

No.

**MASTER PLAN STUDY
ON
THE IRRIGATION AND DRAINAGE PROJECT
IN
THE ADJACENT AREA TO THE YACYRETA DAM**

MARCH, 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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No. 13451

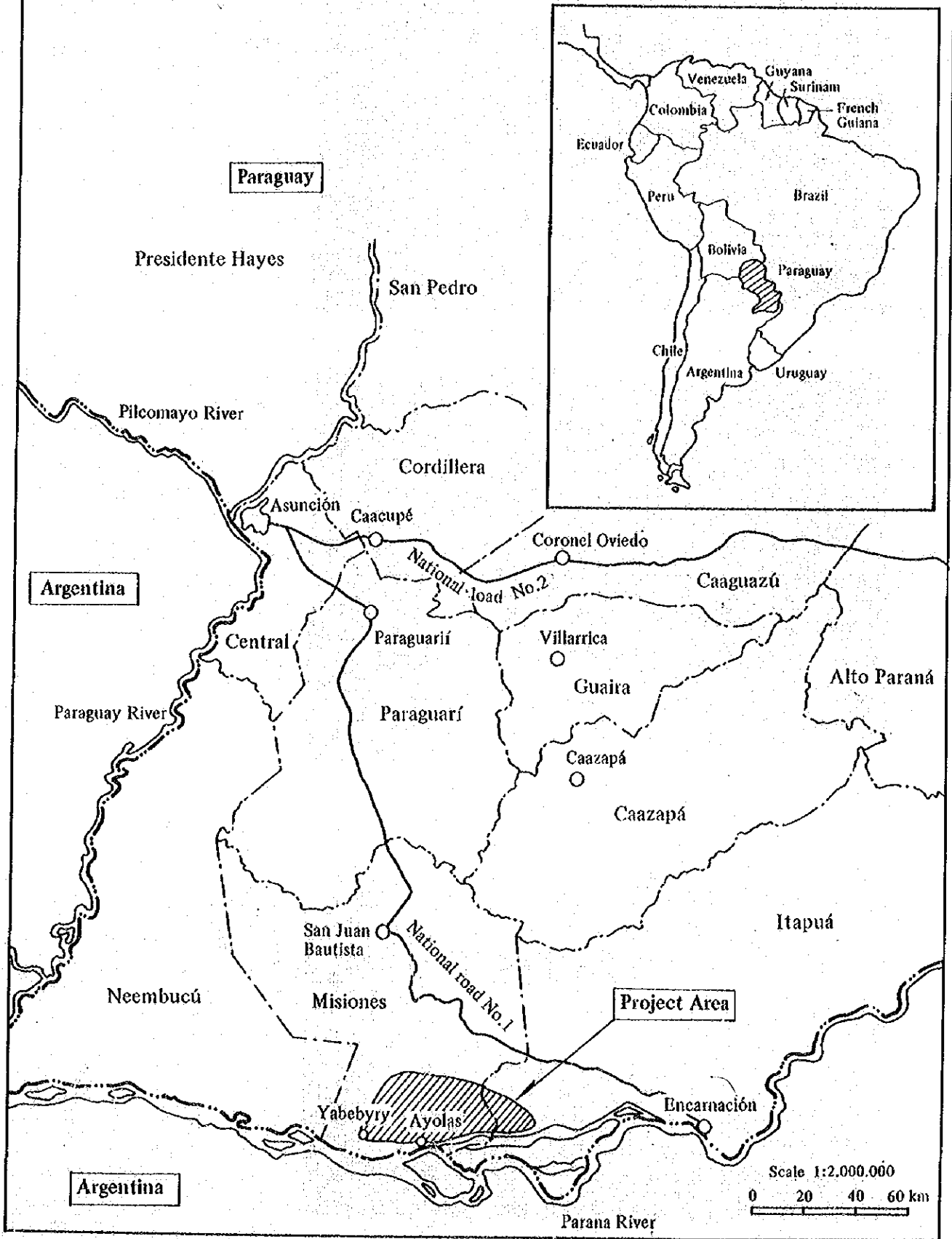
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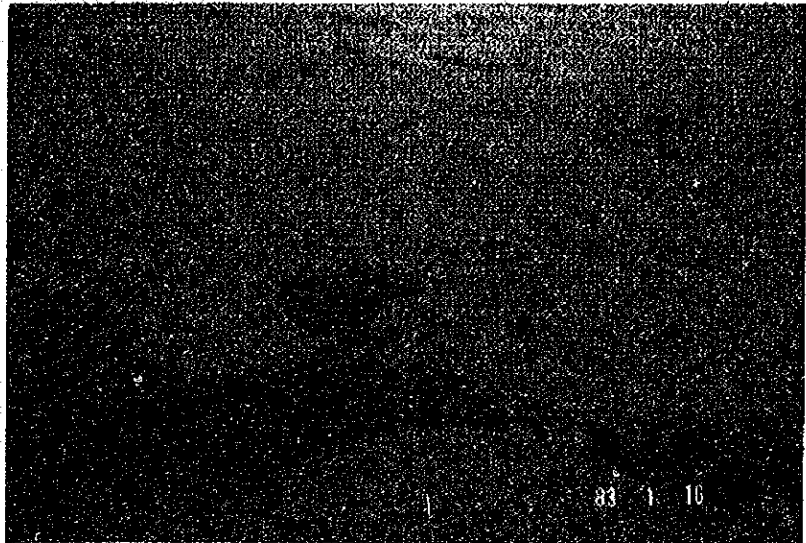
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Location Map of the Irrigation and Drainage Project in the
Adjacent Area to the Yacyreta Dam in the Republic of Paraguay



1. An aerial photograph of the survey area

Forests and woods (Monte) are dotted across the area and natural pastures occur in a zone of swampy land.



2. An aerial photograph of the middle reaches of the Atinguy River

The Parana River flows into the central part of the survey area and is one of the main drainage rivers.



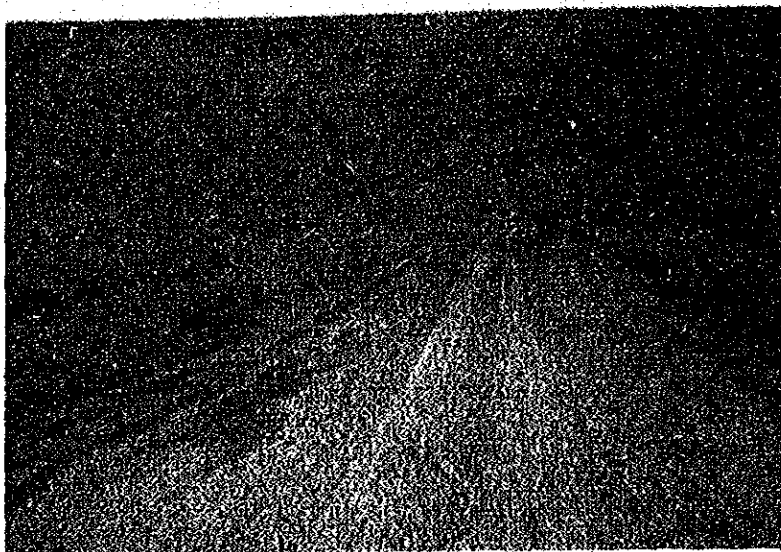
3. Source of the Yabebyry River

The Yabebyry River, flowing along the western extremity of the survey area, flows into the Parana River.



4. Inundation along the San Ignacio-Yabebyry Road.

Along the unpaved road connecting San Ignacio to Yabebyry, there is a swampy zone which is usually inundated.



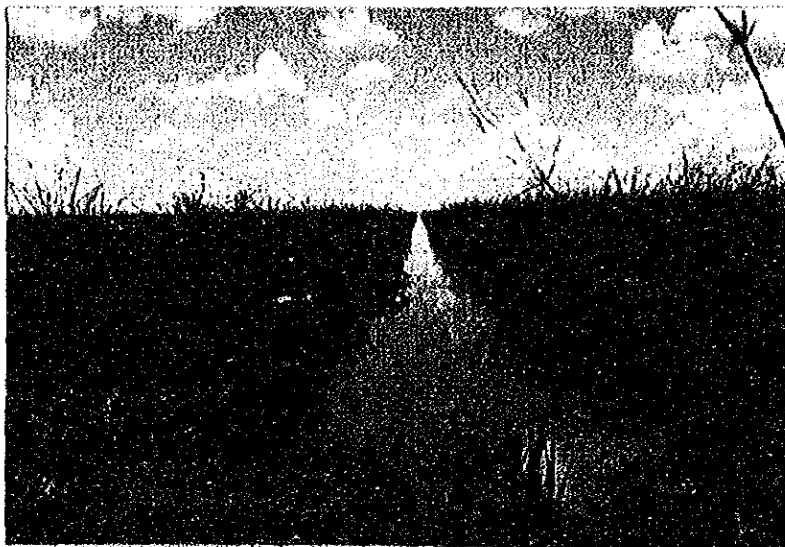
5. Horseback Investigation of Inundated area

The central part of the survey area is an area which is usually inundated, thus, a thorough investigation of this area is impossible, even by horse.



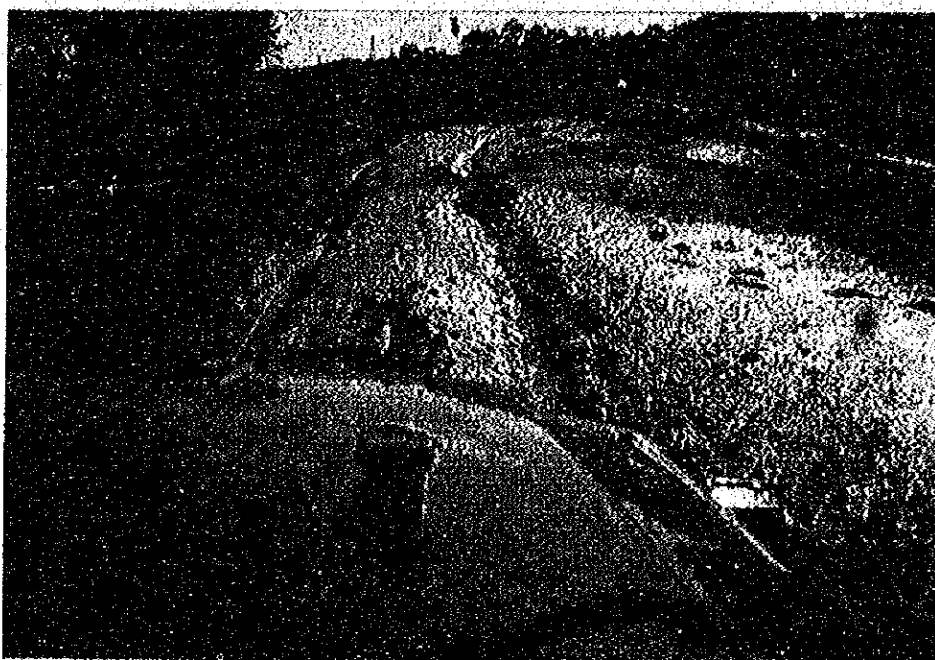
6. Artificial drainage channels (Zanja) in the survey area

Each ranch digs its own Zanja (width: 1 ~ 3m; depth: 0.25 ~ 1.5m), but regular maintenance is hardly ever carried out.



7. Pumping station on the
Bolf Farm

Four water pumps
(one of the boiler
type and three of
the diesel engine
type) to supply
water for the pro-
duction of rice are
located southwest of
San Cosmo y Danian
on the banks of the
Parana River.

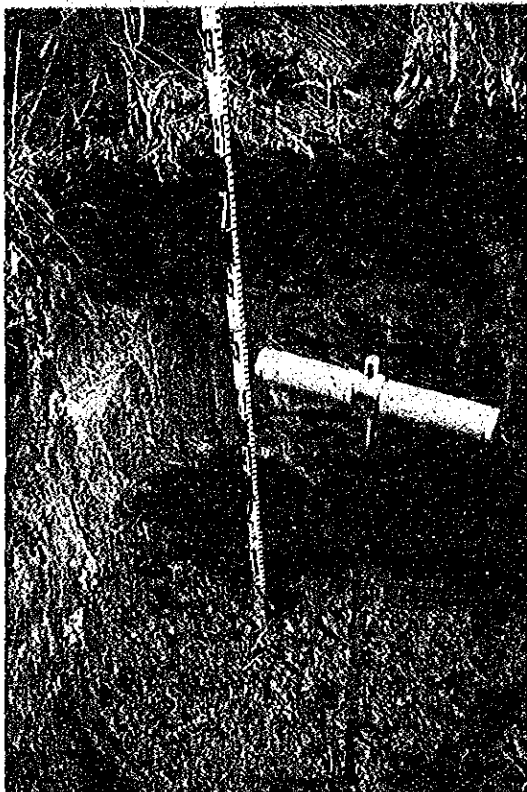
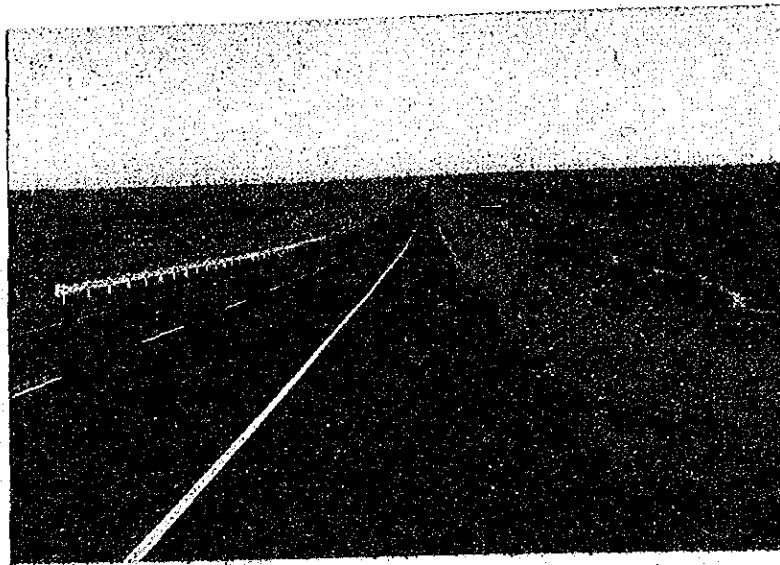


8. Yabebyry-San Cosmo Road

The unpaved road has a total width of 10m
and an effective width of 7m. The photo-
graph shows the condition of the road after
a rainfall. Passage is impossible for 2 or
3 days.

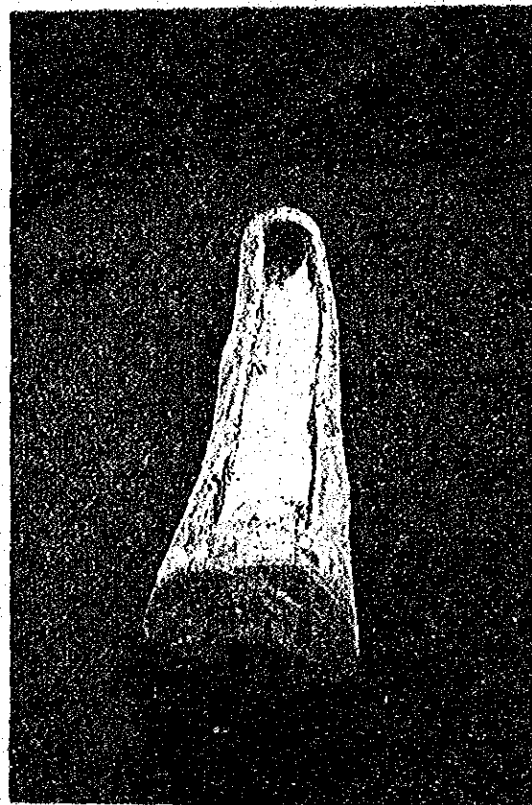
9. Access Road 1-B

Branching off the National road No. 1 and passing through San Cosmo y Danian, the access road leading to Ayolas has a total width of 17.5m and an effective width of 7m.



