "Mercados Armenia S.A." found that the then existing facilities could not cope with the volume needed for the total number of citizens, and that the galeria and its surroundings showed a general deterioration.

So the company's objectives in the development of commercialism in Armenia lies in the direction of minimizing the discrepancies in the service, both in wholesale and retail business.

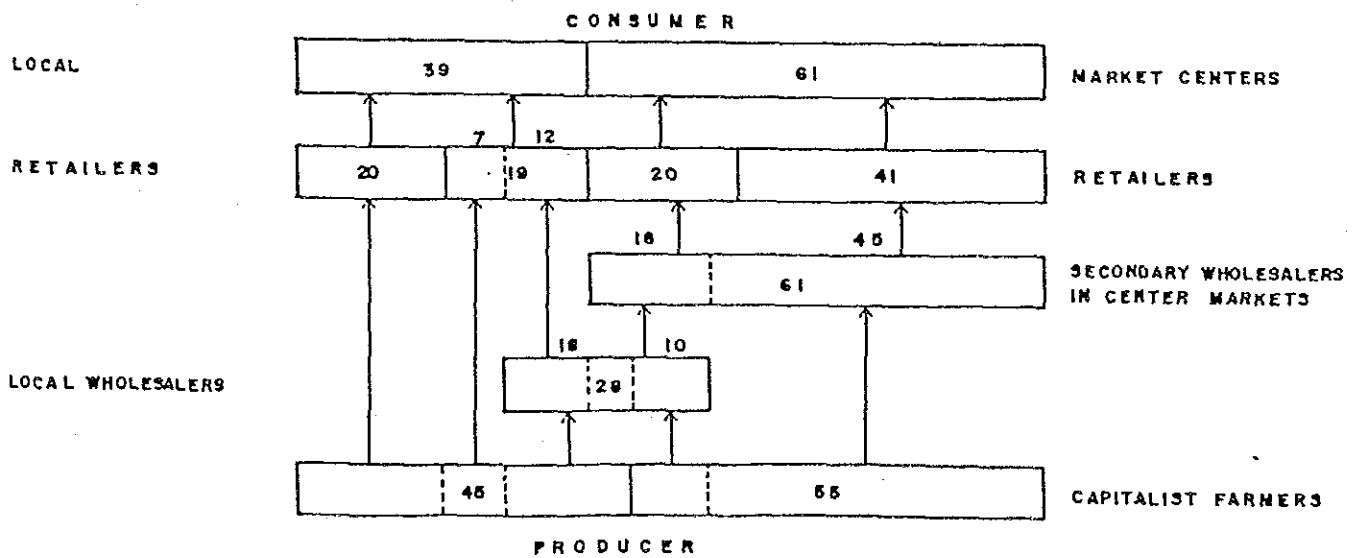
PLANTAIN (%)



SOURCE: TRADING STRUCTURE, AGRICULTURE SECRETARIAT, 1986

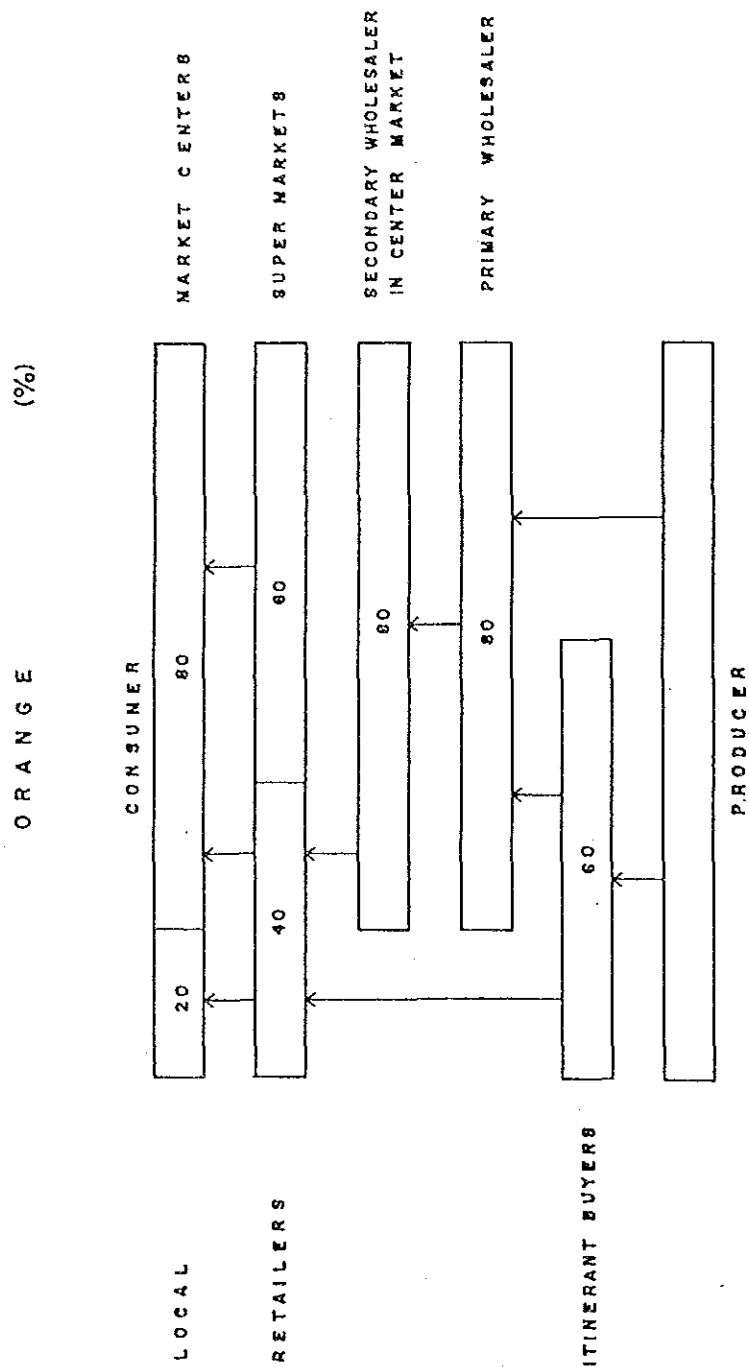
Fig. 4.4.2 DISTRIBUTION CHANNEL OF PLANTAIN

CASSAVA (%)



SOURCE: TRADING STRUCTURE, AGRICULTURE SECRETARIAT, 1986

Fig. 4.4.3 DISTRIBUTION CHANNEL OF CASSAVA



SOURCE: TRADING STRUCTURE, AGRICULTURE SECRETARIAT, 1988

Fig. 4.4.4 DISTRIBUTION CHANNEL OF ORANGE

4.4.8 Agro-products Processing Facilities

Apart from dairy product processing facilities, agro-industry in Quindio may be divided into two major categories: coffee-related and other industries. The former consists of coffee berry processing plants and threshing and milling factories; coffee berry processing plants are owned by approximately 8 thousand independent coffee growers except for one managed by the cooperative of Armenia. Agro-industry other than coffee-related one is as summarized below.

<u>Products</u>	<u>Location</u>	<u>Remarks</u>
Brown Sugar	Montenegro	12,000 kg/week
Fruits Cake	Circasia	10,000 box/month
Orange	Armenia	8,000 lb/week (packing)
Plantain's Fine Powder	La Tebaida	
Herb	Filandia	

In order to satisfy local expectation for further development of the agro-industry, attractive incentives to provoke attention of the private sector would be essential.

4.4.9 Agriculture Supporting Services and Institutions

Services to support farmers' crop production activity is provided under the general coordination of the Bureau of Agriculture of the Departmental Office. Taking account of the importance of coffee production within the regional economy, Coffee Committee plays a key function for the promotion and development of the agricultural sector of the Department.

(1) Bureau of Agriculture of the Departmental Office

Established in August, 1985, the Bureau of Agriculture has a principal objective to promote and develop the agricultural sector of the Department in general. In collaboration with UPRA, the bureau is responsible for the analysis and diagnosis of the agricultural activities in the Department, and formulation of future development strategies and programs of the sector. "Fruits and Vegetables Production Promotion Plan" is one of the programs at present implemented by the bureau.

(2) Coffee Committee

Coffee Committee is managed under the superintendent of Fedecafe and is incorporated in the departments producing coffee more than 1% of the national production. Coffee Committee of Quindio has the following functions:

Engineering Div.: Provision and improvement of rural infrastructure

Health Div.: Promotion of healthy life among coffee growers

Administration Div.: Editing of information, accounting and supply of materials and inputs

Technical Div.: Farm administration and implementation of diversification programs

Extension Service: Direct technical and socio-economic services to farmers through municipal committee, and implementation of "leaf rust" prevention and other campaigns

Recently, the concern of Coffee Committee has extended to crops other than coffee, and livestock, which is certified by the implementation of the "Five Years Diversification Plan 1984 - 1989". As to access to the credit service, Coffee Committee gives information and instruction to beneficiaries so that they be facilitated to be loaned by public organizations. Besides, Coffee Committee prepares a special credit line with favored conditions addressed to small farmers.

(3) Other Supporting Institutions

INCORA: Mainly responsible for rendering credit and technical assistance services to small farmers

DRI-FOND: In view of solving deficient socio-economic conditions of rural population and increasing food production in less development regions, C.R.Q. in collaboration with Coffee Committee, ICA and SENA is preparing projects to be implemented in Quindio.

Caja Agraria: Provides credit services to farmers with funds supplied by the Agricultural and Livestock Financing Fund (FFA) of the Central Bank and its own fund.

SENA: Takes charge of the vocational training and education for workers or those who are looking for job opportunities. It has a local office in Armenia to which the Agriculture and Livestock Center is affiliated. This Center educates and trains candidates for farm administrators and leaders of cooperatives offering various courses to be completed within four years.

(4) Cooperatives

There are five cooperatives in Quindio which have been organized by farmers; four by coffee growers and the rest by producers of vegetables and fruits. The cooperatives of the coffee growers are located in Armenia, Calarca, Montenegro, and Quimbaya and the number of members in these four cooperatives was 6,342 as of December 1985. This means that approximately 80% of the total coffee growers in the Department were associated with cooperatives. The essential purpose of forming cooperative among coffee growers is to commercialize their products.