10. Pedological Investigation

The area for the investigation is located 10km east of the middle reaches of the Yabebyry River. The soil type is Palanosils, representative of soil type in the survey area.



11. Salt Trough

Some places have Paraguay's salt troughs which, in addition to salt, also have powdered bones mixed in.

Abbreviations and Conversion Rates

US\$:	United States Dollars
G.S.	:	Guaranies (Paraguan Monetary Units)
1 USR	:	160 GS., 1 GS = ¥1.5 (1 US\$ = ¥240)
MAG	:	Ministerio de Agricultura y Ganaderia
GT	:	Gabinete Tecnico
IAN	:	Instituto Agronomico National
CRIA	:	Centro Regional de Investigación Agricola
CEMA	:	Centro de Mecanizacion Agricola
IBR	:	Instituto de Bienesta Rural
DIEAF	:	Direccion de Inuestigacion y Extensión Agropecuaria y Forestal
DIAP	:	Departamento de Investigacion Agricola y Forestal
SEAG	:	Departamento del Servicio de Extension Agricola y Ganadera
SENASE	:	Servicio Nacional de Semilla
AUCA	:	
SFN	:	Servicio Forestal Nacional
CEDEFO	:	Centro de Desarrollo Forestal
E.B.Y.	:	Entidad Binacional Yacyreta
IACS	:	Inter Americano Giodesico Servicio
IGM	:	Instituto Geogratico Militar
BNF	:	Banco Nacional de Fomento
CAH	:	Credito Agricolal de Habilitacion
FG	:	Fondo Ganadero

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CAPTER 1 INTRODUCTION

1.1 Background of Survey

As a joint venture with Argentina and financed by the World bank, the Bank of America Continents and city banks, the Republic of Paraguay is executing a hydraulic power generation project at the site of Yacyreta Island on the Parana River, the common boundary of both countries.

In accordance with the "Treaty of Yacyreta" concluded between the government of the two countries in 1973, prior to the execution of this project, both governments were entitled to take a maximum of 108m³/sec of water for their agricultural development. The government of Paraguay projected the agricultural development in the vast area adjacent to the Yacyreta Dam on the northern bank of Parana River utilizing the 108m³/sec of water available from the dam.

This agricultural development is an integrated development whose major content is the large scale irrigated farming and stock raising being positioned as a model development under the long term program. Meanwhile, The Economy in Paraguay still depends basically upon the field of agriculture and livestock, which is a very important factor for socio-economic progress. As the basic purpose for developing the area adjacent to the Yacyreta Dam, Paraguay aims at attaining the following four items:

- 1) Extended production and improved quality through modern farming methods;
- 2) Fostering of settlement for the sake of increasing the population of rural areas;

- 3) Fostering of the resettlement of farmers in the area to be submerged owing to the Yacyreta Dam construction;
- 4) Extended production of agriculture and livestock products for export.

Recognizing the importance of this development program, the government of Paraguay requested the technical cooperation from the government of Japan. Because Paraguay considered it unfeasible to cope with the program by itself on the grounds that Paraguay is hardly experienced in agricultural development involving such large scale irrigation and drainage, (the area is over 150,000 ha) and because the program is an integrated agricultural development.

Thus, the government of Paraguay requested the government of Japan for technical cooperation in mapping out the master plan for this area. In response to this request, the government of Japan dispatched the preliminary survey team to Paraguay in August of 1982, and the S/W survey team in September of the same year. Then, the Government of Japan decided to cooperate to map out the master plan of the integrated agricultural development of the area adjacent to the Yacyreta Dam as a part of their technical cooperation project.

In accordance with the scope of works agreed upon in September 1982, the Japan International Cooperation Agency (JICA) which is the executive organization of the technical cooperation of the Japanese Government is to enforce the mapping out of the master plan during the period from late November 1982 through to the end of March 1985.

1.2 Purpose of Survey

1.2.1 Purpose

The Survey shall be made to map out the master plan for enforcing the integrated agricultural development, and for attaining the Paraguay's below-mentioned basic development purpose of the area adjacent to the Yacyreta dam through performing highly productive agriculture by utilizing the $108\text{m}^3/\text{sec}$ of water available from the dam.

- 1) Increasing production and improving quality through modern farming methods
- 2) Securing employment chances and improved living conditions
- 3) Extending production of agriculture and livestock products for export

The survey shall also be made to transfer the technologies for mapping out the master plan of agricultural development.

In other words, it involves the mapping out of the large scale irrigation and drainage plan considering the effective utilization of water supplied through the dam and the integrated rural plan for materializing a highly productive agriculture. Furthermore, it takes into account the establishment of the basic concept for the feasibility study which may be made in future.

1.2.2 Scope of Survey

The 1st year (1982) centered around the basic survey, and collected the existing data concerning meteorology, hydrology, soil, farming, land use, land condition, facilities, etc. in order to understand the current state of the area to be covered by the development, and also

singled out problematic points and roughly determined the area to be covered by the development program. In other words, it aimed at:

- 1) Understanding Paraguay's economic and agricultural state by collecting and analyzing relevant national material;
- 2) Understanding the current states of meteorology, hydrology, soil, farming, irrigation and drainage facilities, etc., through field surveys of the area, and the collection and analysis of existing data is carried;
- 3) Observing and collecting basic data through installing observation apparatus to collect hydrological and meteorological data concerned, in case of data indispensable shortage;
- 4) Based upon the field survey results, to arrange the basic data collected, to analyze conditions of irrigation and drainage, land, environment, farming, rural economy and so on, to make coordination among above conditions, and to roughly determine the location and size of area to be developed.

1.3 Executive Policy of Survey

1.3.1 Survey Plan

This survey shall be enforced for the three years of the 1st year (1982), the 2nd year (1983), the 3rd year (1984) in accordance with the Scope of Works agreed upon in September 1982 between the governments of Paraguay and Japan. In enforcing the survey, the survey works within the below mentioned scope shall be executed through full conference with the government of Paraguay, the Yacyreta Public Corporation and other organizations concerned.

1) The 1st Year

Centered around the basic survey and emphasizing the understanding of current states of the area to be developed, to single out the problematic points and roughly determinate the area covered by the development plan.

- (1) Collection and analysis of exsisting data
- (2) Installation of observation apparatus for data collection
- (3) Current states survey concerning meteorology hydology, soil, farming, irrigation and drainage facilities etc.
- (4) Rough determination of the area to be covered by the development

2) The 2nd Year

To continue to enforce the 1st year's basic survey, to map out the basic development concept in full consideration of the basic purposes and various conditions concerning the area to be covered, and to roughly determine the development plan.

- (1) Continuation of the 1st year's basic survey
- (2) Rough determination of the development plan

3) The 3rd year

Based upon the basic development concept roughly determined in the 2nd year, to estimate to the project cost of the development plan, to make economic evaluation for the plan, and to map out the integrated agricultural development plan, also, to confirm the priority order of sub-project.

- (1) Rough estimation of project cost of development plan
- (2) Economic evaluation (economic analysis, financial analysis)
- (3) Mapping out of the integrated agricultural development plan

(4) Confirmation of the priority order of sub-project

1.3.2 Remarks on Survey

Most of the survey area adjacent to the Yacyreta Dam consists of natural pasture and swamps for which drainage measures are inevitable. Furthermore, it is necessary to study such a technical side as development of large scale irrigated farming effectively utilizing the dam supplied water along with the socio-economic and administrative side as represented by the rural development in line with the Paraguay's long term policy.

Since the integrated agricultural development plan of this area is the first, large-scale, agricultural development in Paraguay, demonstrative and spreading effect for future development projects are expected. Furthermore, though an increased agricultural and livestock products in the covered area is expected, the increased rice production in particular, is not expected to fully consumed in the domestic market. Therefore, it is necessary to consider the overseas market and the distribution system of agricultural and livestock products, which will be the major determinants of this development plan's success or failure.

From the above points of views, the following are considered important especially in the socio-economic and administrative aspects and the technical aspects:

- 1) Study on the village plan and the land distribution plan with the settlement;
- 2) Study on the crop rotation system of paddy field and grassland in view of maintaining fertility;
- 3) The posture improving technology in drainage area;
- 4) Study on criteria for agricultural land development in the flat and vast area;

- 5) Study on large scale mechanization;
- 6) Study on grassland improvement, and upland irrigation;
- 7) Erosion control measures, and the preservation of forest zones and other measures for environment/conservation;
- 8) Study on processing facilities and;
- 9) Survey on overseas market and the distribution system of farm products.

1-4 Outline of Survey Activities

1-4-1 Composition of the survey team

(1) Members of Japanese Survey Team

Name	In charge of
Yoji Takano	Leader
Akimasa Yamashita	Irrigation
Sumihiko Masaki	Drainage
Yoshifumi Harada	Meteorology / Hydrology
Shigeichi Koma	Cultivation / Pedology
Shozo Miyaki	Land utilization
Takayoshi Kato	Farming
Yoshiki Abe	Dairy farming / Livestock
Akira Ito	Agricultural Land Development
Kazuo Kimura	Rural development / resettlement
Choki Kameya	Agricultural economy
Tetsuro Takahashi	Environment conservation
Ken Nishida	Soil mechanics
Yasuhito Sato	Survey / Designing
Osamu Shimizu	" / "

(2) Counterparts of Paraguayan Side

(Ministry of Agriculture and Livestock)

Summarizing/Coordination	Ing. Agr. Conrado Pappalardo M. (MAG)
Technical Coordination	Ing. Agr. Wilfrido A. Zárate G. (")
Advisor	Ing. Agr. Shiro Hirata (")

(Yacyreta Public Corporation)

E.B.Y summarizing	Ing. Fernando Yaluk (E.B.Y.)
Summarizing/coordination	Ing. Roberto M. Cubas C. (")
Technical coordination	Ing. Juan C. Pineda (")
" (Agolas)	Ing. Hugo Ruiz (")
" (Asuncion)	

(Specialized counterparts)

Topography	Ing. C. Guido Vera (E.B.Y.)
Meteorology	Ing. For. Menandro Grisetti O. (E.B.Y.)
Hydrology	Ing. Miguel A. Leguizamón (E.B.Y.)
Soil/Land Classification	Ing. Ramón Ramírez (E.B.Y.)
Irrigation	Ing. Roberto Cubas C. (E.B.Y.)
Drainage	Ing. Marcos Martínez F. (E.B.Y.)
Agriculture and Livestock	Ing. Agr. Aristides Raidan G. (MAG)
"	Ing. Agr. Wilfrido A. Zárate G. (MAG)
Livestock and grassland Improvement	Ing. Agr. Nelson Blanco (MAG)
"	Dr. Osvaldo Raidan G. (MAG)
Agricultural Cooperatives Organizing, etc.	Sr. Cesnr Leivr (MAG)
"	Ing. Cornelio Vazquez (MAG)
Infrastructure	Ing. Juan C. Pineda (E.B.Y.)

1-4-2 List of Contacted Person

Organization	Name	Position
Ministry of Agriculture and Livestock	Ing. Agr. Don Hernando Bertoni	Minister
	Ing. Oscar Meza	Director, Technical Cabinet
	Ing. Ricardo Samudio	Chief Secretary, Agriculture Livestock Experiment Extension Planning Office
Yacyreta Public	Ing. Fulio Cesar Monglos	Chief, Planning- Coordination Office
Meteorological Department, Ministry of National Defence	Ing. Fransisco Salano Santacruz	Director, Meteorological Department
Weather Stations		
Santa Rosa	Ing. Teresa Conception Ropez	
Aylas	Ing. Jose Calasanz Moscarda	
Encarnacion	Ing. Juan Augel Miranda	
Carmen del parana	Ing. Cristian Iorge Arce	
San Cosme y Danian	Ing. Zully Cardozode Gauto	
Isla Yacyreta	Ing. Joaquin Rossi Encargado	
National Experi- mental Station (I.A.N.)	Ing. Rovertto Casaccia	Chief
	Ing. Fatacha Rodas	Researcher (soil) " (rice cropping)
Asuncion University	Dr. Gonbales Erico	Professor (Pedology)
	Dr. Patrocinio Alonso	Professor (pedology)
	Dr. Ruben Fretes	" (grassland)
	Dr. Alberto Oka	" (breeding)

Organization	Name	Position
Japanese Embassy in Paraguay	Tadashi Otaka	Ambassador
	Fuzo Uchimura	Councillor
	Toshiro Akakuma	Secretary
Consulate at Encarnacion	Toshiharu Sugita	Consul
	Toshio Sato	Vice Consul
	Toshiro Kojima	Director
	Tatsuo Ando	Chief, General Affairs Section
	Masaharu Torii	Chief, Operation Section No.1
	Takehiko Maeda	Chief, Operation Section No.2
	Tatsuso Suzuki	Operation Section No.2
	Kenji Yamamoto	"
JICA (Encarnacion)	Toshihide Shinozaki	Branch Chief
	Toru Inoue	
	Kenichi Kariya	Staffer
	Tetsuya Hayakawa	
JICA (Alto Parana)	Ichiro Makino	Chief
	Akio Kikuchi	Staffer
JICA (Yguazu)	Yuji Ishihara	Deputy Chief
	Akira Yokoyama	Section Chief
JICA (Paraguay Agricultural Experimental Station)	Takao Okumura	Chief
	Shusuke Yukawa	Chief, Research Office
	Shigenari Koga	Researcher
Dispatched Expert	Shiro Hirata	Ministry of Agriculture and Livestock
	Sadakichi Yoshida	"
	Akira Machida	CRIA
	Masaru Niwa	"
	Hideo Katahira	"

Organization	Name	Position
Dispatched Expert	Toshio Sato	CEDEFO
	Takayuki Serizawa	CEMA
	Yoshio Senpoku	"
	Katsuo Ito	"
	Narihide Nagayo	JOCV Staffer at Carmen del Parana