On the other hand, a cooperative of vegetable and fruit producers was just organized in February, 1987. The members of this cooperative, 23 in total, are distributed over such municipalities as Calarca, Genova, Pijao and Salento. The cooperative was formed under the initiative and assistance of the Departmental Office which is promoting the production of vegetables and fruits in marginal zones as an option to coffee production. Under the contract with the Departmental Office, the members of the cooperative will be benefited by the subsidy of the Departmental Office which bears a half of the production cost. Marketing of products will be made on the full responsibility of the cooperative.

4.4.10 Development Plans and Programs in Quindio

Agricultural development plans and programs being prepared and/or implemented in Quindio are, among others, as follows:

- 1) Five Years Diversification Plan 1984 - 1989 (Coffee Committee)
- 2) Integrated Rural Development Plan (DRI - CRQ)
- 3) Vegetables and Fruits Production Promotion Plan
(Agricultural Bureau of Departmental Office)
- 4) Agriculture and Livestock Development Plan 1987 - 1990 (URPA)

The outlines of these plans are described in 5.2.2 of the present report.

CHAPTER 5 DEVELOPMENT CONCEPT

5.1 GENERAL

Master plan is generally elaborated with an establishment of target year by which it is implemented. The target period ranges from 10 to 20 years depending on the degree of development of a plan. In view of formulating a feasible integrated agricultural development plan, the target period for the completion within the present Master Plan is set as 15 years. Therefore, if the Plan starts in 1991, the target year by which the Plan is completed will be 2005.

Prior to formulation of the Plan, an optimum future land use plan for the agricultural sector of the Department of Quindio was preliminarily considered for the premises of establishment of the Master Plan to be accomplished by 2005, through review of a future land use plan for which the target year is not incorporated.

The present development concept deals with to what extent (goals) and how (strategies) an optimum future land use plan would be accomplished by 2005.

The development concept is built up on the basis of development potentials and constraints of agriculture as analyzed through the field survey result, with the intention of national and regional administration authorities and expectations of local population taken into account. As for the intention of the administration authorities, national and regional policies on the orientation of future Quindian agriculture was analyzed from the viewpoint of the national development plan, relevant regional development plans, etc. On the other hand, expectations of local population were studied from questionnaire survey at the level of local leaders and farmers.

The above development concept may be illustrated in the flow chart as given in Fig. 5.1.1.

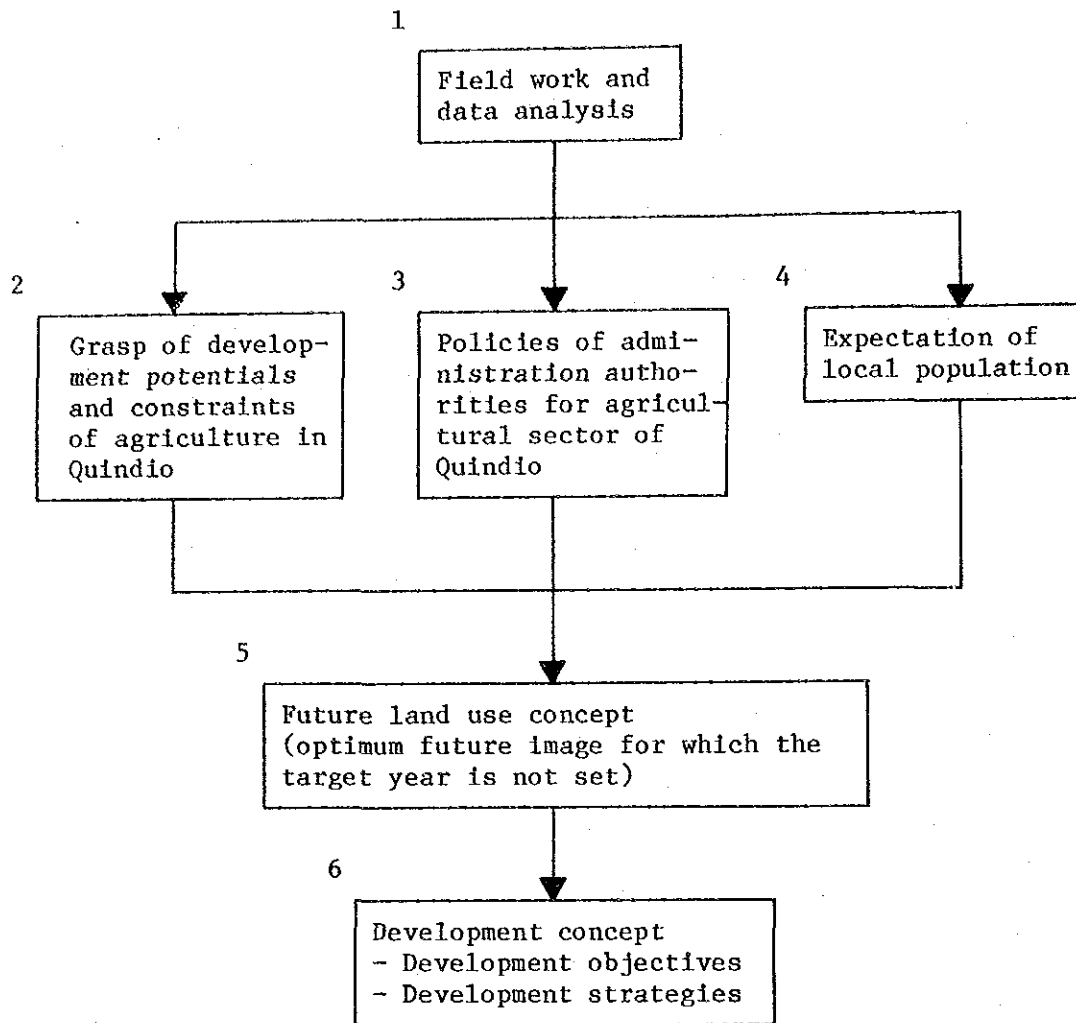


Fig. 5.1.1 FLOW CHART FOR ELABORATION OF DEVELOPMENT CONCEPT

5.2 POLICIES OF ADMINISTRATION AUTHORITIES FOR THE DEVELOPMENT OF AGRICULTURE IN QUINDIO

5.2.1 National Strategies for the Agricultural Sector

Agriculture is the mainstay in the national economy of the Republic of Colombia, and its output is the second highest after manufacturing sector and represented 21% of the GDP in 1985 as well as the participation of agricultural product in total national exports was 68% in 1986. Nevertheless, the growth of agricultural sector has stagnated in recent years.

In Colombia about 70% of the whole population is concentrated in the highland with an altitude of 1,500 - 3,000 m under comfortable climate. Agriculture is developed in this area. In fact, this area supplies about 60% of main food for nations and about 20% of industrial material. However, this area has the following problems, which make farming activity unstable and impedes development of regional economy. The Department of Quindio extends over western slope of the Central Range and is covered in the above mentioned area.

- Less land endowed with favored natural conditions
- More small farmers
- More extensive agricultural practice
- Over-emphasized coffee cultivation
- Out migration of rural population

The Department of Quindio has no long-term agricultural development plans of national level. However, orientation of future agriculture in Quindio intended by Colombian national side may be studied from the National Development Plan and the Policies of National Federation of Coffee Growers (FEDECAFE). The study is summarized as shown below.

(1) National Development Plan (1987-1990)

The four years socio-economic development plan envisages the achievement two targets simultaneously: less social distortion and a consistent economic growth.

The development objectives for agricultural sector have been determined as follows:

- Improvement of agricultural productivity
- Enhancement of living condition in rural area and Upgrading of farmer's income
- Increased production of exported agricultural products

The agricultural development strategies relevant to the Department of Quindio in which are mentioned in National Development Plan are shown as follows:

- Implementation of integrated rural development by Fund-DRI
- Conservation, control, and effective utilization of natural resources (water, land, etc.)
- To control water in rivers for irrigation and domestic water
- Implementation of small scaled irrigation projects

- To control coffee production in consistent with export volume and maintenance reasonable income level for coffee growers
- Encouragement to production of non-traditional export foods

(2) Policies of National Federation of Coffee Growers (FEDECAFE)

National Federation of Coffee Growers (FEDECAFE), having large influence on the coffee production policy, is anxious about the unfavorable conditions such as the recent recession of price in the international market and world-wide stagnation of consumption, and has established the following two policies to guide the coffee committees at departmental level, that is, its affiliated organizations.

- Stabilization of nation-wide coffee production
- Diversification of crops in coffee farms

In response to guidance of FEDECAFE, Coffee Committee at departmental level establishes and promotes a local development plan. At present the Five Years Diversification Plan (1984-1989) has been executed by Quindio Coffee Committee.

5.2.2 Agriculture Development Policies in Quindio

At present four agricultural development plans are elaborated or implemented in Quindio. From these plans picked up and reviewed are the following agriculture development policies at department level.

Five Years Diversification Plan 1984 - 1989 (Coffee Committee)

- Promotion of crop and livestock husbandry in marginal areas for coffee production
- Encouragement of crop cultivation for self-consumption of coffee growers

This plan consists of five development projects and supplementary projects supporting them. The five projects are for plantain, citrus, livestock, forestry, and commercialization of products.

Integrated Rural Development Plan (DRI-CRQ)

- Rural development projects in marginal areas for coffee cultivation.
- Support to less development areas (Filandia, Salento, Genova, Cordoba, and Pijao)

The purpose of DRI's Plan is to improve unstable socio-economic conditions and to increase food production in rural areas. Under the superintendence of Ministry of Agriculture, DRI performs relatively small-scale projects all over Colombia with financial assistance given by the World Bank and Inter-American Development Bank. In Quindio, CRQ takes the initiative of said projects, with participation of Coffee Committee, ICA, and SENA. Projects under planning include "Small Basins Integrated Management Project" and "Pisciculture Promotion Project", both of which are intended for the above area.

Vegetables and Fruits Production Promotion Plan (Agricultural Bureau of Departmental Office)

- Improvement of self-supply rate of vegetables and fruits in the Department
- Support to marginal areas for coffee cultivation and to small farmers
- Organization of cooperatives for promotion of better marketing

The plan is limited to a small scale, and intended to implement in 12 ha in 1987 and 24 ha in 1988.

Proposed crops include pea, carrot, onion, cabbage, tree tomato, blackberry, and "luro".

Agriculture and Livestock Development Plan 1987 - 1990 (URPA)

- Improvement of self-supply rate and consolidation of agricultural products market.
- Preservation and control of natural resources.
- Effective utilization of natural resources.
- Growth of agriculture sector and generation of more job opportunities.

In June, 1987 this plan was established by URPA and OPSA and a part of "Nation-wide Regional Agriculture and Livestock Development Plan", which is a project supported by UNDP/FAO.

5.2.3 Orientation of Future Agriculture in Quindio

At present, the Department of Quindio has no long-term agricultural development plan. However, orientation of future agriculture in Quindio intended by Colombian side (national and local authorities) may be studied from the Socio-economic Development Plan and Programs and existing regional agricultural development plans. The Study is summarized as shown below.

Improvement of productivity (Emphasis placed on small farmers and developing areas for rectification of disparity among sub-regions)

Diversification of crop production (Improvement of coffee over-emphasized agriculture and food self-supply rate in the Department)

Conservation, control, and effective utilization of natural resources.

Upgrading of farmer's living standards and enhancement of living conditions in rural area.

5.3 REQUIREMENTS OF LOCAL POPULATION

In order to be acquainted with expectations of local population which is a critical factor in establishing the development concept, various types of inquiry survey were carried out on development in Quindio. The survey made it possible to concretely grasp intention of inhabitants.

(1) Inquiry survey for leaders and engineers

About 50 leaders and engineers in the Department were targeted for their opinion regarding constraints on development, necessary project, etc. The survey result is as shown below.

Ranking of answer	Constraints on development of Quindio Prefecture	Project necessary for regional development	Project necessary for agriculture development	Concept on coffee waste treatment
1	Coffee monoculture	Promotion of agriculture product processing sector	Promotion of agricultural product processing sector	Enlightenment for water quality preservation
2	Lack of planning ability of administration authorities	Water resources development	Consolidation of marketing system	Study of economical treatment system
3	Inappropriate finance system	Development of marginal areas and coffee culture areas	Diversification of crop and livestock husbandry	Utilization of concentrated treatment system
4	Underdeveloped infrastructure	Road improvement	Improvement of farmers' cooperative	Introduction of concentrated treatment system
5	Inadequate provision in farmer education and support service	Establishment of marketing system	Introduction of irrigated farming	Adequate measures inavailable at present

Coffee monoculture is ranked the first among constraints on development. This suggests that local people are afraid of future trend of coffee production (international market price and reduction of consumption) while they expect industrialization from agriculture. Both in regional development and in agriculture development, promotion of agro-products processing is ranked the first. This also indicates that local population expects revitalization of regional economy by agro-industry, i.e., industrialization. However, the promotion of the agro-products processing sector involves introduction of private capital. It seems important to improve infrastructure which attract private capital and to take into careful consideration incentive finance and taxation. Coffee waste treatment is a problem common to nation-wide coffee production regions, not limited to the Department of Quindio. Many leaders and engineers find it difficult to establish in short-run socioeconomically acceptable measures against coffee wastes, although they have serious problem consciousness.

(2) Inquiry survey for farmers

Coffee farmers and other farmers were interviewed to state their opinion on their farms management. The survey result is as summarized below.

- 1) About 78% of coffee farmers are satisfied with the present management, and about 97% of them have intention to continue coffee culture for the future. In addition, about 30% of farmers attempt to expand their coffee production area. The reason is that assistance service of Coffee Committee assures them of relatively stabilized production and marketing.
- 2) About 22% of coffee farmers are dissatisfied with the present situations because of low productivity and fewer income. About 12% of dissatisfied farmers consider introducing crops other than coffee, for example, cassava, plantain, kidney beans, etc. which are easily cultivated with guarantee in marketing.
- 3) Farmers point out the following three problems in the present coffee plantation management.
 - Poor quality and high wage of coffee labourers.
 - Strict credit conditions for agricultural activities.
 - Expensive inputs.
- 4) Inquiry survey was also addressed to such crops as cacao, cassava, orange, plantain, potato, sorghum, soybean, and tomato, of which 6 crops except for sorghum and soybean exceed coffee in the net return per ha (refer to 4.4.6.).

The survey result may be summarized as follows.

Almost all farmers who have traditional mind intend to continue coffee culture because of sufficient assistance of Coffee Committee, although they know that coffee is not the most profitable product.

Those who have enough financial resources and progressive spirit are engaged in production of crops other than coffee and earn higher profit.

It seems necessary to promote consciousness innovation of traditional coffee farmers and consolidate support service such as credit, extension technical assistance, marketing, etc. so that an intensification of farming activity comprising diversification of crops might be realized.

5.4 POTENTIALS AND CONSTRAINTS ON DEVELOPMENT

5.4.1 Potentials on Development

In the light of future of the Department of Quindio, it seems that, from natural and social viewpoints, development should be progressed, with emphasis placed on agriculture - the leading industry, and that the whole regional development of economy is expected through propagated effect into other industries. In view of agricultural development, the development potentials of the Department is reviewed and summarized as follows.

- 1) The Department is endowed with natural conditions (meteorology and soil) suitable for agriculture, and as such has margins for improvement of agriculture productivity.
- 2) An annual precipitation of 2,000 mm offers an opportunity for better utilization of water resource.
- 3) Armenia, the capital of the Department, is situated at the key point in road traffic, forming a junction to main cities in adjacent departments.
- 4) The Department is favored with human resources; local population features high literate rate and higher proportion of attendance to universities.
- 5) The Department has high potential for modernization of agriculture; four agriculture investigation and research institutions and two universities are established in the Department.

5.4.2 Constraints on Development

With all the potentials described above, the Development of Quindio has been constrained by the following physical and socio-economic factors.

(1) Natural Aspects

- 1) Undulating topographical conditions prevent from developing agriculture productivity and water resources.
- 2) A mountain zone runs through the Department from north to south and is connected to a hill zone on the west side. The boundary of the two zones are subject to flood and a rock flow.
- 3) In the Department, the land utilized for agriculture and grazing extends to the steep slope area in the mountain zone, which is not suitable for development. A delay in improvement of production infrastructure causes extremely low productivity. In addition, the deforestation in the mountain and forest zones reduces the capability of water resource cultivation, being the factor of flood and erosion.
- 4) Water pollution is in progress in rivers in the Department due to human factors such as urban sewage and coffee wastes.

(2) Socioeconomic Conditions and Social Infrastructure

- 1) Economic growth in the agricultural sector is stagnated. The production of the agricultural sector accounted for 43% of the Gross Regional Product (GRP) in 1960 and only 27% in 1980.
- 2) Quindio is one of the major coffee production regions in Colombia, but stabilization of agricultural management requires diversified cropping practice in coffee farms.
- 3) There is a substantial disparity in productivity between the coffee producing area and the area producing crops other than coffee and within the coffee producing areas; furthermore, an imbalance in productivity is conspicuous between optimum and marginal areas for coffee production.
- 4) A notable difference in the scale of management (land holding size and financing capacity) correlates with difference in productivity.
- 5) Population in the Department has been growing, but efflux continuously exceeds influx; that is, social decrease continues. In particular, youth tends to move out of the Department, and resulting reduction in local vitality is now a matter of concern.
- 6) Pavement of roads in the area is under-developed. This not only impedes development of local economy but aggravates living environments of inhabitants.
- 7) Without sewage treatment plants the pollution of river water is being accelerated in such degree as to form a social problem.
- 8) Almost all power supply depends on other departments. Excessive dependence results in trouble in stable supply.
- 9) Insufficient agricultural support services are provided to producers of crops other than coffee, and improvement in processing, storage, and distribution system is delayed.
- 10) Organization of farmers such as cooperatives, etc. for producers of crops other than coffee is delayed.

5.5 FUTURE LAND USE CONCEPTS

5.5.1 Basic Considerations

In general, the future land use plan is prepared from comprehensive viewpoint. Such a plan is studied from various components represented by topography, soil, meteorology, environmental preservation, supply and demand of food and socio-economic, cultural and historical background. The above local characteristics have been reviewed for the Department of Quindio, and the future land use concepts have been established on the basis of the following basic considerations.

- 1) In the light of maintenance of ecological balance, the existing forest area shall be conserved while new forest frontier shall be developed.
- 2) In view of promoting diversification of crops and improvement of self-supply rate of food in the Department, grazing land shall be converted into the upland crop area.
- 3) The considerations mentioned in 1) and 2) envisage to reduce grazing land. However, an intensive use of the present extensive grass land and an introduction of better cattle farming shall enable supply of dairy and meat products to satisfy local demand.
- 4) Basically, the future coffee culture area shall be kept unchanged from the existing area in consideration of matching the policy of FEDECAFE for stabilization of production at the national level. However, introduction of substitute crops will be also studied for some marginal areas for coffee production.
- 5) It is expected to delineate a land use which shall contribute to improvement of agriculture productivity on the basis of careful consideration of socioeconomic conditions, such as agricultural management and employment, in addition to natural conditions such as meteorology, soil, and topography.

5.5.2 Future Land Use Concepts

The future land use concepts have been finalized for the following seven zones on the basis of the above basic considerations. The concepts are also based on the land use plan by altitude approximated by the basic development concepts shown in the Phase-I Progress Report. In addition, socioeconomic conditions such as agricultural management are also taken into account. The future land use concepts are closely related to the long-term development concept of other sectors such as land conservation and disaster prevention plan. Such long-term development concept is described in the Annexes separately prepared.