List of Collected Materials

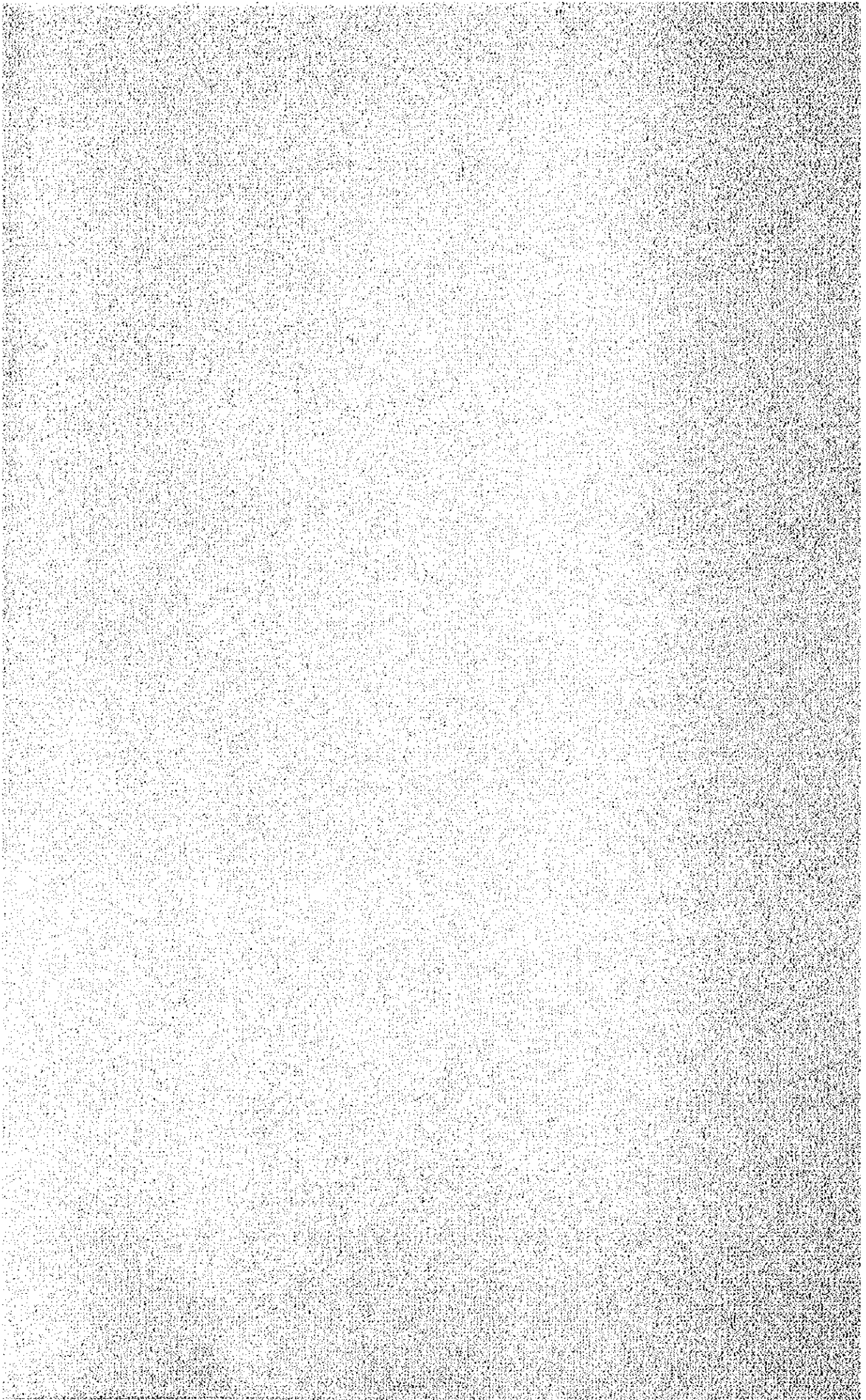
Number	Name	Issuing Institution
1.	Map of Paraguay (1/2,000,000)	Instituto Geografico Militar
2.	Map of Paraguay (1/1,000,000)	"
3.	1/50,000 topographical map (related part)	"
4.	Proyeccion de la Roblacin Economicamente Active a Nivel Nacional Vhabano-Rural y Departmental	M.A.G.
5.	Censo Nacional de Poblacion y Viviendas	"
6.	Bulletin of the Cacupe National General Experimental Agriculture Laboratory (extract) - Growing of paddy rice	"
7.	Site map of the Yacyreta Dam Ascenso (1/2,000,000) reduced scale)	E.B.Y.
8.	Cuentas Nacionales 1974/1981	Banco Central del Paraguay
9.	Boletin Estadistico	"
10.	Anuario Estadistico del Paraguay	Ministerio de Hacienda
11.	1983 Paraguay State Estimate	J.I.C.A. (Asumcion)
12.	Cuentas Culturales (1981/1982)	M.A.G.
13.	Ncmina de Cooperativas de Produccion Inscriptas Tin la Direccion General de Cooperativismo (1980.11.30)	"
14.	Cultivo de Arroz (1978)	"
15.	Programa National de Arroz (1978)	"
16.	Salarias Minimas Actualizadas	M.J.T.
17.	Promedio Anual de Precios de Products Agropecuarias Recibidos Par el Productor en el Interior del Pais (1972.81)	M.A.G.

Number	Name	Issuing Institution
18.	Tractor and combine imports (numbers and prices for 1972~1981)	M.A.G.
19	Tractor prices for Jan. 1982.	"
20.	Value of materials for agricultural production (agricultural fertilizers and chemicals) Jan. 1983	"
21.	Summary from the Paraguay Agricultural General Experimental Laboratory (Nov. 1982)	JICA Paraguay General Experimental Agriculture Laboratory
22.	Construction Plans for paddy field walls (Convey) in the Elena Region and proposals for paddy rice cultivation methods	Overseas Youth Coopera- tive Members (Mr. Narihida Eitai)
23.	Proniega Informe Anual (1976~1981)	M.A.G.
24.	Summary of Cattle Keeping in the Yaguazu Region	J.I.C.A. (Yaguazu)
25.	Proyecto Yacyreta Informe Complementario a Los Banco	E.B.Y.
26.	Proyecto Yacyreta Informe Complementario a Los Banco	"
27.	Simtesis Actualizada del Proyecto Yacyreta	"
28.	Estudio de Factibilidad Tecnico- Economico-Financiero del Aprovechamiento del Rio Parana a la Altura de las Islas de Yacyreta y Apip	"
29.	Site map of Yacyreta Dam (1/50,000) (1/50,000)	"
30.	Site Map of Itaibate Dam (reduced scale 1/20,000)	"
31.	Flooding map and water volume plan for the Itaibate dam (reduced scale 1/400)	"

Number	Name	Issuing Institution
32.	Construction of facilities for water catchment at the Yacyreta Dam (1/250, 1/500)	E.B.Y.
33.	Site map of the Land side of the Yacyreta Dam	"
34.	Plan of the existing road and Acceso (1/40,000)	"
35.	Range of influence of the Yacyreta Dam (1/100,000)	"
36.	Map of the region inundated by Yacyreta Dam	"
37.	Standard Levels relating to the Yacyreta Dam (41)	"
38.	Survey of the Acceso Road (Plan, Section along length, Standard Levels)	"
39.	Geographical Map (East of the the Santiago - Ayolas Acceso)	"
40.	Geological Map (1/250,000)	"
41.	Flow diagram based on Thiessen's Law (East from Atinguy River)	"
42.	Data on the volume of water in the Atinguy River	"
43.	Plan de Desarrollo Regional de Itapua y Misiones Tomo I Diagnostico "Analisis de la Situacion Global y Sectorial"	M.A.G.
44.	Los Arboles de la Region Oriental del Paraguay	C.E.D.E.F.O.
45.	Estudios de Poblacion Regional	M.A.G.
46.	Des Arrollo Forestal Paraguay Una Estrtegia de Desarrollo Para el Sector Forestal	C.E.D.E.F.O.

Number	Name	Issuing Institution
47.	Fortalecimiento del Programa Forestal Paraguay	M.A.G.
48.	Panorama Forestal Latino Americano	S.F.N.
49.	Servicio Forestal Nacional	"
50.	Mapa de Vegetacion Nacional	E.B.Y.
51.	Estudio Faunisticos Cronograma Tentativo	"
52.	Aspectos Ambientales en el Prayecto Yacyreta	"
53.	Justificacion de los Programas	"
54.	Rescate de la Fauna de la Isla Yacyreta	"
55.	Lista de Animales en el Refugio Provisorio	"
56.	Aspectos de Saludy Ecologia en el Proyecto Yacyreta	"
57.	Proyecto Conservacion de la Ictiofauna en la Zona de Yeyreta	"
58.	Bpeve Balance del Recurso Bosaue en Paraguay	Asuncion University
59.	Plano de Ubicacion del Area Destinada a Vivero	E.B.Y.
60.	Sistema de Reforestation	C.E.D.E.F.O.
61.	Japanese Projects in Paraguay	J.I.C.A. (Asuncion)
62.	Encarnacion (1940~1980)	Bureau of Meteorology, Department of Defence
63.	San Juan Bantista. (1955~1980)	"
64.	Yacyreta (1963~1980)	"

Number	Name	Issuing Institution
65.	Santa Rosa (1981.6~1982.7)	E.B.Y.
66.	Carmen del Parana (1981.6~1982.7)	"
67.	Gnal Delgado (1981.6~1982.7)	E.B.Y.
68.	Ayolas (1981.6~1982.7)	"
69.	Sancosme (1981.6~1982.7)	"
70.	Monthly Rainfall in Yabebyry	Army Engineering crew
71.	Standard levels for 1/10,000 topographical maps	E.B.Y.
72.	Yacimientos de Prestamos Presa de Tierra Lateral Derecha Ubicacion de Perforaciones y Calicatas Clasificacion de Materiales	"
73.	Niveles Piezometricos Presa Lateral Derecha	"
74.	Presa de Tierra Lateral Derecha Area de Prestamo Perfiles de Perf	"
75.	Mapa Geologico de Afloramientos Area de Proyecto	"
76.	Recopilacion de las Principales de yes Vigentes	I.B.R.
77.	Organograza - I.B.R.	"
78.	Location of farmhouses to be relocated in connection with the Yacyreta Dam	E.B.Y.



CHAPTER 2

THE OUTLINE OF THE PRESENT SOCIO-ECONOMIC STATE IN PARAGUAY

2.1 Population

The population of Paraguay in 1972 was 2,433,000 according to the national census conducted in the same year. The population is estimated to have increased to 3,168,000 in 1980 and to 3,268,000 in 1981 according to data compiled by the Ministry of Finance and the Central Bank.

The population increase curve and the age structure of the population are shown in Fig. 2-1, 2 and 3.

From 1972 to 1980, the population increased by 810,000 or 3.76%.

The population is concentrated around the (Oriental) Region spread along the Paraguay River, and makes up 97.5 percent of the total population. In the five departments in the Western (Occidental) Region however, only about 80,000 people live. A drift of the population to Asuncion and other cities has been discernible in recent years, making the population of rural areas decrease. The population density is 19.2 persons per square kilometer in the Eastern Region, but only 0.33 in the Western Region. The national population density is 7.8 persons on average, and Paraguay is one of the countries with the lowest population density in Latin America. It is roughly the same as, the neighboring country of Bolivia.

Table 2-1 shows the area, population, population density and other factors for the 19 departments for which administrative partitions were established in 1973. Residential conditions of the urban areas and of the rural areas are also shown in Table 3.

According to this statistics Itapua and Misiones Departments, which are both concerned with the integrated agricultural development project of the area adjacent to Yacyreta Dam, cover 26,081 Km² and amount to 6.4% of the

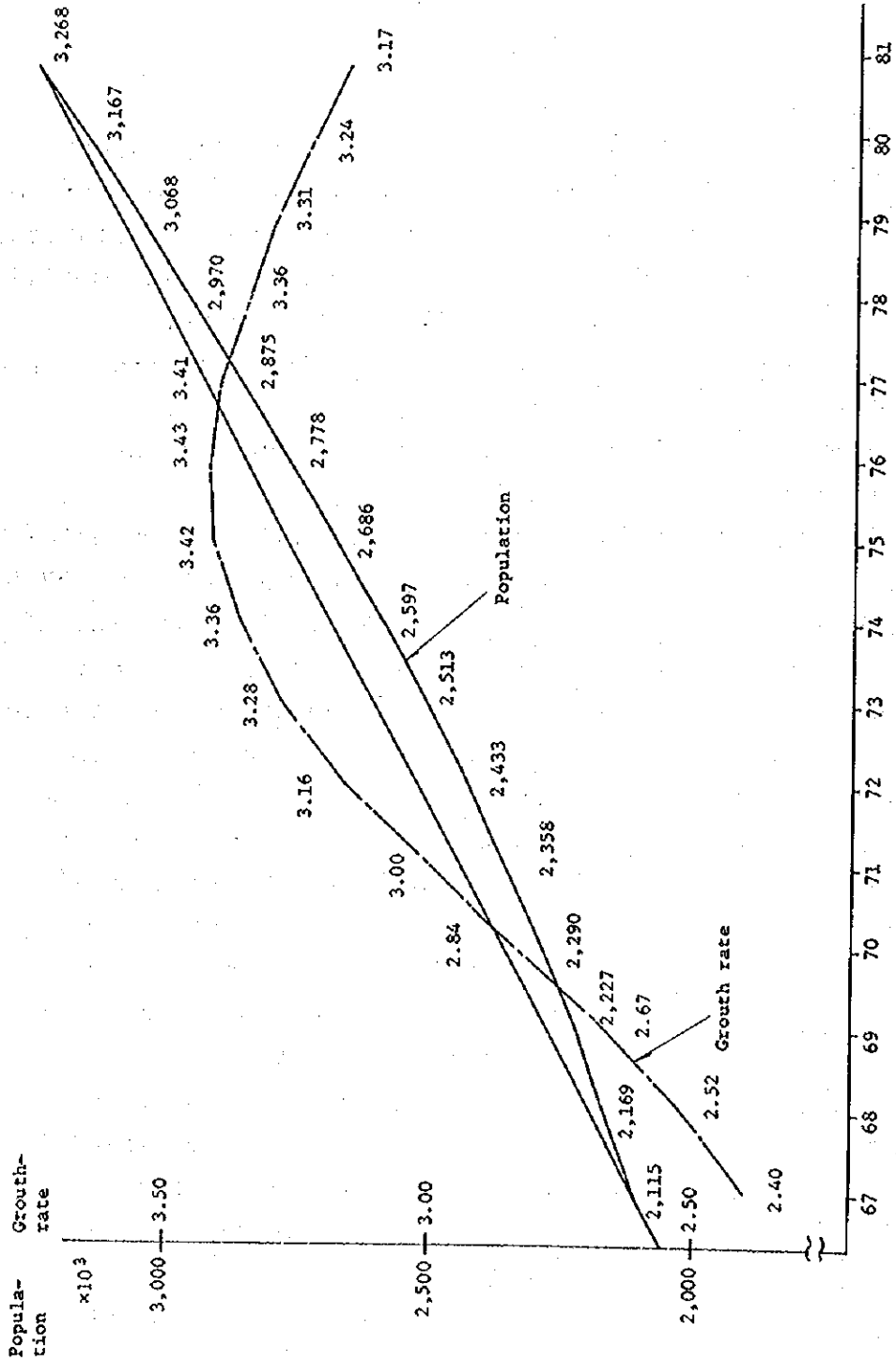


Fig. 2-1 Population Growth Rates

Population in 1972: 2,357,955
 Population in 1980: 3,167,985
 Growth population: 810,030
 Growth rate: 3.76%