Table 5.5.1 FUTURE LAND USE FORMATION BY ZONE

Zone No.	Future Land use Formation	Actual Land use	Altitude (m)	Characteristics	Improvement Proposal
1	Grazing land	Pasture	950-1,100	Thin soil layer, Low productivity	Technical assistance, Farm road
2	Intensive Agriculture	Upland, Coffee, Pasture	950-1,200	Fertile soil, Less undulating land, Low precipitation	Irrigation and drainage works, Farm road, Agro-products processing facilities
3	Coffee Plantation	Coffee, Plantain, Cassava	1,200-1,800	Water pollution, Sliding of surface soil, Higher productivity	Water treatment, Technical assistance, Diversification of crop production
4	Integrated farming (Vegetables - livestock)	Pasture, Forest	1,650-2,000	Fertile soil, Less undulating land, High precipitation, Low productivity	Technical assistance, Farm road, Organization of small farmers
5	Integrated farming (Tree crops- livestock)	Pasture, Forest	1,800-2,500	Slope and desolated land, Efflux of population, Low productivity	Technical assistance, Farm road, Disaster prevention, Forestation
6	Pasture and ecological conservation	Pasture, Forest	2,000-3,000	Steep slope and desolated land, Major concentration of water resources, Low productivity	Forestation, Improved pasture, Soil conservation
7	Environmental conservation	Forest, Arid mountain	3,000 and higher	Infeasible for crop cultivation	Maintenance of ecological balance

5.5.3 Future Land Use Projection

The future land use plan including afore-mentioned seven zones plus urban areas, roads, etc. is presented in the opening page and division by each zone is given in Fig. 5.5.1. Distribution by zone including urban area, roads, etc. is as follows:

LAND USE PROJECTION

Zone	Landuse Formation	Area (km ²)	%
1	Grazing land	79.4	4.1
2	Intensive agriculture	176.2	9.0
3	Coffee plantation	612.4	31.5
4	Integrated farming (vegetables - livestock)	101.3	5.2
5	Integrated farming (tree crops - livestock)	55.3	2.8
6	Pasture and ecological conservation	895.8	46.0
7	Environmental conservation	26.3	1.4
Total		1,946.7	100.0

Furthermore, actual and projected land uses are compared in the following manner:

COMPARISON OF ACTUAL AND FUTURE LAND USE

Landuse	Actual		Projected		Balance	
	Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Coffee	610.3	31.4	578.2	29.7	-32.1	-5.3
Upland Crops	82.5	4.2	202.0	10.4	+119.5	+144.8
Tree Crops	3.8	0.2	76.2	3.9	+72.4	x19
Grazing Land	691.9	35.5	300.0	15.4	-391.9	-56.6
Forest	513.2	26.4	734.7	37.8	+221.5	+43.2
Urban Area	16.0	0.8	27.9	1.4	+11.9	+74.4
Idle Ared	29.0	1.5	27.7	1.4	-1.3	-4.5
Total	1,946.7	100.0	1,946.7	100.0		

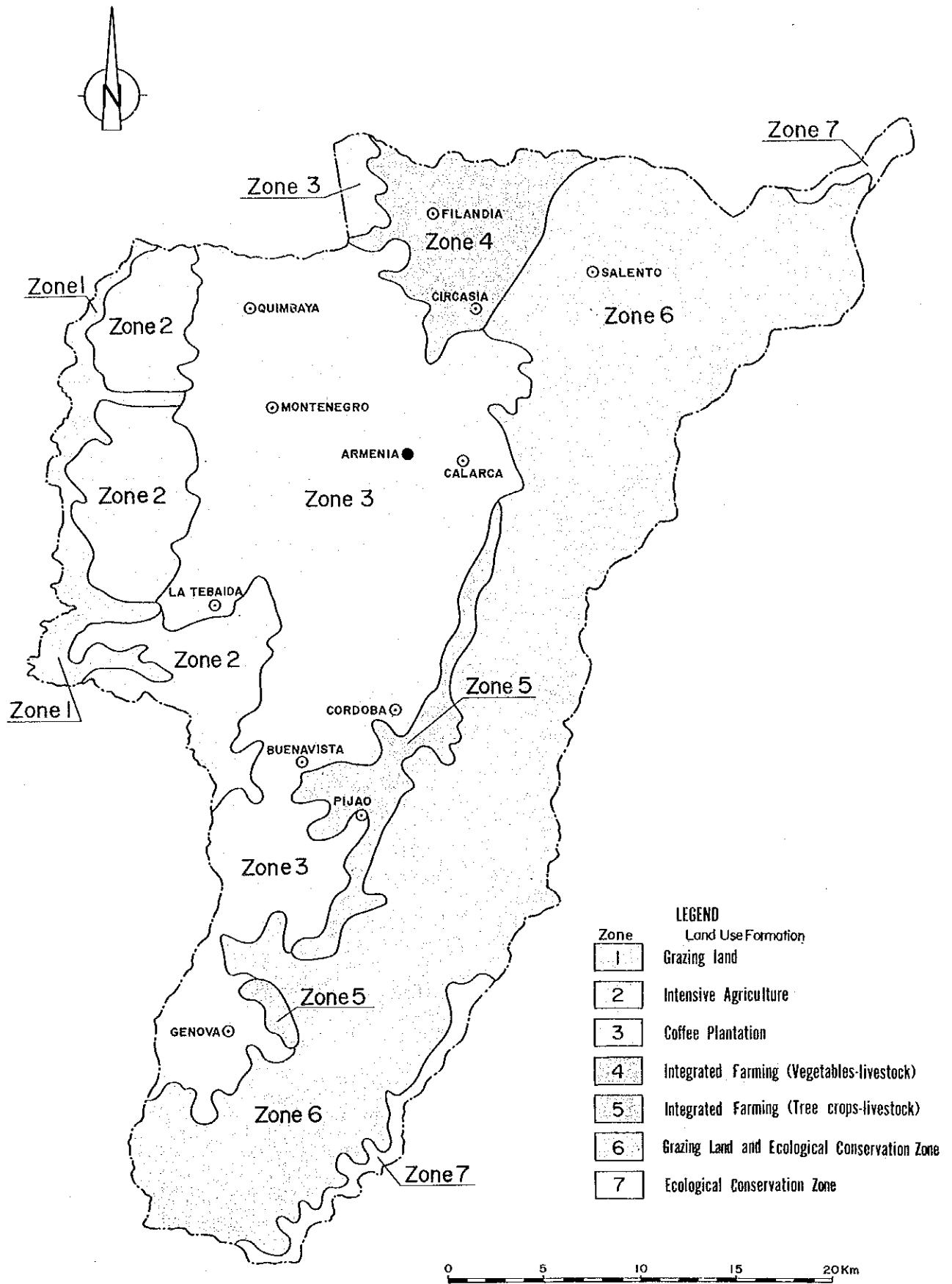


Fig.5.5.1 FUTURE LAND USE FORMATION BY ZONE IN QUINDIO

5.6 DEVELOPMENT CONCEPT

5.6.1 Development Objectives

In response to the future land use concept which is prepared without aiming for goals, there would be various alternatives as to how to improve and develop agriculture in Quindio by 2005. Here, set is the development objectives to be attained by 2005 in order to define the orientation of development. The development objectives are suggested, as shown below, on the basis of potentials and constraints on the development of agriculture in Quindio. Policies of national and local administration authorities, expectations of local population, etc. are taken into careful consideration.

(1) Rectification of Disparities

The Government of Colombia establishes "rectification of social disparities" as one of national strategies in the Socio-economic Development Plan and Programs 1987 - 1990 and intends to eradicate poverty. There are following disparities in agricultural sector of Quindio.

- Economic imbalance gap between coffee farmers under careful assistance of FEDECAFE and the other farmers.
- Imbalance in farm management (land size and financial resources).
- Local difference due to natural conditions (meteorology, soil and topography).

Therefore, the development concept gives top priority to the rectification of these disparities, and envisages to implement agricultural development projects that can contribute to attainment of this objective.

(2) Improvement of Coffee Production per Unit of Land

FEDECAFE aims at stabilization of coffee production and diversification of coffee producing farms at the national level. To intensify the coffee farms is also an important concern for the Department, which depends largely its economic background on coffee. The development concept deploys productivity improvement measures, with emphasis placed on stabilization of coffee production, improvement of quality, and diversification of coffee producing farms, although the planted area will be kept almost unchanged.

(3) Diversification of Crop Production

Agriculture in Quindio depends on three crops: coffee, plantain, and cassava. The total planted area of these three crops accounts for more than 95% of the total, and other crops are almost negligible. Diversification of crop production shall be promoted for the purpose of improving the constitution of regional and farmers' economy largely dependent on coffee, elevating food self-supply rate for consumption within the Department, and supplying raw materials to the agro-industry.

(4) Intensification of Agriculture by means of Better Utilization of Water Resources

In Quindio, crops are cultivated largely dependent on rainfall, so irrigated field is scarcely found. In recent years, however, farmers with sufficient financial resources increasingly improve productivity by employing sprinkler irrigation. The development of water resources is proposed mainly for ensuring irrigation water and for hydroelectric generation and rural water supply. The development shall contribute to the improvement of land production bases and amelioration of living environment in rural areas, and intensification of farming activity in Quindio.

(5) Conservation of Natural Environment

The conservation of natural environment is of concern to the Department and should be accelerated at an earlier period. In addition, emphasis is also placed on conservation of the mountain zone of the Department, prevention of disaster, soil conservation of farm land subject to erosion, and improvement of water quality badly affected by coffee wastes and urban sewage.

(6) Enhancement of Living Conditions

Living conditions in rural areas shall be enhanced in addition to increase of farmer's income.

Also promoted is improvement of rural infrastructure such as roads, mini-hydroelectric plants, and rural water supply system.

5.6.2 Development Strategies

Subsequent to the development objectives discussed above, development strategies have been prepared in view of implementing integrated agricultural development project by 2005.

(1) Development Strategies for Rectification of Disparities

1) Agricultural development in marginal areas for coffee production

A marginal area is located in the western part of the Department at an altitude of 1,200 m or lower (Zone 2). This area is targeted for intensive agriculture oriented to upland crops by planting them to comply with land and other natural conditions, measures against soil erosion, improvement of cropping techniques, installation of irrigation and drainage facilities, and encouragement for formation of a farmers' association. In consideration of expectations of local population, easy access to water availability, topographical conditions, etc., three areas consists of both sides in the downstream of the Quindio River, La Tebaida, and San Jose, have been selected for development.

2) Agricultural development to upgrade small farmers

Agriculture is developed in the area (Zone 4) - Circasia and surrounding zones to the north of the Department, where small farmers with land holdings 3 ha or less are distributed most widely in the Department. The development is expected to support these small farmers in this area. Although being mainly utilized for grazing land at present, this area is suitable for production of vegetables and fruits owing to favorable meteorology and soil. Therefore, the mixed farming system combined these products with swine production shall be proposed.

3) Agricultural development for relaxing imbalance among sub-regions

This development is proposed for Genova and Pijao areas (Zone 5) where farmers suffer from inferior living conditions and less development has been made as compared with the central zone of the Department because of major distribution of mountain and hill zones under severe topographical conditions. The mixed farming system composed of tree crops and swine production shall be introduced into these areas so as to increase income of farmers.

(2) Development Strategies for Improvement of Coffee Production per Unit of Land

1) Introduction of multi-purpose irrigation into coffee plantation

Field survey on coffee farmers has proven that coffee irrigation contributes to alleviate reduction in yield in case of drought and to minimize deterioration of coffee quality. Another field survey proved that irrigation enables coffee culture even in marginal area resulting in superior yield of 2.2 tons/ha to the departmental average of 1.6 tons/ha. Multi-purpose irrigation shall be introduced into La Tebaida area which is accessible to water for irrigation, together with coffee processing water, pest control and weeding, etc. The effect of irrigation in this area is expected to spread to the whole Department.

2) Model farm for coffee plantation in highland

In order to improve productivity of the coffee plantation in highland where less improved varieties are introduced, a model farm shall be incorporated in Cordoba area; in this farm test, research, extension activities, etc. related to cropping techniques such as soil management, fertilizing, inter and mixed cropping will be conducted. Also emphasized is the study on the cropping pattern of intermediately planting crops profitable enough to compensate reduction in farmer's income - such income drop as to take place during a period from young to mature plant for improved varieties or stumping of existing plants.

(3) Development Strategy for Diversification of Crop Production

Diversification of crop production according to land capability shall be facilitated by reviewing the present land use in agricultural development area to be identified from the viewpoint of rectification of imbalance. Also promoted is diversification of intercrops to be introduced in the coffee plantation. As diversification of crops is promoted, new crops are increasingly produced, so it is important to consolidate marketing system so that new crops could be reasonably sold. At the same time, the distribution mechanism will be improved through formation of producers' association.

(4) Development Strategy for Better Utilization of Water Resources

Integrated water resources development shall be promoted by constructing dam in the Navarco River belonging to the Quindio river system to supply irrigation water, power generation water, rural water, etc.

(5) Development Strategy for Conservation of Natural Environment

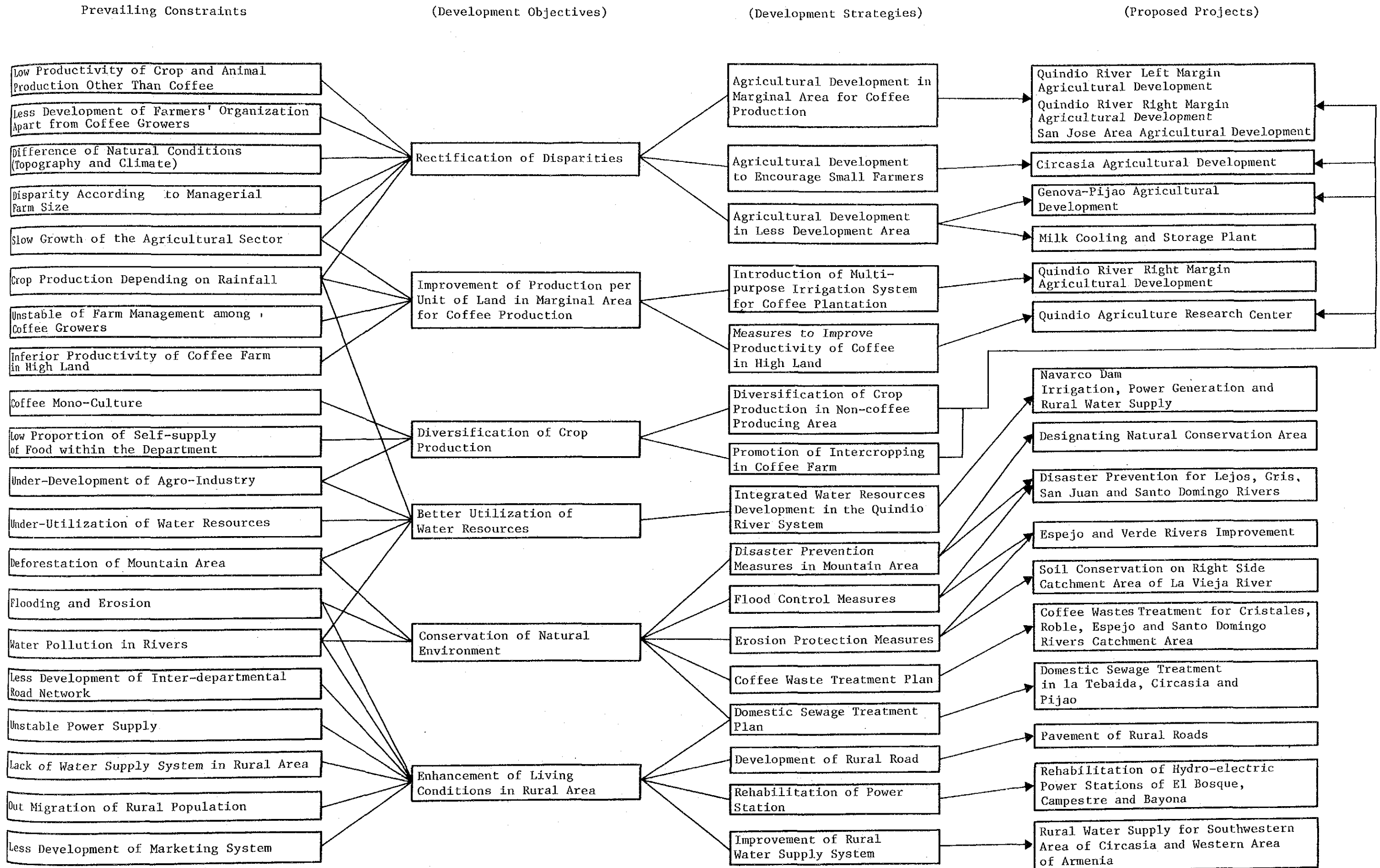
Although overlapped by agricultural development for rectification of imbalance among sub-regions, projects for prevention of disaster and soil conservation shall be implemented mainly in the southern part of the Department. The water quality improvement projects shall be progressively implemented in phasing, with local characteristics (financial capacity, operation and maintenance system, etc.) taken into account.

(6) Development Strategy for Enhancement of Living Conditions in Rural Area

Infrastructure such as roads, mini-hydroelectric plant, rural water supply shall be improved in order to enhance well-being of farmers. The road improvement plan places emphasis on pavement of the existing roads while consideration is taken of referring to the Roads Development Plan for 2000 as prepared by Directorate of Planning, Departmental Office. The mini-hydroelectric power development plan envisages rehabilitation of the existing facilities that are out of order. Rural water supply gives priority to an area where existing water intake facilities are incapable to satisfy the local demand (south-western part of Circasia) and another area where the inferior quality of water is taken (western part of Armenia).

Fig. 5.6.1 summarizes the flow from the identification of constraints for the agricultural sector of the Department to concept dealt with in this chapter as well as the establishment of development objectives.

Fig. 5.6.1 SUMMARY OF DEVELOPMENT CONCEPT



CHAPTER 6 FORMULATION OF THE MASTER PLAN

6.1 DEVELOPMENT FRAMEWORK

Based on to the development concept presented in the previous chapter, development goals to be attained by 2005 have been tangibly established as given below.

6.1.1 Population

As described in ANNEX A, it is forecasted that the population of the Department in total increases whilst that in rural area trends decelerated, if the projects proposed in this Master Plan are not implemented. The decrease of population in rural area will be attributable to the continuous efflux of rural people. Furthermore, the annual growth rate of the population in Quindio for the period of 1973 - 1985 (1.3%) is inferior to the national average of 1.7%. Thus the Department of Quindio confronts the out migration of local population.

The projection of Quindian population up to 2005 in this Master Plan is made subject to mitigating efflux of local population toward other departments as well as facilitating to hold rural people where they actually live. This implies the implementation of the Master Plan envisages the activation of regional economy together with the stabilization of local population.

Under the circumstances, the projection of population in this Plan aims to catch up with the national growth rate during 1990 - 1995. It is assumed that the annual average growth rate in Colombia falls on 1.5% during 1985 - 2005. The projection of population in rural area is made assuming that, with the implementation of the Master Plan, the decrease of rural population will be braked during 1990 - 1995, turns to remain unchanged from 1995 onward. Consequently, the population framework in Quindio is projected as summarized below.

Year	1985	1990	1995	2000	2005
Urban area	306,070	333,000	362,000	393,000	426,000
Rural area	71,790	67,000	67,000	67,000	67,000
Total	377,860	400,000	429,000	460,000	493,000

As a reference, the projection of population which follows the past trend is also made in the following manner:

Year	1985	1990	1995	2000	2005
Quindio	377,860	400,000	421,000	442,000	463,000
Colombia	27,838,000	30,379,000	32,757,000	35,134,000	37,512,000

6.1.2 Production Goals and Rate of Self-supply

The output of agricultural products and its rate of self-supply within the Department in the target year (2005) of the Master Plan have been estimated. For this purpose, URPA's relevant projection was referred to and, in addition, the growth of population projected by the Study Team, development objectives of the Master Plan and other factors were taken into account.