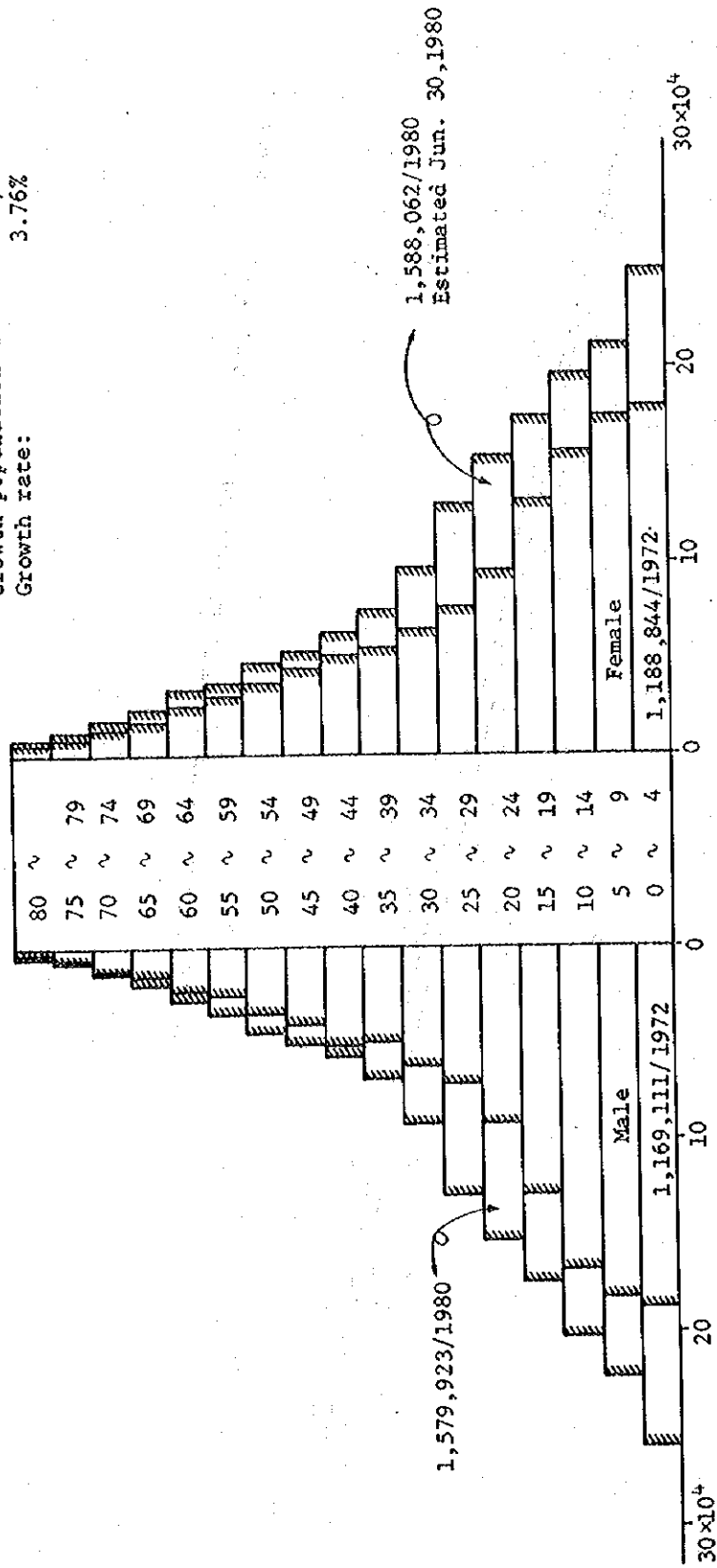


Fig. 2-2 Population Pyramid

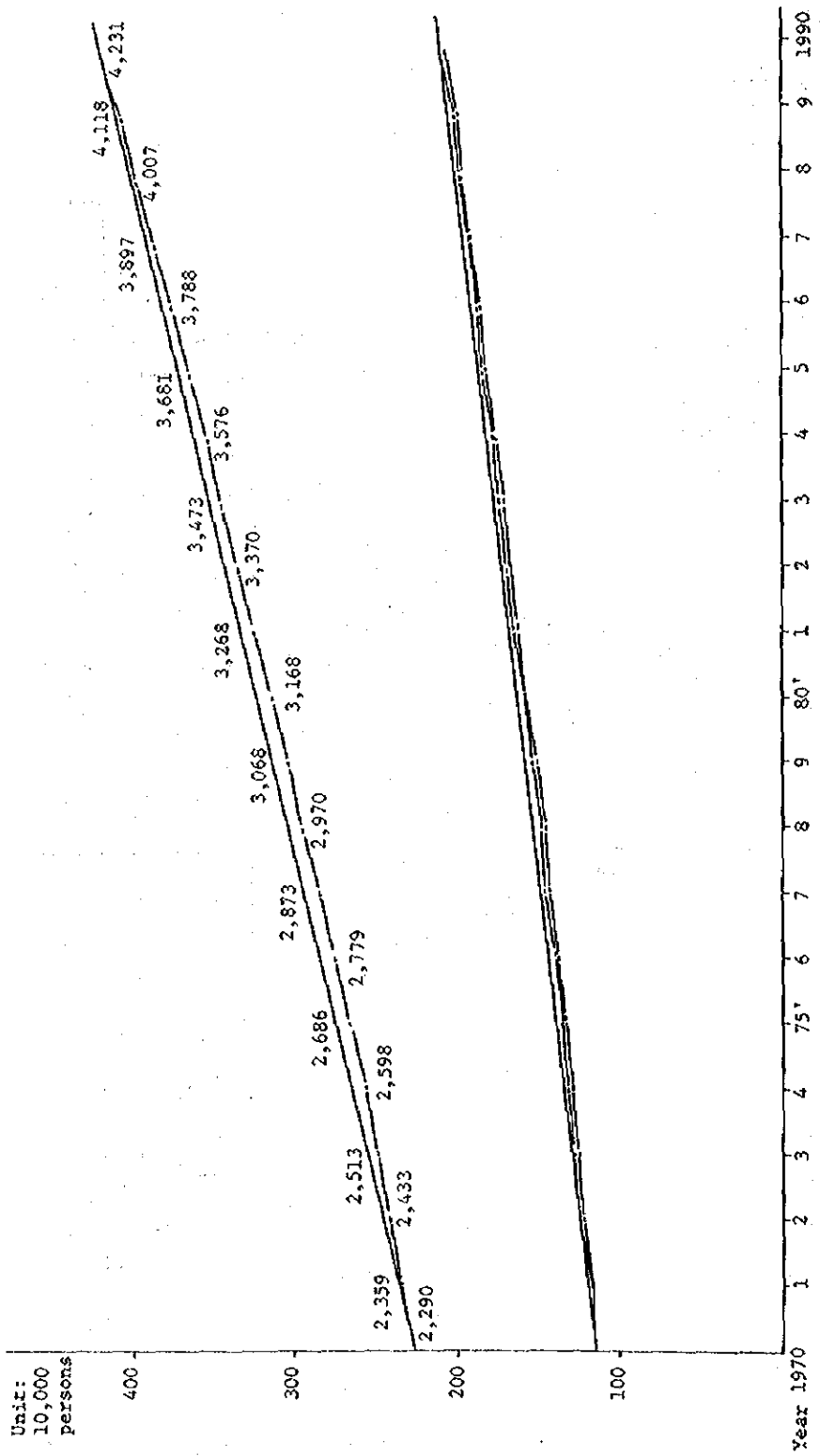


Fig. 2-3 Population Transition Estimated Curve

Table 2-1. Area and Population Distribution by Department (1980)

Department	Area (km ²)	Population (1,000 persons)	Percentage of population (%)	Population density (Persons/km ²)	Urban region (1,000 persons)	Rural region (1,000 persons)	Remarks (Local region %)
Total Paraguay	406,752	3,167.9	100.0	7.79	1,232.7	1,935.2	61.1
Asunción	117	513.3	16.2	4,327.18	513.3	-	0
Concepción	12,051	128.4	4.1	7.11	38.5	89.9	70.0
San Pedro	20,002	189.5	6.0	9.47	29.4	160.1	84.5
Cordillera	4,943	203.0	6.4	41.07	39.0	164.0	80.8
Guaira	3,022	135.3	4.3	44.77	42.5	92.8	68.6
Caaguazu	12,298	316.5	10.0	25.74	57.0	259.5	82.0
Caazapa	9,496	112.7	3.6	11.87	16.3	96.4	85.5
<u>Itapúa</u>	<u>16,525</u>	<u>301.1</u>	<u>9.5</u>	<u>18.22</u>	<u>73.1</u>	<u>228.0</u>	<u>75.7</u>
<u>Misiones</u>	<u>9,556</u>	<u>96.4</u>	<u>3.0</u>	<u>10.09</u>	<u>31.3</u>	<u>65.1</u>	<u>67.5</u>
Paraguari	8,705	222.3	7.0	22.54	34.5	187.8	84.5
Alto Parana	14,895	218.0	6.9	14.64	63.0	155.0	71.1
Central	2,465	400.6	12.6	162.52	192.3	208.3	52.0
Neembucu	12,147	84.0	2.7	6.92	26.9	57.1	68.0
Amambay	12,933	103.7	3.3	8.02	42.5	61.2	59.0
Canendiyu	14,667	62.7	2.0	4.27	9.4	53.3	85.0
Oriental	159,827	3,027.5	97.5	19.32	1,209.0	1,878.5	62.0
Occidental	426,925	80.4	2.5	0.33	23.7	56.7	70.5

Source: Statistical Bulletin of Paraguay 1980, Ministry of Agriculture and Livestock

total area of the country. The two departments have a population of 397,500 which is equivalent to 12.5% of the national population. The population density is 15.24 persons/km² slightly less than the average of the Eastern Region area. As for the residential situation of the urban and rural areas in both departments, nearly 70% of population inhabits the rural area which is typical of the eastern region, and the inhabitant pattern is of the concentrated type. According to the statistics of the Ministry of Finance: immigrants from foreign countries amounted to 10,453 persons during the two years of 1979 and 1980. 5,855 persons of these were Brazilians, who comprised 56 percent of the total immigrants.

The composition of immigrants by nationality is shown in the following table.

Table 2-2

nation/year	1979	1980
1. Brazil	3,032 persons (56.6%)	2,823 (55.4%)
2. China	827 (15.4)	1,047 (20.5)
3. Argentina	496 (9.3)	408 (8.0)
4. Mexico	365 (6.8)	195 (3.8)
5. Germany	95 (1.8)	99 (1.9)
(for comparison)		
8. Japan	45 (0.8)	35 (0.7)*
Total	5,356 (100)	5,097 (100)

* As for the year 1980, Japan is 11th.

2.2 Industrial Population

The population composition in Paraguay according to industry is shown in Table 2-3.

Table 2-3 Population classified by industry
(persons, %)

/year industries	1977		1978		1979		1980	
	persons	%	persons	%	persons	%	persons	%
agriculture & livestock	482,900	46.7	508,161	46.0	534,836	45.3	571,457	45.2
mining	3,310	0.3	4,012	0.4	6,477	0.5	9,435	0.7
manufacturing	148,849	14.4	159,545	14.4	169,651	14.4	191,901	15.2
construction	48,813	4.7	55,269	5.0	56,498	4.8	57,984	4.6
electric industry	3,335	0.3	3,400	0.3	3,470	0.3	3,944	0.3
commerce	94,325	9.1	99,277	9.0	107,855	9.1	114,538	9.1
transport	30,939	3.0	31,068	2.8	31,214	2.6	31,305	2.5
service	179,145	17.3	200,575	18.1	222,018	18.8	232,993	18.4
others	41,829	4.2	44,022	4.0	47,840	4.1	50,758	4.0
employment	1,033,445	100 (96.25)	1,105,329	100	1,179,859	100	1,264,315	100
unemployment	40,290	(3.75)	35,361	(3.10)	31,029	(2.56)	26,633	(2.06)
economically active population	1,073,735	(100)	1,140,690	(100)	1,210,888	(100)	1,290,948	(100)
economically active population as % of total population	37.4		38.4		39.5		40.7	
economically inactive population as % of total population	62.6		61.6		60.5		59.3	
total population	2,873,346		2,970,153		3,068,481		3,167,985	

As seen in Table 2-3, agriculture and livestock is the largest industry or Paraguay in terms of employment. Although the ratio of population engaged in agriculture and livestock to the total employment has been declining yearly, the number of people engaged in agriculture and livestock increased by 6.05% in 1980 to the previous year. Compared with the increase rate of the number of total employment, 3.24% marked in 1980 to the previous year, the former is almost twice of the latter.

In terms of employment, the service sector is the second, in which 18% level of the population is employed. The other industry in which more than 10% is engaged is the manufacturing industry only. The industrial structure of Paraguay is thus based on agriculture and livestock.

2.3 Gross Domestic Product and National Income

2.3.1 Gross domestic product

The gross domestic product (GDP) of Paraguay for 1981 was 708.689 billion Gs according to the 1974/1981 National Financial Report of the Central Bank of Paraguay, whereas the real GDP for the same year, which was deflated by the consumer price index taking the bench mark as 1977, was 390.837 billion Gs.

The real GDP showed a 48.3% increase during the four years from 1977 to 1981. Although the real economic growth rate differs according to the year (the highest growth rate since 1970 was 12.8% in 1977, while the lowest was 4.8% of 1970, the average growth rate from 1970 to 1981 is 7.85%) showing a steady increase. The growth rate of 1981 to the previous year was 8.5%, and has surpassed the average rate since 1970.

Table 2-4 Gross domestic product in Paraguay

year	GDP (at current price) (mil. Gs.)	Real GDP deflated by CPI which is based on in 1977 (mil. Gs.)	Real growth rate (%)
1970	74,921	157,761	4.8
1971	83,736	166,341	5.4
1972	96,899	177,056	6.4
1973	125,437	189,794	7.2
1974	168,018	205,430	8.2
1975	190,439	218,413	6.3
1976	214,069	233,741	7.0
1977	263,612	263,612	12.8
1978	322,542	292,235	10.9
1979	430,514	323,504	10.7
1980	560,459	360,383	11.4
1981	708,689	390,837	8.5

2.3.2 National income

The national income of Paraguay for 1981 was 585.18 billion guaranis. Deflated by the consumer price index which is based on 1977, the real national income was 324.446 billion Gs.

Shown by an index on a basis of 224.151 billion Gs in 1977, it was 144.7 billion Gs. That is to say, the real national income increased by about 45% during the four years from 1977. The real economic growth rate of 1981 was 9.8% over that of the previous year.

The per capita national income for 1981 was 179,000 Gs. Deflated by the consumer price index which is based on 1977, it was 99,000 Gs. Compared with the 78,000 Gs for 1977, the per capita national income showed an increase of about 27% during these four years.

Table 2-5. National income of Paraguay.

year	National income (at current prices) (million GS)	Deflated by CPI which is based on in 1977 (million GS)	Real growth rate (%)
1977	224,151	224,151	10.0
1978	266,464	240,805	7.4
1979	351,433	269,574	10.3
1980	459,576	295,514	11.3
1981	585,180	324,446	9.8

Table 2-6 Domestic Gross Product & National Income

Unit: 1,000,000 GS

Year	Domestic Gross Product			National Income		
	Value (at GS current value)	Value (1977 conversion value)	Annual increase rate of domestic gross product (1977 conversion)	Value (at GS current value)	Value (1977 conversion value)	Annual increase rate of national income (1977 conversion value)
1962	45,448	112,208		39,846	100,169.0	
63	48,372	116,553	3.9	42,269	103,878.2	3.7
64	51,452	121,083	3.9	45,026	107,789.2	3.8
65	55,892	127,577	5.4	48,703	112,755.0	4.6
66	58,702	129,060	1.2	50,504	112,361.2	-0.3
67	62,077	140,051	8.5	52,232	119,979.0	6.8
68	65,224	144,461	3.1	54,579	122,665.4	2.2
69	70,093	150,416	4.1	58,872	127,451.0	3.9
70	74,921	157,761	4.8	63,658	134,337.0	5.4
71	83,736	166,341	5.4	72,031	142,480.0	6.1
72	96,899	177,056	6.4	83,851	152,241.0	6.9
73	125,437	189,794	7.2	110,419	164,220.0	7.9
74	168,018	205,430	8.2	151,530	182,737.0	11.3
75	190,439	218,413	6.3	171,224	197,157.0	7.9
76	214,069	233,741	7.0	187,748	203,684.0	3.3
77	263,612	265,612	12.8	224,151	224,151.0	10.0
78	322,542	292,235	10.9	266,464	240,805.0	7.4
79	430,514	323,504	10.7	351,433	265,574.0	10.3
80	560,459	360,383	11.4	459,576	295,314.0	11.3
81	708,689	390,837	8.5	585,180	324,446.0	9.8

Table 2-7 Gross Domestic Product

Unit: 1,000,000 GS

Item	1977	1978	1979	1980	1981
Net domestic product	228,721	274,077	353,759	467,293	582,428
Fixed capital expenditure	24,621	32,253	49,190	58,630	77,688
Indirect tax	10,342	16,297	27,586	34,578	48,625
(Minus) subsidy	Δ 72	Δ 85	Δ 21	Δ 42	Δ 52
Gross domestic product	263,612	322,542	430,514	560,459	708,689

Table 2-8 Variation of Gross Domestic Product Measured with 1977
as a Reference Year (Percent Increase from the Previous Year)

Items	1977	1978	1979	1980	1981
Net domestic product	10.3	8.4	7.2	12.5	7.3
Fixed capital expenditure	62.4	23.0	27.7	1.3	20.6
Indirect tax	-8.6	37.0	35.2	17.2	2.0
(Minus) Subsidy	-34.5	-5.3	-58.3	-1.8	
Gross domestic product	12.8	10.9	10.7	11.4	8.5
Private consumption expenditure	12.8	7.3	7.3	10.2	5.6
Government consumption expenditure	11.5	19.0	6.2	8.0	22.0
Fixed capital formation	29.6	19.5	21.7	15.9	12.1
Increase in stored goods	-49.7	100.3	-4.2	-9.1	1.8
Exported property and service	20.1	12.0	16.4	7.3	-4.0
Minus: Imported property and service	31.5	14.8	14.0	9.3	-1.0
Appropriation to gross domestic product	12.8	10.9	10.7	11.4	8.5

Table 2-9 Gross Domestic Product Based on 1977 and the Composition
Unit: 1,000,000 ₪ (₺)

Items	1977	1978	1979	1980	1981
Net domestic product	228,721 (86.7)	247,758 (84.8)	265,630 (82.1)	298,701 (82.9)	320,630 (82.0)
Fixed capital expenditure	24,621 (9.4)	30,342 (10.4)	38,732 (12.0)	39,256 (10.9)	47,325 (12.1)
Indirect tax	10,342 (3.9)	14,171 (4.8)	19,157 (5.9)	22,453 (6.2)	22,909 (5.9)
Minus: Subsidy	Δ 72 (-)	Δ 36 (-)	Δ 15 (-)	Δ 27 (-)	Δ 27 (-)
Gross domestic product	263,612 (100)	292,235 (100)	323,504 (100)	360,383 (100)	390,837 (100)
Private consumption expenditure	197,055 (74.9)	211,850 (72.5)	227,322 (70.2)	250,564 (69.5)	264,631 (67.7)
Government consumption expenditure	16,353 (6.2)	19,454 (6.6)	20,656 (6.4)	22,308 (6.2)	27,219 (6.9)
Fixed capital formation	62,922 (23.8)	74,819 (25.6)	91,075 (28.1)	105,561 (29.3)	118,311 (30.3)
Increase in stored goods	2,150 (0.8)	4,306 (1.5)	4,125 (1.3)	4,500 (1.2)	4,582 (1.2)
Exported property and service	39,600 (15.0)	44,347 (15.2)	51,626 (16.0)	55,110 (15.4)	59,271 (13.6)
Minus: Imported property and service	Δ 54,468 (20.7)	Δ 62,541 (21.4)	Δ 71,300 (22.0)	Δ 77,960 (21.6)	Δ 77,177 (19.7)
Appropriation to gross domestic product	263,612 (100)	292,235 (100)	323,504 (100)	360,383 (100)	390,837 (100)

Table 2-10 National Income

Unit: 1,000,000 GS

Items	1977	1978	1979	1980	1981
Wage income	91,600	106,100	150,900	195,300	242,850
Private enterprise income	123,188	145,341	176,205	238,696	310,635
Social capital undistributed profit	4,030	5,230	7,380	9,260	12,300
Direct tax	2,441	4,937	6,493	8,837	11,187
Industry and realty income	2,946	4,909	10,530	7,609	8,315
Minus: Public bond interest	Δ 54	Δ 53	Δ 75	Δ 126	Δ 107
Total	224,151	266,464	351,433	459,576	585,180

Table 2-11 Per capita national income

year	(Unit: Gs)				
	1977	1978	1979	1980	1981
Per capita national income	78.010	89.714	114.530	145.069	179.037
Deflated by CPI which is based on in 1977	78.010	81.075	86.549	93.281	99.265
Real growth rate (%)	9.94	3.93	6.75	7.78	6.41

2.3.3 Gross domestic product by industry

The agriculture and forestry are most important industry, and their production occupied the largest portion of the total gross domestic product of Paraguay. Agricultural and forestry production has steadily increased yearly. The gross production was about 90 billion Gs in 1977, having increased to about 165.1 billion Gs in 1980 and about 196.8 billion Gs in 1981.

Deflated by the consumer price index which is based on 1977, the real product was about 111 billion Gs in 1980 and about 118.4 billion Gs in 1981. The real growth rate in 1981 was 6.7%. Deflated by the consumer price index taking the bench mark as 1977, it was 7.1%.

Nevertheless, the position of the agricultural and forestry in the national product has lowered comparatively due to remarkable progress made by other industries. Agricultural and forestry production accounted for about 30% of the gross domestic product in 1981.

On the other hand, the gross production by mining and manufacturing increased to 168.1 billion Gs in 1981, making up about 24.7% of the gross domestic product of the same year.

Public works (electric and water supply, and sanitary, transport and communication systems) have made remarkable progress with the strong support of the Government. Gross domestic product in 1981 was 44.3 billion Gs, amounting to 5.8% of the gross national product. The real growth index for 1981, which is based on 1977, was 151.3. Further great progress is expected in this category construction of the Itaipu and Yacyreta Dams and other related development projects. In other words, such projects will be a tractive force in the growth of manufacturing and mining as well as for agriculture and livestock.

The total production of the service sector centering on commerce recorded 299.4 billion Gs in 1981, amounting to 40.1% of the gross domestic product. Its real growth index was 153.0, being the second position in all industries following that of mining and manufacturing.

Commerce is, in particular, significant for Paraguay's gross domestic product. Having shown more than a 10% increase over the previous year for these several years, the gross production in this field has continued to make up more than one-fourth of the gross domestic product since 1977. A higher growth in this field is anticipated with changes in the population as well as in social circumstances, because of poor natural resources.

Gross Domestic Product at Sub-Sector Level

1. Agriculture

Major agricultural commodities in Paraguay include soybeans cotton, cassava, corn, etc. The Gross Domestic Product contribution for 1981 was 24.7 billion Gs in soybeans 16.8 billion Gs in cotton, 24.5 billion Gs in cassava and 16.8 billion Gs in corn, totalling to 133,954,840,000 Gs.

The share of soybean and cotton which are two major export commodities in the agricultural production is 31.7%. Including cassava and corn which are mainly used for domestic consumption, the share of these four commodities was as high as 57.6%.

2. Livestock

Meat cattle are mainly reared and followed by pigs horses sheep, goats chickens etc. In terms of gross domestic product contribution 1981, these come to approximately 121.4 billion Gs, which is a total of the major products amounting to 66.0 billion Gs and by products 55.4 billion Gs. Livestock production for 1981 is shown in Table 2-12.

3. Forestry

Forestry products are composed of logs processed wood, firewood/ charcoal and palm (edible and plant cultivation) which contribute 20.3 billion Gs to gross domestic product 1981. The legislation enacted in 1973 prohibits wooden logs from being exported unless further processing is made, and this has given a favourable impact on the development of sawing and processing (tannin, resin and perfumed oil, etc.) industries.

4. Mining

Paraguay is not endowed with mineral resources. Except for limestone, quarries to supply road and other construction materials are the largest.

5. Manufacturing

Except for cottage manufacturing, manufacturing activities are yet to be developed. The major manufacturing production in 1981 includes, in order of production volume; food-processing amounting to approximately 40.0 billion Gs, petrochemical products 20.0 billion Gs, wooden-related products 17.0 billion Gs, ferrous and non-ferrous metal products 3.6 billion Gs. Their total contribution comes to 107,594,200,000 Gs.

6. Transport and Communication

The gross domestic product of the transport industry for 1981 was approximately 24.0 billion Gs, in which vehicle transport amounted to 19.3 billion Gs as a core activity. More than half of the vehicle transport is dominated by buses as mass transport. Vehicle transport is followed by air transport (approximately 2.3 billion Gs), river transport (approximately 1.2 billion Gs) and rail transport (approximately 1.1 billion Gs). Gross domestic product contribution in communication is nominal 5.7 billion Gs.

7. Commerce

The gross domestic product contribution for the commerce for 1981 was approximately 188.4 billion Gs which is higher than the secondary industry. Domestic distribution of manufacturing and agricultural goods plays a major role, which is followed by international trade.

8. Public Finance and Other Services

The 1981 gross domestic product resulting from government expenditure is 26.7 billion Gs. Approximately 12.7 billion Gs is contributed by the central government accounting for 47.6%, whereas the share of local governments is 14.2% and municipal office such as Asuncion City is 5.9%.

Gross domestic product contribution by other services for 1981 was approximately 64.3 billion Gs. Education contributes 14.6 billion Gs (22.8%), health and hygiene 6.4 billion Gs (10%), domestic services 8.4 billion Gs (13.1%) and others 34.8 billion Gs (54.2%).

2.4 National Economy

The scale of the national economy in both supply and demand reached 822.7 billion Gs in 1981. Needless to say, the biggest demand is dominated by the expenditure in personal consumption which comes to 63.5% of all. Fixed capital formation follows next which accounts for 23.6%. This shows the capital investment has become very active. Though the expenditure in government consumption is as low as 6%, it is on the gradual increase suggesting the improvement of government services.

The scale of government budget is given in Table 2-14. It was 76.8 billion Gs for 1981, which was 9.3% in terms of the scale of national economy and 108% in terms of the gross domestic product.

Indirect tax is the major revenue amounting to 48.6 billion Gs, and its share in total revenue was 54.6%. It is then followed by direct tax except for family business, general direct tax and income derived from public enterprises and real estate.

The highest expenditure is made in wages and public services and amounts to 48.6 billion Gs, and its ratio to the total expenditure is 63.6%. Next comes savings, transfer to personal business, etc. Mention must be

Table 2-12 Change in Gross National Product by Industry

Item	1975				1977				1980				1981			
	Current (1,000,000 Gs)	Conversion (1,000,000 Gs)	Increase from previous year (%)	Proportion (%)	Current (1,000,000 Gs)	Conversion (1,000,000 Gs)	Increase from previous year (%)	Proportion (%)	Current (1,000,000 Gs)	Conversion (1,000,000 Gs)	Increase from previous year (%)	Proportion (%)	Current (1,000,000 Gs)	Conversion (1,000,000 Gs)	Increase from previous year (%)	Proportion (%)
Agriculture	37,727	49,008	3.4	22.4	59,308	Same as left	15.6	22.5	101,238	74,185	10.6	20.6	120,086	80,268	8.2	20.5
Stock farming	23,841	20,809	20.8	9.5	21,777	-	1.3	8.2	46,652	24,444	4.0	6.8	55,405	25,226	3.2	6.5
Forestry	8,546	8,031	9.3	3.7	8,590	-	9.1	3.3	16,402	11,870	12.3	3.3	20,300	12,439	4.8	3.2
Fisheries	170	185	28.2	0.1	250	-	14.3	0.1	845	486	7.4	0.1	993	506	4.0	0.1
Sub-total	70,284	78,033	8.2	35.7	89,925	-	11.1	34.1	165,136	110,986	9.2	30.8	196,784	118,440	6.7	30.3
Mining	365	390	20.2	0.2	685	-	23.6	0.2	2,285	1,422	26.0	0.4	2,933	1,635	15.0	0.4
Manufacturing	29,759	35,495	1.8	16.3	44,974	-	20.1	17.1	92,338	59,877	12.6	16.6	118,469	64,662	8.0	16.6
Construction	7,163	6,822	21.2	3.1	10,560	-	31.1	4.0	34,317	22,832	26.0	6.3	46,740	26,650	16.7	6.8
Sub-total	37,287	42,707	1.4	19.6	56,220	-	22.0	21.3	128,939	84,131	16.2	23.3	168,142	92,947	10.5	23.8
Total of production and manufacturing section	107,571	120,740	5.7	55.3	146,144	-	15.1	55.4	294,076	195,117	12.1	54.1	364,926	211,387	8.3	54.1
Electricity	2,305	2,807	22.0	1.3	3,953	-	11.7	1.5	11,238	6,634	20.4	1.8	13,148	6,899	4.0	1.8
Water and health	434	528	14.8	0.2	654	-	12.6	0.3	1,685	995	10.0	0.3	2,123	1,119	12.5	0.3
Transport and com- munication	7,600	8,806	13.8	4.0	10,264	-	8.3	3.9	23,784	14,031	10.5	3.9	29,059	14,480	3.2	3.7
Sub-total	10,339	12,142	15.6	5.5	14,871	-	9.4	5.7	36,707	21,660	13.3	6.0	44,331	22,499	3.9	5.8
Trade (including properties)	43,594	53,547	4.4	24.5	66,026	-	12.0	25.0	144,870	93,827	10.5	26.1	188,378	101,694	8.4	26.0
Government enterprises	6,494	9,090	16.6	4.2	10,283	-	6.0	3.9	19,115	13,053	7.0	3.6	26,678	16,033	22.8	4.1
Housing	5,018	5,189	7.2	2.4	6,077	-	8.3	2.3	14,993	8,159	9.0	2.3	20,091	8,722	6.9	2.2
Other services	17,424	17,705	5.8	8.1	20,211	-	7.0	7.7	50,698	28,566	10.9	7.9	64,286	30,501	6.8	7.8
Sub-total	72,529	85,532	6.0	39.2	102,597	-	10.1	38.9	229,676	143,606	10.2	39.9	299,432	156,950	9.3	40.1
Total of service section	82,868	97,673	7.1	44.7	117,468	-	10.0	44.6	266,383	165,266	10.6	45.9	343,763	179,449	8.6	45.9
Total	190,439	218,413	6.3	100.0	263,612	-	12.8	100.0	560,459	360,383	11.4	100.0	708,689	390,837	8.5	100.0
(Total population)	(2,686,457)				(2,873,346)				(3,167,985)				(3,268,489)			
Gross national product per capital	70,900 Gs	81,300			91,700 Gs				176,900 Gs	113,700			216,800 Gs	119,600		

Remark: Conversion values are based on 1977.

Table 2-13 Total Supply and Demand

Units: 1,000,000 ₪

Items	1977	1978	1979	1980	1981
Gross domestic product	263,612 (82.9)	322,542 (82.9)	430,514 (82.6)	560,459 (84.0)	708,689 (86.1)
Imported property and services	54,468 (17.1)	66,481 (17.1)	90,552 (17.3)	106,884 (16.0)	114,068 (13.9)
Total supply	318,080 (100)	389,023 (100)	521,066 (100)	667,343 (100)	822,757 (100)
Private consumption expenditure	197,055 (62.0)	236,523 (60.8)	326,714 (62.7)	417,826 (62.6)	522,598 (63.5)
Governmental consumption expenditure	16,353 (5.1)	21,500 (5.5)	24,710 (4.7)	34,732 (5.2)	48,625 (5.9)
Fixed capital formation	62,922 (19.8)	81,256 (20.9)	116,142 (22.3)	152,654 (22.9)	194,129 (23.6)
Increase in stored goods	2,150 (0.7)	6,461 (1.7)	6,830 (1.3)	8,550 (1.3)	10,064 (1.2)
Subtotal of domestic demand	278,480 (87.6)	345,740 (88.9)	474,396 (91.0)	613,762 (92.0)	775,506 (94.2)
Exported property and service	39,600 (12.4)	43,283 (11.1)	46,670 (9.0)	53,581 (8.0)	47,251 (5.8)
Total demand	318,080 (100)	389,023 (100)	521,066 (100)	667,343 (100)	822,757 (100)

Remark: Conversion value are based on 1977.