Unit: ton

Products	1985			2005		
	Output	Consumption	Rate of Self-supply (%)	Output	Consumption	Rate of Self-supply (%)
Rice	0	14,000	0	0	16,800	0
Wheat	0	2,600	0	0	3,100	0
Coffee	104,000	1,800	*	110,900	1,900	*
Plantain	265,200	17,000	*	298,600	41,100	*
Cassava	115,000	5,800	*	116,400	12,400	*
"Panela"	2,300	25,400	9	5,600	32,100	17
Potato	2,700	9,200	29	5,700	11,700	49
Fodder Crops	5,000	18,400	27	17,200	30,400	57
Beans	600	2,800	21	5,500	3,400	*
Tomato	15,100	6,700	*	18,700	8,800	*
Other Vegetables	500	2,000	25	15,500	10,400	*
Orange	16,000	10,100	*	30,400	15,300	*
Other Fruits	1,000	3,700	27	19,300	15,600	*
Beef	2,900	11,600	25	3,500	14,000	25
Pork	300	1,100	27	900	1,200	75
Chicken	2,100	900	*	2,200	1,100	*
Fish	0	300	0	100	400	25
Milk	11,200	30,100	37	13,000	36,000	36
Egg	4,300	4,100	*	4,900	4,900	*

Note: (1) * Accomplishment of self-supply

(2) Output in 2005 has been estimated in accordance with the following assumptions:

1. The supply of rice and wheat depends totally on importation from other departments, because the production of these crops is technically disadvantageous.
2. The products which are presently produced in excess of local consumption are: coffee, plantain, cassava, tomato, orange, chicken and egg. Of which products, slight increase in output is projected for coffee, chicken, cassava and egg while substantial expansion is expected for other four products which have secured marketing channel out of the Department.
3. Vegetables and fruits will be produced by 2005 sufficiently enough as to satisfy local demand. Surplus in production will be exported to other departments or processed within the Department. The rate of self-supply for fodder crops will be raised upto 50% in 2005.
4. Besides production of porks which is expanded substantially, the rate of self-supply of meats shall be maintained at the prevailing level.
5. Consumption of vegetables and fruits was estimated on the basis of the recommended volume of consumption per capita by ICBF and that of other products referring to URPA's projection and population's growth, etc.

6.1.3 Land Use Projection

Taking account of production goals in 2005 quoted in 6.1.2 and the implementation of such relevant development projects as land conservation and disaster prevention, etc. a land use plan has been delineated as shown in Fig. 6.1.1. The land use projection in 2005 is resumed below in comparison with the actual use and long-term proposal.

LAND USE PROJECTION

Unit: 100 ha

Land use Category	Actual		2005	
	Area	%	Area	%
Coffee	610.3	31.4	594.3	30.5
Upland Crops	82.5	4.2	99.8	5.1
Tree Crops	3.8	0.2	29.0	1.5
Pasture	691.9	35.5	592.6	30.5
Forest	513.2	26.4	581.9	29.9
Urban Area	16.0	0.8	21.4	1.1
Other area	29.0	1.5	27.7	1.4
Total	1,946.7	100.0	1,946.7	100.0

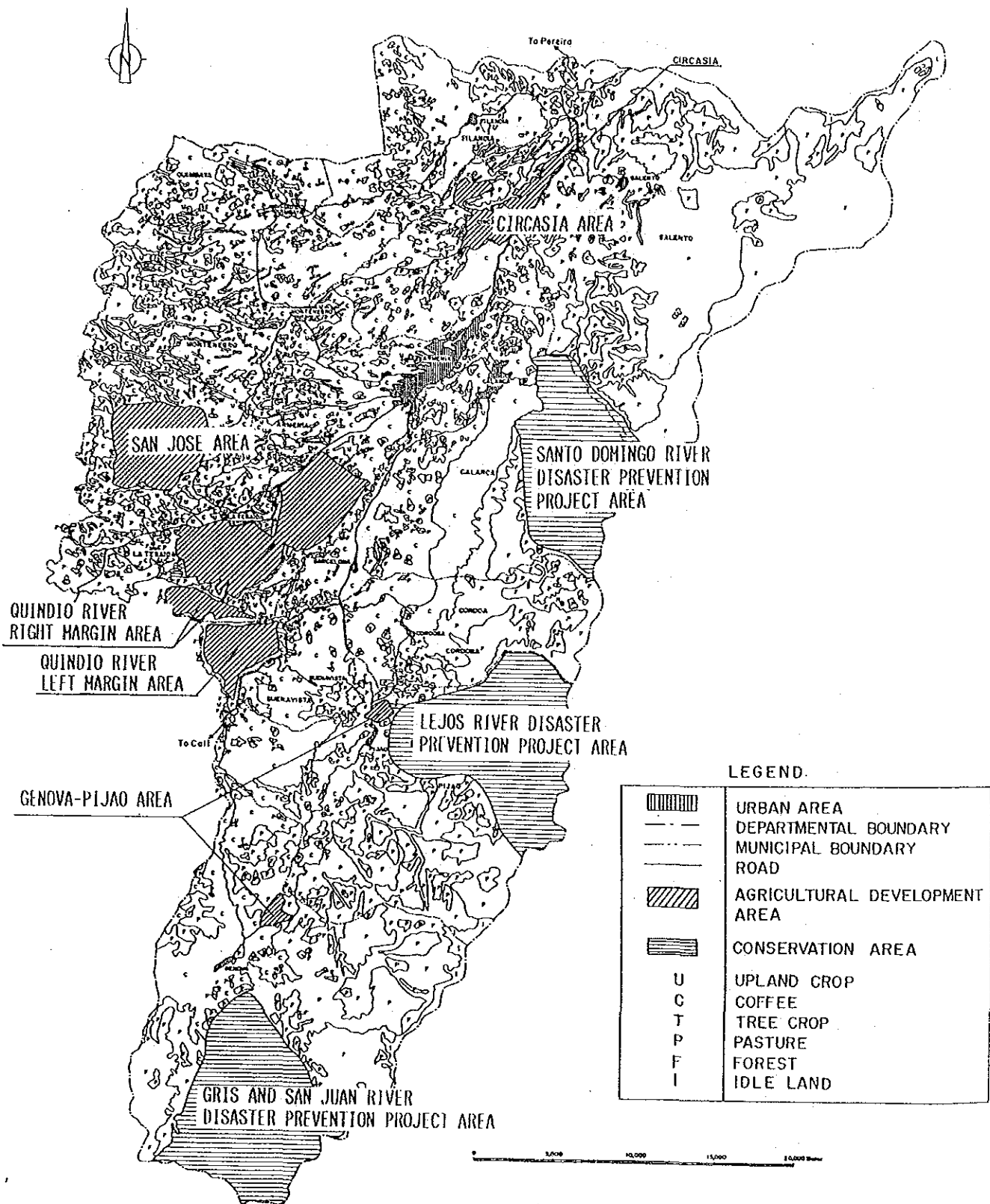


Fig. 6.1.1 Future Land Use Map (2005)

6.2 AGRICULTURAL DEVELOPMENT AND PROMOTION PLAN

The Agricultural Development and Promotion Plan is the hub in the present Master Plan, because it contributes directly to increasing farmers' income producing major economic effects.

For the selection of proposed agricultural development areas, the following components were taken into consideration.

- Rectification of disparity among sub-regions within the Department (to raise the levels of small farmers and underdeveloped sub-regions).
- Intensification of coffee production per unit of land.
- Diversification of crop production.

(1) Agricultural Development Plan

Taking account of compliance with development frameworks, the following five project areas have been identified as agricultural development and promotion area.

Project Area	Development Area (ha)	Future Land Use Formation	Reason of Selection
Quindio River Left Margin	1,500	Zone 2	.Rectification of disparity .Diversification of crop production .Agricultural mechanization
Quindio River Right Margin	5,000	Zone 2 (2,500 ha) Zone 3 (2,500 ha)	.Rectification of disparity .Diversification of crop production .Intensification of coffee production .Introduction of coffee irrigation .Diversification of crop production
San Jose	3,400	Zone 2	.Rectification of disparity .Diversification of crop production .Topographical condition
Circasia	1,600	Zone 4	.Upgrading small farmers .Diversification of crop production .Meteorological and soil condition
Genova-Pijao	400	Zone 5	.Upgrading under-developed southern sub-region .Demonstration to the neighboring zones
Total	11,900		

The whole of agricultural development project area (11,900 ha) is divided into two categories; optimum coffee production zone (2,500 ha) and margin coffee production zone (9,400 ha). The reason for major allocation of development area for the latter is that less supporting services of Coffee Committee have been rendered to this zone and, eventually, farmer's living standard remains lower and cropping technique and infrastructure are less developed than the latter.

The outline of the above mentioned five projects for the agricultural development and promotion plan for the Master Plan is given in the following subsection. In addition, such information as of cropping pattern, cultivation technique, irrigation water requirement and major structures etc. are given in Annexes H, J & M.

1) Quindio River Left Margin Agricultural Development Project

The project area comprises flat and hill land extended on the left catchment area of the Quindio River. The project aims at realizing an intensive cropping activity by introducing irrigation and drainage systems, improved roads, etc., and a formation of cooperative among farmers will be also encouraged. The outline of the project is as follows:

Objectives: Rectification of disparity between optimum and marginal coffee production areas, diversification of crop production

Development area:	1,500 ha
Irrigable area:	1,110 ha
No. of beneficiaries:	280 families (Assumed)
Proposed crops:	Fodder crops, citrus, pineapple
Peak irrigation water requirement:	0.71 m ³ /s (June)
Water source:	Barragan River (Pumping up)

2) Quindio River Right Margin Agricultural Development Project

The present project area covers plain and hill land on the right catchment area of the Quindio River, the provision of irrigation and drainage system and improved rural road network together with formation of farmers' cooperatives are targeted in the project so that an intensive cropping activity might be conducted.