Source: National Census 1974/81, No. 18

Table 2-14 Government Budget

Unit: 1,000,000 GS

Items	Income					Expenditure					
	1977	1978	1979	1980	1981	Items	1977	1978	1979	1980	1981
Industry and realty income	2,946	4,909	10,530	7,609	9,315	Consumption expenditure	16,353	21,500	24,710	34,732	48,625
Indirect tax	10,342	16,297	27,586	34,578	41,946	Wage	10,283	12,266	14,595	19,115	26,678
Direct tax	2,441	4,937	6,493	8,937	11,187	Property and service purchase	6,070	9,234	10,115	15,617	21,947
Direct taxes on corporations	4,691	6,484	8,268	9,840	13,430	Subsidy	72	85	21	42	52
Social security corporation tax	2,927	4,848	6,235	7,016	10,072	Transfer to private enterprises	2,414	3,798	5,043	7,047	9,955
Retirement and pension fund	1,656	1,511	1,846	2,564	3,049	Public liability interest	54	53	75	126	107
Educational corporation	101	118	180	251	299	Savings	3,850	8,215	24,219	20,369	18,091
Domestic service corporation	7	7	7	9	10						
Transfer from private enterprises	2,323	1,024	1,191	1,452	1,952						
Total	22,743	33,651	54,068	62,316	76,830	Total	22,743	33,651	54,068	62,316	76,830

Table 2-15 Savings and Investment

Unit: 1,000,000 GS

Items	1977	1978	1979	1980	1981
Gross domestic fixed investment	62,922	81,256	116,142	152,654	194,219
Change in stored goods (Stock farming only)	2,150 (3.3)	6,461 (7.4)	6,830 (5.6)	8,550 (5.3)	10,064 (4.9)
Gross domestic investment	65,072	87,717	122,972	161,204	204,283
Social capital undistributed profit	4,030 (6.2)	5,230 (6.0)	7,380 (6.0)	9,260 (5.7)	12,300 (6.0)
Private savings	13,133 (20.2)	11,208 (12.8)	Δ 4,025 (Δ3.3)	11,925 (7.4)	25,460 (12.5)
Government savings	3,850 (5.9)	8,215 (9.4)	24,219 (19.7)	20,369 (12.6)	18,091 (8.9)
Overseas savings	19,438 (29.9)	30,811 (35.1)	46,208 (37.6)	61,020 (37.9)	70,744 (34.6)
Appropriation to fixed capital	24,621 (37.8)	32,253 (36.8)	49,190 (40.0)	58,630 (36.4)	77,688 (38.0)
Total	65,072 (100)	87,717 (100)	122,972 (100)	161,204 (100)	204,283 (100)

Table 2-16 Economic Index of Paraguay

(General laborers %)

Items	1977		1978		1979		1980		1981	
	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion	Current Conversion
Financial and service import increase rhythmic	42.0	31.5	22.1	14.8	36.2	14.0	18.0	9.3	6.7	-1.0
Financial and service export increase rhythmic	48.9	20.1	9.3	12.0	7.8	16.4	14.8	7.3	-11.8	-3.9
Domestic gross investment increase rhythmic movement	23.4	23.8	34.8	21.6	40.2	20.3	31.1	15.6	26.7	11.7
Gross investment percentage against G.D.P.	24.7	24.7	27.2	27.1	28.6	29.4	28.8	30.5	28.8	31.4
Financial and service import percentage against G.D.P.	20.7	20.7	20.6	21.4	21.0	22.0	19.1	21.6	16.1	19.7
Financial and service export percentage against G.D.P.	15.0	15.0	13.4	15.2	10.8	16.0	9.6	15.4	6.7	13.6
Fluctuation of consumer's prices	9.4		10.6		28.2		22.4		13.0	
Fluctuation of wholesale prices	8.0		12.8		26.3		7.8		12.2	
Fluctuation of labor salaries and wages	4.3		14.5		20.0		23.3		20.0	
Financial and service trade value		100		91.8		71.2		70.5		60.0
Export purchasing power increase rhythmic movement		40.8		-5.1		-9.2		-5.9		-11.6

Remark: The conversion value are based on 1977.

Source: National Census 1974/1981, No.16

made of the provision of subsidies in the government budget, though still nominal.

2.5 Export and Import

Chronic deficit is observed in the international trade and its balance is increasing.

Major export commodities in 1981 are cottons (US\$127.32 million), seeds (US\$52.52 million), vegetable oils (US\$22.42 million), timber boards (US\$20.52 million), fat cakes

Table 2-17 Shift in export and import (US\$1,000)

Year	Export	Import	Trade Balance	Ratio to Export(%)
1977	278,891	360,075	Δ 81,184	29.1%
1978	281,454	431,993	Δ150,539	53.5
1979	305,176	577,135	Δ271,959	89.1
1980	310,230	675,322	Δ365,092	117.7
1981	295,541	725,000	Δ429,459	145.3

(US\$13.74 million). In terms of export share, cottons accounts for 43.1%, seeds 17.8%, vegetable oils 7.6%, wooden boards 6.9%, fat cakes 4.6%, and these five major commodities account for 80% in total export.

Major import commodities are first of all mining products which amount to US\$104.96 million. They are followed by machinery and equipments, electric products, transport equipment etc. Further, foodstuffs and drinking water are also dependent upon imports to a considerable extent, and account for 7.1% in total imports.

2.6 Agriculture Financing

The financial mechanism is divided into public and private financial institutions. Major public

Table 2-18 Export Conditions of Main Agricultural Products

Item	1977			1978			1979			1980			1981			October, 1982			
	Export amount	Paraguay port amount	Volume	Export amount	Paraguay port amount	Volume	Export amount	Paraguay port amount	Volume	Export amount	Paraguay port amount	Volume	Export amount	Paraguay port amount	Volume	Export amount	Paraguay port amount	Volume	
	1,000,000 GS	1,000 U.S. dollars	1,000 tons	1,000,000 GS	1,000 U.S. dollars	1,000 tons	1,000,000 GS	1,000 U.S. dollars	1,000 tons	1,000,000 GS	1,000 U.S. dollars	1,000 tons	1,000,000 GS	1,000 U.S. dollars	1,000 tons	1,000,000 GS	1,000 U.S. dollars	1,000 tons	
Wood	2,489	19,912	113.3	2,541	20,342	122.4	5,206	42,220	225.1	8,357	66,329	262.2	4,584	36,380	115.4	5,563	39,453	95.4	
Animal products	Processed meat	2,729	22,080	15,276	2,962	23,967	16,699	683	5,522	4,702	132	1,054	988	0.4	3	3,794	221	1,402	743
	Cowhide	681	5,504	6,895	972	7,843	10,369	757	6,128	6,699	393	3,117	2,167	826	6,554	656	786	5,645	2,699
	By-products	56	448	4,632	48	387	3,252	37	302	2,704	32	252	1,474	30	234	8,994	16	120	297
Tobacco	1,688	13,658	22,348	1,143	9,246	14,762	1,057	8,547	12,483	1,278	10,142	14,258	814	6,458	8,994	775	5,747	8,322	
Soybean (seed)	6,948	56,209	241.2	4,741	38,350	192.2	9,717	78,617	334.1	5,304	42,098	235.3	5,989	47,533	221.8	12,770	89,518	467.1	
Maize	-	-	-	-	-	-	-	-	-	314	2,493	25,400	30	238	1,800	83	580	7,200	
Paraguay tea (YERBA MATE)	102	823	1,994	99	793	1,785	142	1,132	1,844	243	1,930	2,663	44	369	712	19	134	209	
Fruits and vegetables	228	1,814	5,040	328	2,606	6,330	445	3,467	7,239	1,056	8,380	18,604	556	4,409	10,609	1,364	8,527	13,522	
Coffee	1,266	10,092	1,869	27	213	60	528	4,193	1,111	290	2,303	634	159	1,260	443	43	307	120	
Cotton	9,971	80,487	58,813	12,375	100,024	83,595	12,083	98,596	76,694	13,335	105,833	75,381	16,290	129,287	90,589	17,484	121,137	109,765	
Sugar	-	-	-	-	-	-	-	-	-	392	3,112	5,800	9	71	170	558	3,900	15,000	
Alcohol and Kanya liquor (Caña Paraguaya)	12	96	98	14	115	123	-	-	-	7	55	198	4	31	31	-	-	-	
Vegetable oil	Palm oil	689	5,521	9,477	595	4,770	7,425	793	6,367	7,587	543	4,311	4,589	596	4,727	6,590	754	5,295	8,208
	Tung oil	2,721	21,896	15,842	1,136	9,192	5,779	1,393	11,238	7,587	1,194	9,475	10,891	1,462	11,603	11,397	1,093	7,906	8,883
	Others	232	1,880	2,961	353	2,854	5,920	186	1,506	3,015	420	3,331	6,753	768	6,091	12,170	318	2,123	5,181
Perfumed oil	1,521	12,291	1,400	1,052	8,497	1,009	1,204	9,732	1,208	1,145	9,093	1,127	834	6,615	739	465	3,271	373	
Oil cake	1,038	8,392	67,610	1,069	8,330	78,730	1,493	12,079	87,597	2,770	21,984	155,770	1,798	14,269	107,706	1,648	11,561	109,051	
Tannin	653	5,284	14,997	638	5,160	14,960	393	3,178	9,782	553	4,388	13,520	702	5,569	14,157	550	3,939	7,612	
Fur	114	923	69	194	1,573	95	105	846	43	99	786	74	51	406	47	49	371	17	
Others																			
Total	34,564	278,891		31,868	256,984		37,716	305,176		39,089	310,230		37,238	295,541		45,152	315,180		

Remark: National Bulletin No. 293

Table 2-19 Import of Main Agricultural Products

Units: US\$1,000, FOB price

Item	1977 years		1978 years			1979 years			1980 years			1981 years		
	FOB price	Index	FOB price	1977 conversion	Index	FOB price	1977 conversion	Index	FOB price	1977 conversion	Index	FOB price	1977 conversion	Index
Animals (Living body and processed products)	561	100	821	991	83	884	926	95	1,022	620	165	1,653	1,174	141
Vegetable processed products	8,343	100	8,818	9,904	89	11,753	11,465	103	15,637	12,986	120	5,230	4,053	129
Animal fats and vegetable oils	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Food and drinking water	21,931	100	31,434	28,670	110	46,206	36,924	125	44,281	31,925	139	44,320	33,174	134
Mining products	44,618	100	64,006	58,374	110	91,926	52,419	175	132,116	51,925	258	104,955	45,405	231
Chemical products	13,826	100	17,276	12,679	136	25,159	16,761	150	31,031	19,313	161	29,984	16,727	179
Plastic products	5,667	100	7,621	7,513	101	8,614	7,837	110	11,062	8,195	135	11,892	8,206	145
Furs and processed products	39	100	45	41	110	14	17	82	35	28	125	17	10	170
Wood and processed products	74	100	55	90	61	64	80	80	4	3	133	2	-	-
Paper materials	6,792	100	6,516	6,294	103	8,068	6,875	117	11,443	7,699	149	8,686	6,215	140
Fiber and processed products	5,540	100	5,856	6,006	97	8,261	7,191	115	8,459	6,811	124	7,513	6,300	120
Shoes, headgears, umbrellas and others	285	100	714	665	107	744	573	130	993	759	131	749	564	133
Cement, stone, asbestos processed products	3,419	100	5,507	4,734	116	3,378	2,871	118	3,088	1,869	165	4,889	3,145	156
Metal processed products	19,323	100	20,641	20,922	99	34,095	30,540	112	23,799	19,648	121	25,392	20,869	122
Machinery and electrical equipment	52,425	100	50,809	53,408	95	60,977	58,068	105	70,106	67,766	103	89,838	77,803	116
Conveyance equipment	50,471	100	58,469	51,414	113	67,784	56,780	119	70,992	52,574	135	69,997	49,330	142
Optical instruments	2,787	100	2,620	2,179	120	4,291	3,678	117	5,986	32,032	190	4,327	4,003	108
Weapons and ammunitions	91	100	276	267	103	234	216	108	135	104	130	162	119	136
Other machinery and equipment	1,798	100	2,135	2,248	95	2,428	1,904	128	2,501	2,032	123	2,778	1,950	143
Collection of artistic handicraft	148	100	82	73	112	32	10	320	-	-	-	-	-	-
Sub-total	238,138	100	283,701	266,472	106	374,912	295,135	127	432,690	315,569	137	412,384	279,047	148
Others	121,937	100	148,292	139,898	106	202,223	159,302	127	217,310	158,505	137	312,616	211,481	148
Total	360,075	100	431,993	406,370	106.3	577,135	454,437	127	650,000	474,074	137.1	725,000	490,528	148

Table 2-20 Export and Import by Country

Item	Argentina	Spain	England	USA	France	Uruguay	Belgium	Nether-lands	West Germany	Italy	Switzer-land	Brasil	Japan	Others	Total
1977 years	4,519	467	1,663	4,886	1,627	1,593	133	5,313	3,507	686	3,607	2,011	791	4,113	34,564
1978	3,040	838	1,851	2,748	436	867	182	3,275	4,837	2,074	1,980	2,524	3,993	3,223	31,868
1979	6,452	689	78	2,179	730	1,659	224	5,605	5,738	2,681	2,562	3,597	2,028	3,494	37,716
1980	9,347	604	227	2,102	624	1,280	723	2,488	4,845	762	3,984	5,070	1,423	5,600	39,089
1981	8,636	478	265	1,929	580	1,150	381	1,670	4,146	418	1,846	6,822	3,143	5,675	37,238
1982, Oct.	7,709	941	544	1,143	993	554	871	2,051	5,553	808	2,026	11,734	3,515	6,712	45,152
1977 years	35,822	3,780	13,445	39,530	13,161	12,889	1,076	42,983	28,374	5,548	26,326	16,266	6,403	33,276	278,891
1978	24,152	6,783	14,975	22,211	3,530	7,013	1,468	26,497	38,808	16,779	15,977	20,416	32,308	26,067	256,984
1979	51,009	5,569	625	17,628	5,907	13,611	1,811	45,344	46,407	21,688	21,789	29,103	16,407	22,278	305,176
1980	74,181	4,796	1,802	16,679	5,028	10,158	5,741	19,746	38,454	6,046	31,614	40,240	11,296	44,449	310,230
1981	68,542	3,791	2,894	15,308	4,603	9,124	2,027	13,257	32,902	3,316	14,651	54,146	24,940	45,040	295,541
1982, Oct	53,319	6,539	3,783	8,095	7,097	3,970	6,058	14,382	38,453	5,563	14,120	82,413	24,583	46,805	315,180
1977	5,434	750	1,741	3,989	649	1,071	202	130	2,822	231	151	6,794	2,879	5,274	32,164
1978	6,119	473	3,843	4,381	809	1,692	242	169	3,300	439	193	7,890	3,174	7,275	39,999
1979	9,302	676	3,048	6,276	1,106	1,799	229	337	3,990	677	289	12,894	4,546	9,957	55,127
1980	13,415	693	3,635	6,446	1,516	1,884	207	272	4,226	593	366	17,704	5,292	8,913	65,160
1981	12,611	758	3,137	6,194	1,146	1,950	301	420	5,171	757	388	16,539	5,291	9,110	63,770
1982, Oct.	11,284	617	4,502	6,021	1,168	940	218	1,213	4,050	766	512	15,956	3,542	9,560	60,334
1977	43,228	5,852	13,813	30,867	5,184	8,497	1,604	1,028	22,380	2,231	1,199	53,915	22,847	42,734	255,377
1978	48,467	3,752	30,500	34,755	6,423	13,428	1,925	1,341	26,191	3,486	1,535	62,711	25,193	57,734	317,738
1979	74,040	5,361	24,192	49,809	8,776	14,275	1,820	2,672	31,665	5,372	2,297	102,334	36,085	79,024	537,722
1980	106,442	5,502	28,843	51,159	12,030	14,952	1,640	2,154	33,534	4,707	2,804	140,505	42,031	70,738	517,141
1981	100,090	6,014	24,898	49,156	9,098	15,475	2,392	3,331	41,038	6,005	3,078	131,257	41,990	72,289	506,111
1982, Oct.	86,375	4,342	29,992	39,524	8,248	7,083	1,684	9,305	29,629	5,584	3,805	115,192	25,265	76,381	442,410

Source: Statistical Bulletin No. 293

Table 2-21 Export and Import Amounts by Economic Regions

Unit: FOB price (US\$1,000)

Item	1977 years		1978 years		1979 years		1980 years	
	Export amount	Import amount	Export amount	Import amount	Export amount	Import amount	Export amount	Import amount
American countries (excluding Latin American countries)	40,739	33,562	23,121	37,568	17,947	52,414	17,136	54,528
Canada	843	164	462	233	42	524	37	261
USA	39,530	30,867	22,211	34,755	17,628	49,809	16,679	51,159
Antilles islands		2,298		2,000		1,738		2,895
Puerto Rico	366	233	448	580	277	343	420	213
Member nations of the Latin American Free Trade Group	75,063	111,575	66,808	129,428	104,017	195,430	140,668	267,656
Mexico	733	644	1,172	687	2,462	499	4,017	496
Colombia	188	213	172	159	382	188	143	203
Ecuador	19	365	5	202	4	475		345
Venezuela	342	239	201	16	129	28	14	13
Brazil	16,266	53,915	20,416	62,711	29,103	102,334	40,240	140,505
Uruguay	12,889	8,497	7,013	13,428	13,611	14,275	10,158	14,952
Argentina	35,822	43,228	24,152	48,767	51,009	74,040	74,181	106,442
Bolivia	27	1,768	112	9	127	571	581	71
Peru	122	27	78	124	36	85	21	132
Chile	8,655	2,679	13,487	3,325	7,154	2,935	11,307	4,297
Central America (ordinary market)		44		92		514		148
Other American continent nations	2,082	911	39	-	1,025	1,241	1,323	1,651
Eastern Europe	17	842	-	1,511	3,638	2,437	80	2,127
Northern Europe (ordinary market)	91,142	32,427	87,082	39,366	121,157	50,304	75,015	54,065
West Germany	28,374	22,380	38,808	26,191	46,407	31,665	38,454	33,534
Belgium	1,076	1,604	1,468	1,925	1,811	1,820	5,741	1,640
France	13,161	5,184	3,530	6,423	5,907	8,776	5,028	12,030
Italy	5,548	2,231	16,779	3,486	21,688	5,371	6,046	4,707
Netherlands	42,983	1,028	26,497	1,541	45,364	2,672	19,746	2,154
E.F.T.A.	50,921	20,241	36,195	38,487	30,532	33,871	47,705	38,176
Austria	-	1,136	-	1,462	38	2,029	-	2,129
Denmark	413	149	765	215	216	1,021	1,811	358
Norway	-	120	10	52	19	75	31	269
Portugal	10,700	130	4,368	137	7,845	119	12,173	109
England	13,455	13,813	14,975	30,500	625	24,192	1,802	28,843
Sweden	27	3,694	100	4,586	-	4,138	274	3,564
Switzerland	26,326	1,499	15,977	1,535	21,789	2,297	31,614	2,904
Western side and East Europe	4,146	6,029	7,258	3,845	7,083	5,703	5,876	6,174
Spain	3,780	5,945	6,783	3,752	5,569	5,361	4,796	3,502
Finland	350	55	31	75	23	285	-	634
Greece	16	4	-	4	3	12	-	6
Ireland		16	-	14	-	11	7	15
Yugoslavia			441		1,488	30	1,073	11
Turkey		9				4		6
Iceland								
Cyprus								
Asia (excluding near and middle east)	10,947	25,786	32,937	30,034	17,903	41,949	16,141	50,447
Ceylon (Sri Lanka)		2		-		-		-
Laos								
Republic of Korea		12		192		533		1,117
China		2,176		3,837		4,160		5,858
Hong Kong		365		383		479		909
India		315		418		549		422
Japan	6,403	22,847	32,308	25,193	16,407	36,085	11,296	42,031

Source: Statistical Bulletin No.293

Unit: FOB price (US\$1,000)

Item	1977 years		1978 years		1979 years		1980 years	
	Export amount	Import amount	Export amount	Import amount	Export amount	Import amount	Export amount	Import amount
Pakistan	-	7	-	-	-	15	-	2
Philippines	-	-	-	-	83	6	187	6
English territory	4,544	62	629	11	1,413	122	4,658	102
Middle and Near East	8	60	21	64	7	99	19	1,804
Israel	7	-	21	-	7	-	3	-
Syria	1	-	-	-	-	-	16	-
Africa (except Middle and Near East)	3,194	23,558	1,382	34,059	801	53,122	2,425	39,009
Africa of French territory								
Algeria	1,206	23,478	818	34,637	-	50,069	1,260	37,082
Congo	27	-	-	-	56	-	23	-
South Africa	1,077	60	73	413	177	431	488	648
Morocco	404	-	491	-	418	-	-	-
Tunisia	480	1	-	-	150	-	654	-
Others	-	19	-	9	-	2,622	-	1,279
Oceania	9	8	27	16	22	27	-	64
Others (including darkness)	623	334	2,114	2,268	1,044	610	3,842	1,493
Total	278,891	255,377	256,984	317,738	305,176	437,721	310,230	517,142

financial institutions are Banco Central del Paraguay (Banco Nacional de Fomento (BNF)), Gredito Agricol de Habilitacion (GAH) and livestock fund (FG), whereas private financing is carried out through commercial banks established under the bank law.

The total loans provided by these financial institutions to agriculture, livestock and forestry were 28.8 billion Gs, of which 73.8% was allocated to agriculture-related production.

Table 2-22 Total Loan Provision to Agriculture, Livestock and Forest in 1981 (Unit: Million Gs)

Financial Institutions	Agriculture	Livestock	Forestry	Total	%
Banco Central	3,058	-	-	3,058	13.2
FNF	12,430	744	35	13,209	62.2
FG	-	2,822.6	-	2,822.6	21.5
Ex-Banco del Paraguay	8.1	1.8	-	9.9	43.6
Commercial Bank	5,750	3,953	-	9,703	4.7
GAF	-	-	-	-	-
Total (%)	21,246.1 (73.8)	7,521.4 (26.1)	35 (0.1)	28,802.5 (100)	10.9

Loan interests are in the following:

Table 2-23 Loan Interests of Financial Institutions

Financial Institutions	Interest (Yearly Base)	Commission	Stamp Fee
Public	12%	1 ~ 2%	0.25 ~ 0.75%
Private	20 ~ 25% (5% less for agriculture)	-	-

Among these financial institutions, BNF and GAH play an important role for providing loans to small and medium farmers.

Banco Nacional de Fomento - BNF

BNF was established in March 1961 by Law No. 281 to take over Ex-Banco del Paraguay and is headquartered in Asuncion with 21 branch and 16 sub-branch offices all over the country. BNF's major business activities are to provide loans for promoting projects under the government development program, to accommodate savings in accordance with the bank law, and to deal with foreign exchange. Loan activities are divided into the following:

- (i) Development Projects: corporate agriculture, livestock, forestry and industry
- (ii) Commerce and Savings: general commerce and service, and bank business
- (iii) Agriculture and livestock: small-scale farming, chicken-raising, dairy farming, fruits cultivation and rural industry

Main fields to which loan is given in the above Agriculture and livestock are those in the framework of the following national development and promotion programs:

- a. Wheat Program (Programa Nacional de Trigo)
- b. Bean Program (Programa Nacional de Soja)
- c. Cotton Program (Programa Nacional de Algodon)
- d. Tobacco Program (Programa Nacional de Tabaco)
- e. Integrated Development Program for agriculture and livestock (Proyecto Integrado de Desarrollo Agropecuaria)
- f. Promotion Program for agriculture and livestock (Programa de Promocion Atropecuaria)

- g. Agriculture and Graziery Technology Program for agriculture and livestock (Programa de Tacnificacion Agropecuaria)
- h. Sugar Cane Program for Alcohol Production (Programa de Cana de Azucar para La produccion del Alcohol)

Promotion Program for agriculture and livestock was started in August 1980 to provide loans to small and medium agricultural enterprenuers, but loan qualifications are so severe that the loan under this program is limited to independent agricultural enterprenuers. However, loan beneficiaries are entitled to receive necessary technical guidance with regard to financing, production technology, agriculture promotion and management through extension services (SEAG).

It is noted that almost all funds channeled through international organizations are given to BNF.

Credito Agricold de Habilitacion-GAH

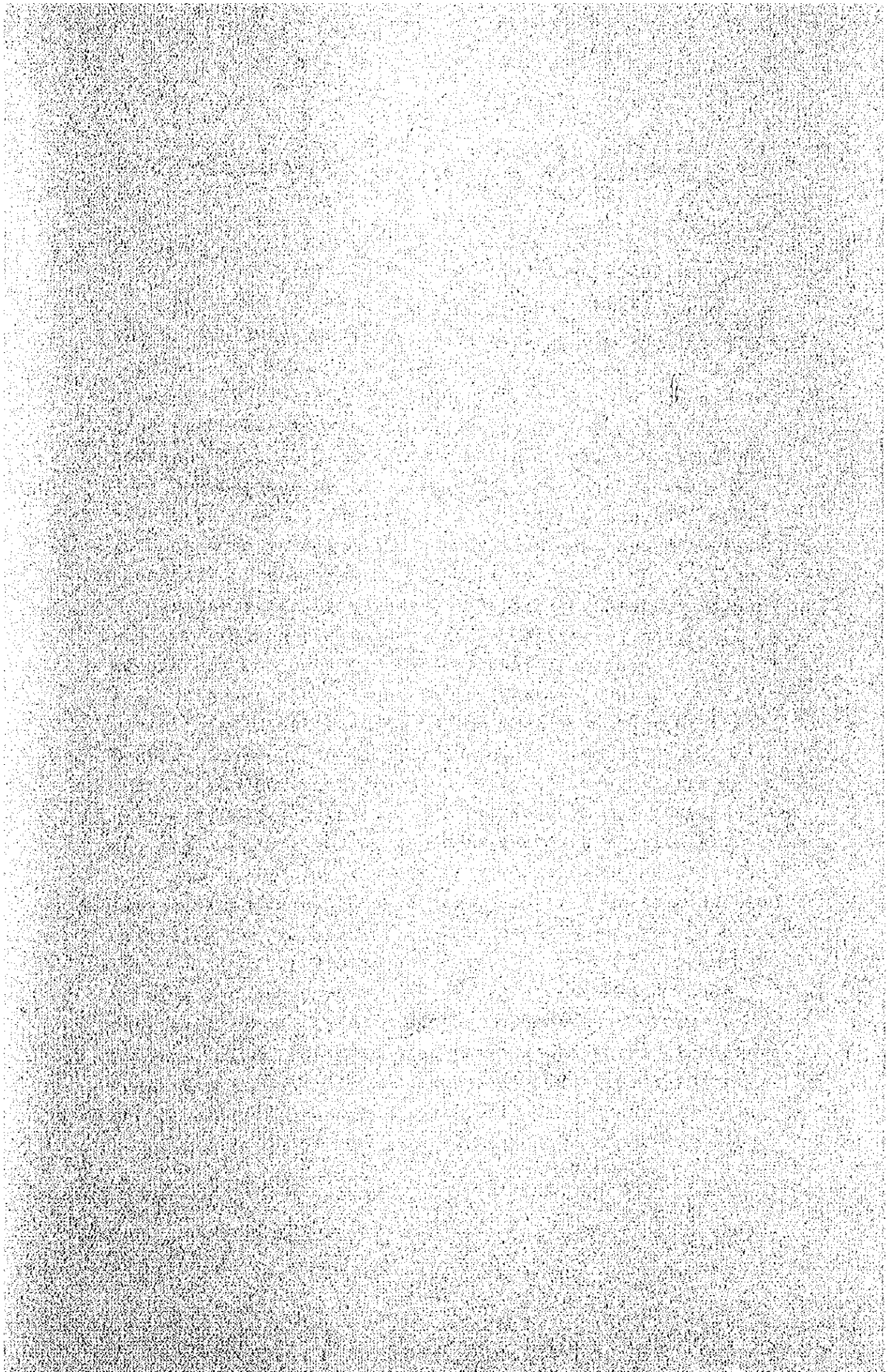
GAH was established in December 1943 by Law No. 1611, which is an independent institution under the supervision of Ministry of Agriculture and livestock. It provides loans mainly to small farmers who are not qualified for loans made available through BNF or through commercial banks. With its head office located in Asuncion, GAH has 7 local office and 19 sub-offices in the regions where small farming is concentrated.

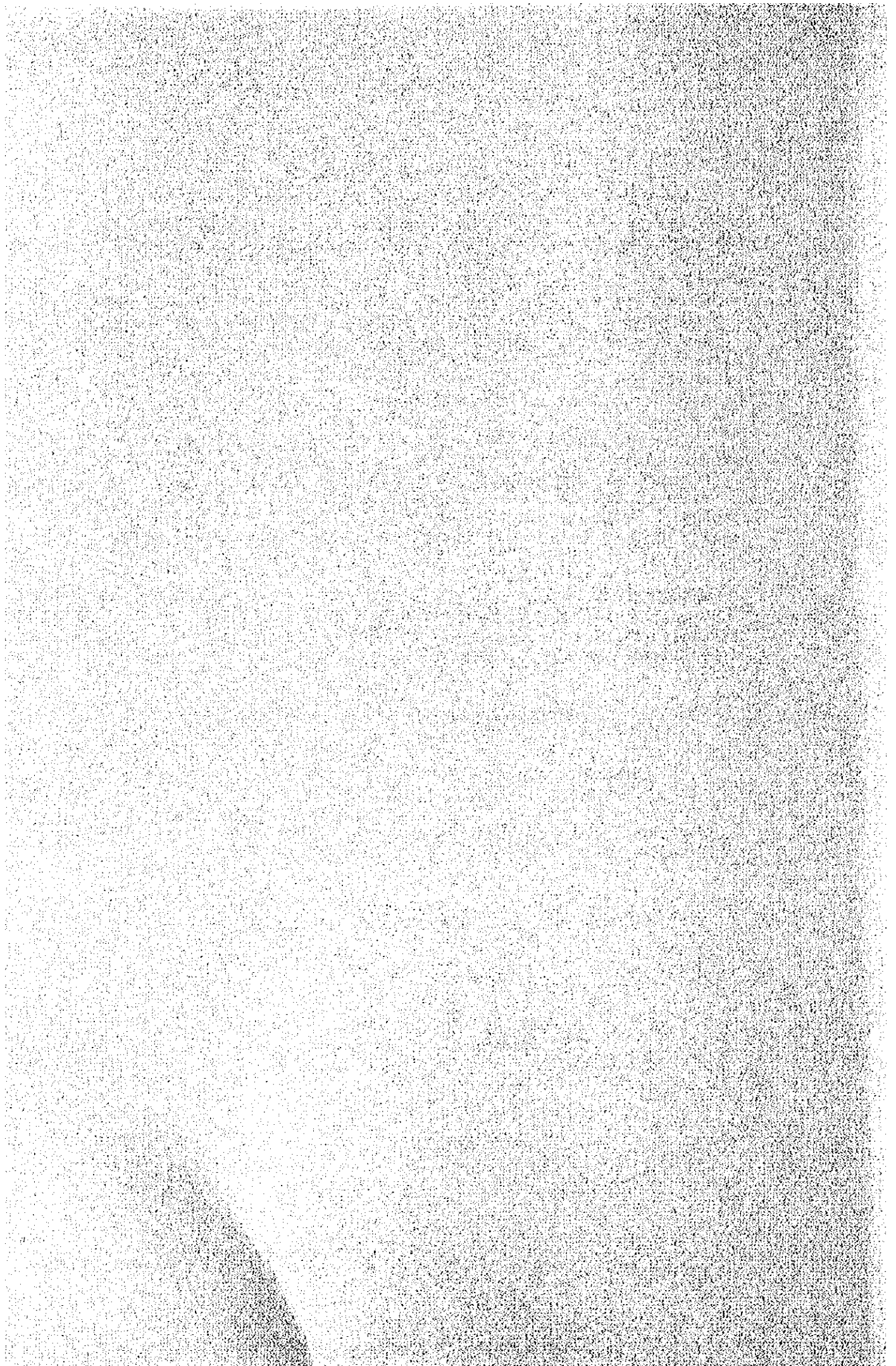
GAH renders services to help small farmers become independent by way of the provision of technical guidance as well as loans to purchase agricultural inputs such as seeds or fertilizers. Farmers qualified to receive loans from GAH have to be members of the (AUCA) agricultural cooperatives.