Objectives: Diversification of crop production, intensification of coffee production per unit of land, and development of marginal coffee production area

Development area:	sub-area (1)	2,500 ha	
	sub-area (2)	2,500 ha	(Coffee plantation)
	Total	5,000 ha	

Irrigable area:	sub-area (1)	1,900 ha	
	sub-area (2)	1,720 ha	
	Total	3,620 ha	

Number of beneficiaries:	sub-area (1)	140 families	(Assumed)
	sub-area (2)	140 families	(")
	Total	280 families	(")

Proposed crops: Citrus, pineapple, fodder crops, cassava, coffee, plantain

Peak irrigation water requirement: 2.49 m³/s (January)

Water source: Navarco River (Navarco Dam)

Major structures: Navarco Dam

- Catchment area: 126 km²
- Effective storage capacity: 6,000,000 m³
- Design high discharge: 1,200 m³/s
- Type: Rockfill Dam
- Height of Dam: 40 m
- Volume of Embankment: 650,000 m³

Headworks

- Location: Existing water intake facility for the El Bosque Hydroelectric Power Station (to be rehabilitated).
- Maximum water intake: 7.22 m³/s (water for power generation and rural supply is included).

The major issue on development of the area is the introduction of irrigation system for coffee plantations. Because very few coffee growers are familiar with benefits of irrigation system on coffee plantation, an impatient provision of the system will lead to confusion. In the light of this, it is advisable that the introduction of an irrigation system should be made in phases; first of all, to incorporate a model farm to demonstrate and to justify technically the efficiency of an irrigation system to coffee production and after farmers clearly grasp the system to introduce it at farm level. Furthermore, in view of sharing the existing water intake facility and driving canal belonging to the El Bosque Hydroelectric Power Station, a coordination shall be vital with EPA for the use of these structures; the construction period of the irrigation system should be determined referring to the EPA's rehabilitation schedule.

3) San Jose Agricultural Development Project

The project intends to introduce an intensive agriculture focused on upland crops. For attaining this goal, irrigation system and road network will be adequately provided and formation of farmers' cooperative will be encouraged. The project has the following features.

Objectives: Development of marginal area for coffee production and diversification of crop production

Development area:	3,400 ha
Irrigable area:	2,460 ha
Number of beneficiaries:	450 families (Assumed)
Proposed crops:	Citrus, fodder crops, cassava, coffee, cacao, etc.
Maximum water requirement:	1.80 m ³ /s (June)
Water source:	Espejo River (Pumping up)
	- Total head: 60 m,
	ϕ 450 x 4 units

One of constraints which this project confronts is the quality of water in the Espejo River from which water for irrigation purpose will be captured. For using water in the Espejo River some measures should be taken to upgrade its quality if this project is implemented before the water improvement program (sewage treatment of Armenia, coffee waste improvement, etc.) to cover the whole stream of the Espejo River. Under the circumstances, it is recommended that the present program should be implemented after the water quality improvement project of the Espejo River.

4) Circasia Agricultural Development Project

This program aims to upgrade small farmers who are concentrated on hilly land located around the urban area of Circasia. Mixed farm management consists of vegetables-fruits production, swine farming and freshwater pisciculture is envisaged by forming a cooperative. For intensifying the farm management, an irrigation system will be introduced and roads within the area will be improved. The project is outlined as mentioned below.

Objectives: Upgrading of small farmers and diversification of crop production

Development area: 1,600 ha
Irrigable area: 1,080 ha
Number of beneficiaries: 400 families (Assumed)
Proposed crops: Vegetables and fruits
Maximum water requirement: 0.50 m³/s (May)
Water source: Small streams within the area (pumping up)

Livestock development plan: Swine production on contract basis

- . Implementing body: Farmers' cooperative
- . No. of feeder pig: 400 heads
- . No. of contracted rearing pig: 6,400 heads/year
(16 heads/farmer)
- . Ancillary facilities: Swine breeding center, small feed mill and meat processing facility

Freshwater pisciculture: For increasing of farmer's income and supply of protein foods to farmers, freshwater pisciculture represented by Tirapia should be promoted jointly with swine production. This enterprise calls for a coordination with the similar nature of project which is being promoted by DRI-CRQ.

Culture pond: 400 places
(200 sqr.m/place)
Number of cultivated fish:
600 pcs/pond

5) Genova-Pijao Agricultural Development Project

The project area (Genova-Pijao) is located on the southern part of the Department which has been under-developed due to the inferior condition of topography. The project is formulated within the mixed farm management proposal composed of tree crops, swine farming and freshwater pisciculture. The improvement of farmlands is expected by providing irrigation system, implementing terrace reclamation and improving roads. For better farm management, the formation of a cooperative among farmers will be promoted. The outline of the project is as summarized below:

Objective: Development of under-developed southern sub-region

Development area: 400 ha (Genova: 200 ha,
Pijao: 200 ha)

Irrigable area: 280 ha

Number of beneficiaries: 30 families (Assumed)

Proposed crops: Tree crops, vegetables for domestic consumption of farmers

Peak irrigation water: 0.08 m³/s for both Genova and Pijao

Requirement: (January)

Water source: Small streams within the area (pumping up)

Livestock development: Swine production on contract basis

- . Implementing body: Farmers' cooperative
- . No. of feeder pig: 100 heads
- . No. of contracted rearing pig: 1,600 heads/year (50 heads/farmer)
- . Ancillary facility: Breeding pig center

Freshwater pisciculture: Freshwater fish culture will be promoted as the case of Circasia area.

Culture pond: 30 places (200 sqr.m/place)

Number of cultivated fish: 600 pcs/pond

(2) Agricultural Promotion Plan

As for the agricultural promotion plan, two projects are selected as follows:

- Quindio Agriculture Research Center Project

This project has an objective to contribute to facilitate an integrated agricultural development of the Department of Quindio.

- Salento Milk Cooling and Storage Plant Project

This project aims at supporting small and medium cattle farmers in Salento.

1) Quindio Agriculture Research Center Project

The establishment of an agriculture research center is proposed in view of relaxing various constraints that the agricultural sector in Quindio confronts, and promoting the development of the Quindian agriculture. The Center is also expected to contribute to smooth implementation of related programs. The organization of the Center is proposed as follows:

Quindio Agriculture Research Center	Agriculture Div.:	Investigation and research on crop production, irrigation, etc. Promotion of extension services for new technology <ul style="list-style-type: none"> . La Tebaida experimental branch farm on agriculture in slope land . Circasia experimental branch farm on agriculture in slope land . Cordoba experimental branch farm on coffee production in marginal highland
	Livestock Div.:	Investigation and research on livestock and extension of new technology <ul style="list-style-type: none"> . Salento experimental branch farm on livestock . Filandia experimental branch farm on livestock
	Ecological Div.:	Investigation and research on maintenance for ecological balance and enlightenment campaign of ecological preservation
	Socioeconomic Education Div.:	Education and training to farmers, extensionist, holding various seminars

In establishment of the Center inter-institutional coordination in relation to respective field of service shall be essential, and the integration of facilities together with the centralization of services shall be facilitated as far as possible so that an economical and effective management of the Center could be attained. The Center is designed to as given below:

Location:	Outskirts of Armenia
Area:	10 ha
Main buildings:	Administration office, meeting hall, training hall, research unit, laboratory, auditorium, dormitory, warehouse, parking lot
Equipments:	Irrigation equipments (pumps, sprinkler, etc.) Various gauging, investigation and test equipments (climate, soil, livestock, ecology, etc.) Processing (computer, etc.) Administration and office supply (vehicle, copy machine, stationery, etc.)

2) Salento Milk Cooling and Storage Plant Project

The dairy factory has limited capacity to collect the total amount of milk to be produced in the Department, so the establishment of a milk cooling and storage plant is proposed to collect once or twice a week and refrigerate milk to be produced mainly by small and medium farmers. The operation and management of the plant will be made by farmers' cooperative. The location of the plant will be in Salento and the storage capacity of the same will be 10 kiloliters per week.

The location of these seven projects is indicated in Fig 6.2.1.

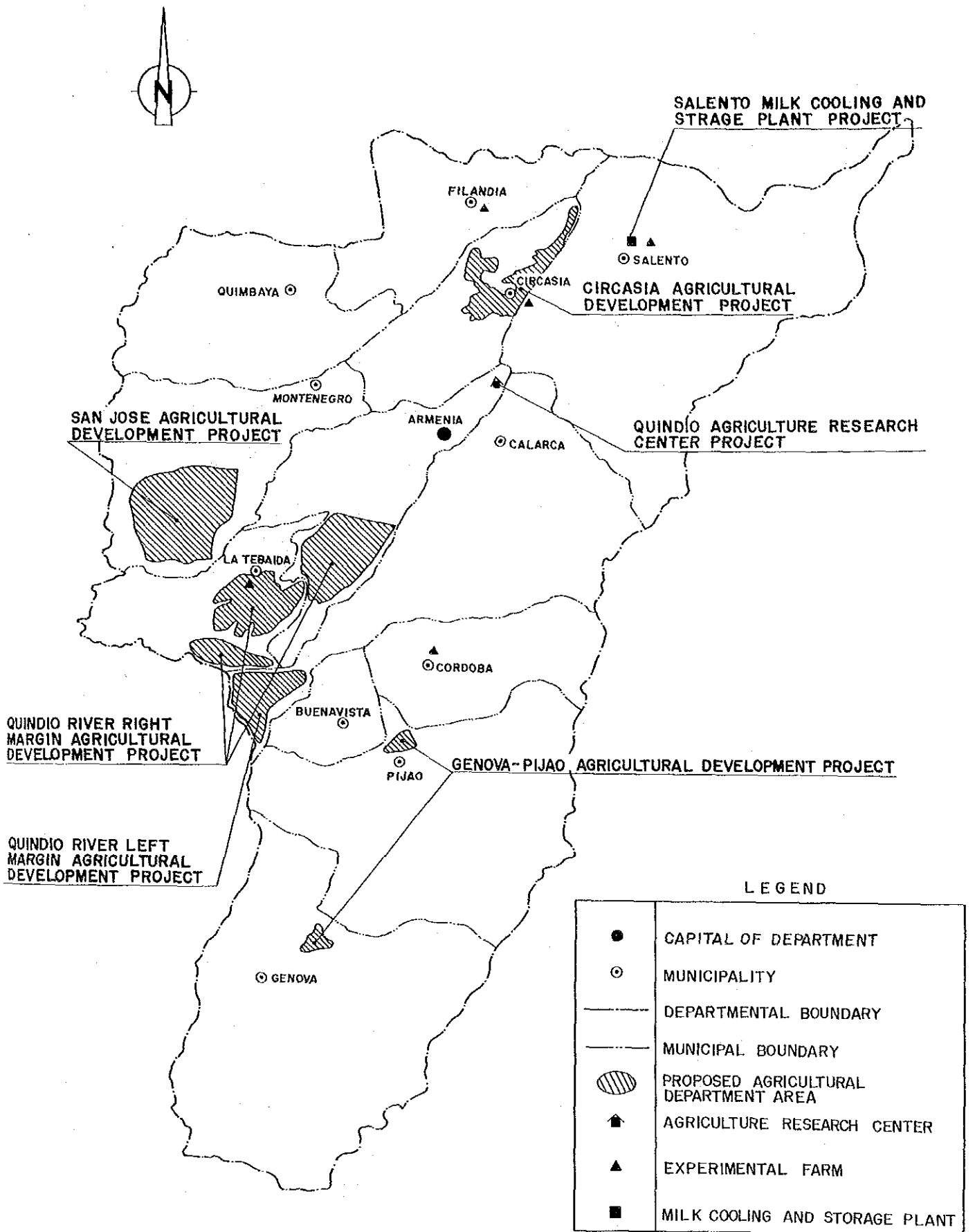


Fig. 6.2.1 PROPOSED AGRICULTURAL DEVELOPMENT AND PROMOTION PROJECTS IN THE MASTER PLAN

6.3 LAND CONSERVATION AND DISASTER PREVENTION PLAN

The two mayor types of natural disaster problems in the Department of Quindio are soil erosion and flooding damage. The present plan has objectives of mitigating natural disasters and preventing land productivity from being deteriorated. Land conservation and disaster prevention Master Plan comprises the following four sub-plans consist of seven projects which shall be implemented and completed by 2005. For identification of these seven projects, long-term development strategies (refer to Annex K) were taken into account.

Sub-plans	Projects	Reason for Selection
1. Designating Natural Conservation Area	Designating Natural Conservation Area	.Conservation of natural environment .Prevention from being developed disorderly
2. Disaster Prevention	Lejos River Disaster Prevention	.Conservation of natural environment .Mitigation of flood damage in Pijao
	Gris and San Juan Rivers Disaster Prevention	.Conservation of natural environment .Mitigation of flood damage in Génova
	Santo Domingo River Disaster Prevention	.Conservation of natural environment
3. River Improvement	Espejo River Improvement Project	.Conservation of natural environment .Mitigation of flood damage in Espejo river
	Verde River Improvement Project	.Mitigation of flood damage in Verde river
4. Soil Conservation	Le Vieja River Right Bank Area Soil Conservation	.Conservation of natural environment .Prevention from soil erosion

The description of development projects, seven in total, is given in the following subsections.

The detail of flood damage, major structures, etc., are shown in Annex K.

(1) Designating Natural Conservation Area Plan

1) Designating Natural Conservation Area Project

From the viewpoint of conservation of natural environment in the Department, this program aims to designate natural conservation areas by law so that these areas might be prevented from being developed disorderly. On the basis of land capability evaluation result conducted in the course of the study, the following watersheds have been proposed as natural conservation area.

PROPOSED NATURAL CONSERVATION AREA

<u>Rivers</u>	<u>Total Area (km²)</u>
Quindio	140.4
Navarco	63.3
Santo Domingo	70.4
Verde	29.7
Lejos	87.7
Azul	72.3
Rajo	114.5
Gris	47.8
San Juan	51.5
<u>Total</u>	<u>677.6</u>

(2) Disaster Prevention Plan

Of above proposed designated area, disaster prevention projects have been proposed with regard to the following three watersheds in which natural resources are presently too destructed to call for urgent measures for rehabilitation.

1) Lejos River Disaster Prevention Project

Objective: Conservation of natural environment and mitigation of flooding damage in Pijao

Watershed area: 87.7 km²

Description of the Project:

- Flood control dam
 - Type: Concrete gravity
 - Height: 33 m
 - Capacity: 1,050,000 m³
- Sabo dam
 - 6 sites
- Bank Protection
 - 7 km
- Reforestation area
 - 15.1 km² (planting density 2.5 m x 2.5 m)
- Woodland path
 - 19 km

2) Gris and San Juan Rivers Disaster Prevention Project

Objective: Conservation of natural environment and mitigation of flooding damage in Genova

Watershed area: 99.3 km²

Description of the Project:

- Bank Protection
 - 10 km
- Sabo dam
 - 7 sites
- Reforestation area
 - 22.2 km² (planting density 2.5 m x 2.5 m)
- Woodland path
 - 15 km

3) Santo Domingo River Disaster Prevention Project

Objective: Conservation of natural environment

Watershed area: 70.4 km²

Description of the Project:

- Sabo dam
 - 12 sites
- Reforestation area
 - 32.0 km² (planting density 2.5 m x 2.5 m)
- Woodland path
 - 13 km

(3) River Improvement Plan

As to river improvement plan, two projects have been formulated as to recover potential river function, and to enhance soil conservation capability in hill land.

1) Espejo River Improvement Project

Objective: Restoration of river functions

Location of the Project: Up to 10 km upper stream from the confluence with La Vieja River

Description of the Project: Cross sectional improvement: 1 km (widening of cross-section)
Soil erosion protection works of slope land of right side: 10 km (drainage works, etc.)

2) Verde River Improvement Project

Objective: Restoration of river functions

Location of the Project: Up to 4 km downstream from the confluence with Santo Domingo River

Description of the Project: Flood protection (riverwall on both banks: 4 km)

(4) Soil Conservation Plan

1) La Vieja River Right Bank Area Soil Conservation Project

The project aims at easing soil erosion that is observed from place to place on farm land extending along the right bank of the La Vieja River.

Objective: Conservation of natural environment

Location of the Project: Lands actually eroded or subject to future erosion along the right bank of the La Vieja River

Description of the Project: - Gully erosion protection works: 52 sites
- Reforestation: 0.6 km² (Green belt)

The location of above projects included in the land conservation and disaster prevention plan is shown in Fig. 6.3.1.

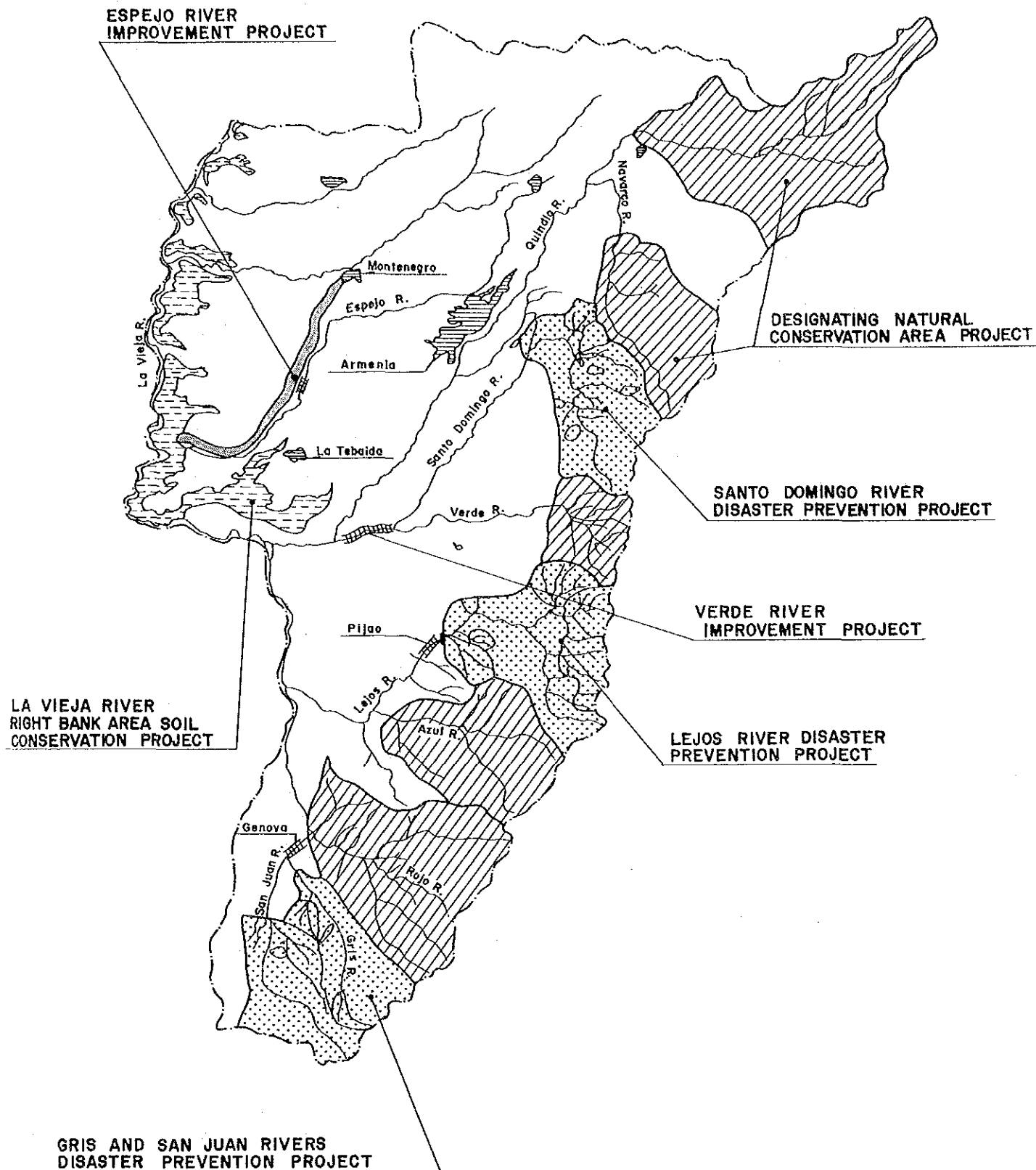


Fig. 6.3.1 PROPOSED LAND CONSERVATION AND DISASTER PREVENTION PROJECTS IN THE MASTER PLAN