Table 2-24 B.N.F. Loan Condition

<u>Items</u>	<u>Conditions</u>
1. Subject of loan	<ul style="list-style-type: none"> * Small and medium size farmers and stockbreeders as well as cooperatives * Eligible to have a loan of the Agriculture Promotion Funds are those who possess net properties up to 4,992,750 GS. * Eligible to have a loan of the Small-scale Ranch Funds are those who possess net properties up to 7,767,900 GS.
2. Amount of loan (Total amount possible)	<ul style="list-style-type: none"> * Private farmers 1,890,000 GS * Cooperatives <ul style="list-style-type: none"> Direct loan 9,450,000 GS Sublease loan 37,800,000 GS * Producers' unions 6,300,000 GS * Small-scale farms 2,520,000 GS
3. Terms and purposes of loan	
3.1 Short term (Up to 18 months)	<p>Purposes: Purchasing feed; wages to be paid for transaction, transportation storing, processing, packing and refining of agricultural and livestock products; purchasing a small number of beef cattle; expenses for the provision of primary products required for cultivation, etc.; expenses for seeds, fertilizer, pesticides required from the time of tilling through harvesting; expenses for contract labor and daily labor; expenses for reaping, drying, threshing and transporting; and purchasing parts of agricultural machines.</p>
3.2 Medium term (18 months - 5 years)	<p>Purposes: Purchasing facilities for poultry farming and raising a few other domestic animals; purchasing working oxens and cows; purchasing transporting machines and agricultural machinery; purchasing small machinery; improvement of machinery facilities; purchasing and installing agricultural equipment for the primary products, small furnishings relevant to poultry farming, pig raising, bee culture and fish culture; and expenses required for the recovery of soil functions.</p>

<u>Items</u>	<u>Conditions</u>
3.3 Long-term (5 years - 12 years)	Purposes: Purchasing cattle for breeding; purchasing tractors; expenses required for the recovery of soil functions; expenses for construction of a temporary hut, stretching wire, making a fence, and building a milking machine and milking place; purchasing bulls for breeding construction of large facilities such as a silo, a place for cargo collection for village houses and a grain storage; expenses for boring a well, constructing irrigation and drainage facilities, irrigation channel and small waterway dam; expenses for constructing a village water supply facility and electrification; expenses for cultivating long-term crops (fruit trees).
4. Repayment of loan	Production expenses: Within 60 months after harvesting (short-term) Facility funds: At the time of earning incomes every year (middle-term and long-term)
5. Mortgages	Real and movable property (Require guarantor)
6. Interest	12% per year, 2% for commission charge, and 1% for others
7. Others	When an application is made for a loan, 50% - 60% of the applicant's properties can be loaned out.





CHAPTER 3 PRESENT STATE OF AGRICULTURE AND LIVESTOCK INDUSTRY

3.1 Outline of Agriculture and Livestock Industry

Paraguay is a country with an area of 407,000km², of which 19,017,000 ha is used for agriculture and livestock farming. In this farming area, 1,610,000 ha is used for crop cultivation and 170,000 ha for long-term crops. The area for stock-farming is 17,291,000 ha, and 47% of national land is utilized for agricultural and livestock.

The population of Paraguay for 1981 is assumed to have been about 3,270,000 people. Nearly 570,000 people were engaged in agriculture and livestock, and occupied about 45% of the working population.

Paraguay is broadly divided into the Western Region and the Eastern Region, which have differing natural conditions and peculiar agricultural features.

For instance, agriculture in the Western Region constitutes stock-farming in the main, but that of the Western Region is a complex one consisting of crop cultivation and stock farming. And there are quite a number of farmers who are engaged in crop cultivation in the Itapua and Alto Parana Departments in particular.

The agricultural peculiarity of this country is the livestock industry which chiefly consists of beef cattle utilizing the favorable natural conditions. The number of beef cattle for 1980 amounted to 6,340,000 head and that of pigs 1,000,000 head. Therefore the number of beef cattle is twice the size of the population of Paraguay. However, since the method of their fastening is extensive under the present circumstances, it requires 4 years before beef cattle can be shipped.

It seems there are infinite possibilities in the agricultural development of this country, if its natural conditions are utilized effectively. It is also urgently necessary to increase the production of wheat and other products that are present by imported.

3.2 Trends of Main Crops

The present state of the cultivation of agricultural products is shown in Table 3.1. The trends of main crops only are described in the following.

3.2.1 Soybean

Soybean cultivation here has a long history. Soybeans were cultivated for the purpose of pressing oil until the beginning of the 1960's. But the area of their cultivation was expanded in accordance with the increase in demand for soybeans as food, edible oil and feed since the beginning of the 1970's. (Refer to Table 3-1, Fig. 3-1 in Appendix.) The global soybean boom started sometime around 1975, when the production volume of soybeans went beyond 200,000 ton, which arrived at 740,000 ton in 1980.

The area of soybean culture was 150,000 ha in 1975, which became 480,000 ha in 1980. Soybeans are the important crops next to cotton in export quantity, and Paraguay is one of the few countries exporting soybeans.

The area of soybean cultivation is the hilly country of the Eastern Region with Itapua and Alto Parana Department at its center, and occupies 70% of the total area of cultivation.

Regarding the soybean project which started with the wheat project since 1968, there is the planting system of summer crop soybeans and secondary crop spring wheat worked up by a mechanized farming method.

Table 3-1 The Annual Crops

(Unit: 1,000 ha, 1,000 ton)

	1975		1976		1977		1978		1979		1980	
	Area	Harvesting	Area	Harvesting	Area	Harvesting	Area	Harvesting	Area	Harvesting	Area	Harvesting
Garlic	0.6	1.3	0.6	1.4	0.7	1.6	0.7	1.5	0.7	1.6		
Alfalfa	4.5	23.6	4.6	14.6	4.8	26.0	4.8	26.0	4.7	25.7		
Cotton	100.0	99.6	109.9	107.5	200.2	227.4	284.9	283.8	312.5	234.7	258.1	227.5
Pea	3.3	3.0	3.4	3.1	3.8	3.5	3.9	3.6	4.1	3.7		
Paddy (rice)	17.3	442	17.1	40.7	18.3	45.6	20.7	434	22.0	47.4	24.1	53.9
Rice	7.3	11.7	11.0	16.1	15.3	23.1	11.1	14.8	8.1	9.5	14.2	18.8
Sweetpotato	13.0	105.3	13.7	113.6	14.1	119.2	14.6	116.9	14.1	106.3		
Sugar cane	20.6	764.2	20.8	774.1	21.0	789.7	22.1	863.3	22.3	890.1		
Sorgo (grain)	9.7	274.0	10.3	302.9	12.0	379.7	12.7	396.7	-	-		
Sorgo (ear)	9.9	-	10.4	-	11.3	-	12.7	-	13.0	-		
Onion	4.2	27.8	4.5	27.8	4.9	32.2	4.2	26.1	4.0	24.0		
Arabian bean	9.5	8.4	9.9	8.8	16.0	14.7	15.7	13.6	15.7	13.0		
Maize	22.6	300.8	257.3	351.5	288.1	401.0	275.9	355.4	352.7	550.4	376.6	584.7
Cassava	96.5	1,427.6	106.5	1,573.3	116.1	1,718.6	120.3	1,837.5	126.4	1,888.0		
Peanut	13.6	15.2	20.4	18.2	22.6	24.7	23.7	23.0	23.9	23.4		
Esica	8.0	0.4	10.8	1.0	12.5	1.2	14.2	1.3	14.9	1.4		
Potato	0.5	3.7	0.4	3.5	0.6	5.3	0.9	7.4	1.0	8.8		
Poroto bean	63.4	50.0	66.8	52.3	86.2	70.7	81.4	64.7	79.1	57.8		
Sorgo	6.2	8.1	6.8	9.0	6.5	8.7	6.4	8.1	6.9	8.5		
Tobacco	20.6	28.3	278	38.6	29.8	41.4	21.5	26.9	20.5	25.9	15.0	205
Castor-oil plant	21.1	185	21.8	23.5	19.8	21.8	22.2	22.3	23.3	23.1		
Wheat	25.2	180	24.2	29.3	28.5	28.3	31.5	37.8	52.3	58.3	47.0	43.0
Soybean	150.2	220.1	173.4	283.5	228.8	276.9	272.2	333.1	360.3	549.2	475.3	737.3

Source: Encuesta Agropecuaria Por Muestreo - 1979 - MAC

Speaking of the general feature of this planting system, spring wheat is cultivated by fertilization, but soybeans are grown without fertilization by making use of the residual effects.

The Ministry of Agriculture and Livestock has been offering guidance w.r.t. the following points for the present areas of cultivation.

1. Thorough performance of the method of fertility conservation (soil making)
2. Extension of high yield varieties and appropriate technology for cultivation

Soybeans are cultivated mainly in the areas where the soil consists of nitosols, ferraalsols and luvisols. According to the Programa Nacional de Soja conducted by the Ministry of Agriculture and Livestock, the area suitable for cultivation amounts to 4,000,000 ha, of which 1,360,000 ha is the most suitable area for cultivation.

Table 3-2 Area Suitable for Soybean Cultivation

(Unit: 1,000 ha)

Department	Total area	The most suitable area	Suitable area		Cultivated area in 1979	Rest of suitable area
			Suitable area	Total		
Itapua	1,552.5	920.0	130.0	1,070.0	196.1	373.9
Alto Parana	1,489.5	-	750.0	750.0	75.6	534.4
Canendiyu	1,466.7	80.0	580.0	660.0	33.7	524.3
San Pedro	2,000.2	-	530.0	530.0	13.0	532.0
Caaguazu	1,229.8	80.0	370.0	450.0	18.0	432.0
Caazapa	949.5	100.0	200.0	300.0	3.2	294.3
Amambay	1,293.3	102.0	-	102.0	23.3	78.2
Misiones	953.6	80.0	-	30.0	8.2	71.3
Guaira	300.2	-	30.0	30.0	6.0	24.0
Others	29,337.3	-	-	-	16.3	15.3
Total	40,576.2	1,362.0	2,540.0	4,002.0	403.4	2,398.5

Source: PROGRAMA NACIONAL DE SOJA

In Itapua Department, the area of soybean cultivation in 1980 is 230,000 ha out of 1,070,000 ha which is the total suitable area of soybean cultivation, and in Mision Department, the area of soybean cultivation in 1980 is 10,000 ha out of 80,000 ha which is the total suitable area of soybean cultivation.

The area of soybean cultivation is small in comparison with the suitable area of cultivation. This seems to be due to the reason that a considerable amount of funds is required for machinery, but in 1982 the rates of interest was high and the price of soybeans was as slow as 25 Gs/kg.

3.2.2 Cotton

Cotton which is a traditional agricultural product had been cultivated since the older time. From Table 3-3, Fig. 3-3 in Appendix, the area of cultivation stands in 3rd rank next to soybeans and corn. Cotton is grown in the area of 260,000 ha in 1980.

The rate of its growth has made a threefold increase since 1975, and the amount exported ranks top as usual.

The yield of cotton was 100,000 tons in 1975, and had increased 2.3 times the 230,000 ton for 1980. Its achievement goes way beyond the 1979 target of 160,000 ton in the cultivation area of 135,000 ha aimed for in the 5th Economic Social Development Plan.

In the following are shown the factors of its production increase:

1. New varieties REBA-B-50 were introduced from France, and these were then improved in Paraguay and REBA-B-279 was developed.
2. Under the guidance of the Agriculture and Forestry Extension Bureau, Seeds Service

Department, high yield varieties of cotton were distributed to the cultivators. Beside this, along with the extension of cultivation techniques, improvement of fund accommodation and improvement of cotton cultivators' production skills, the scale of its production was expanded.

Cotton is grown centering around Caguazu and Parguari Department in the central part of the Eastern Region. Its yield in these two departments for 1980 occupies more than 60% of the total volume of its production in the country. The soil of the cotton production area is orthic acrisols or planosols that are the same as the area under survey.

3.2.3 Corn

As the case of cassava, corn is an extremely popular crop cultivated by most of the farmers.

It is the foodstuff indispensable for the people of Paraguay. At the same time, it is an important crop as feed for small cattle.

The transition of its production in the past 5 years is shown in Table 3-3, Fig. 3-3 in Appendix.

Itapua is a department where corn is produced in the largest quantities and is grown in its hilly area.

They grow corn for two purposes, i.e. for domestic consumption as a cash crop.

New species of corn are: Central, Neembuca, etc.

3.2.4 Wheat

The wheat production zone chiefly consists of Itapua, San Pedro and Misiones Department. Recently, in Camerdiyu and Caguazu Department wheat is also grown.

In case of Itapua Department, wheat is cultivated as a secondary crop with soybeans. And since both wheat and soybeans can be harvested by using the same machine, there has been a radical increase in wheat cultivation.

Wheat is one of the rare Winter crops. Besides this, it has the advantage that it can be cultivated repeatedly along with soybeans, and can be cultivated in a large area. Wheat is indispensable for daily life. However, since its domestic production does not satisfy its demands, it is imported in large volumes every year and the Government of Paraguay has been encouraging farmers to increase wheat production.

The amount of imports has been affecting the balance of trade of the nation to a considerable extent.

In order to increase its domestic production, they are trying to introduce appropriate varieties, improve cultivation techniques, offer financial aids for mechanization, provide measures against damages made by blight and noxious insects and to develop varieties resistant against them.

An increase of the wheat yield in 1979 was due to the expansion of the cultivation area, and not due to an increase of the size of its yield per unit area.

The wheat yield is as low as 1.1 ton/ha - 1.2 ton/ha. We can think of the following points as the reasons for this.

1. Shortage of high yield varieties high crops.
2. Not many farmers are using agricultural chemicals in order to prevent and remove damages made by blight and noxious insects.
3. Since fertilizer is expensive, the quantity of fertilization is small. And the fertility of soil is low because of repeated cultivation.

If these points mentioned above are solved, it is possible to expand the area of its cultivation as the case of soybeans.

The state of wheat cultivation in the past 5 years is shown in Table 3-4, Fig. 3-4 in Appendix.

3.2.5 Cassava

Cassava is an important crop for the daily life of Paraguayan, and most of the farmers here cultivate it for the purpose of food and feed. Cassava is cultivated all over the country and there is no place for production concentration for it.

Its flour is mixed with the flour of wheat as the material for bread, and the Government has taken legal measures to encourage this method (Regulation No. 1544). The state of its production is indicated in Table 3-5, Fig. 3-5 in Appendix.

Its yield per unit is about 15 ton/ha in national level average, but Caagazu and Concepcion Department which are the main producing zone of Cassava have the crop over 20 ton/ha.

3.2.6 Rice

Domestic rice cultivation consists of paddy rice and upland rice as shown in Table 3-6 & 7, Fig. 3-6 & 7 in Appendix.

Itapua and Misiones Department constitute the concentrated zone of paddy rice cultivation, and Comediyu and Amanbay Department constitute the representative production zone of upland rice. They respectively occupy the yield more than 70% of the total rice produced in Paraguay.

The total volume of rice production was 56,000 ton in 1975, which is 73,000 ton in 1980, indicating a tendency of gradual increase.

The production of upland rice has a tendency of gradual increase also, even though it varies radically depending on the year.

Glancing at the transition of rice production in the past, it was 8,000 ton average during 1969 through 1974, which became 16,000 ton during 1975 through 1980. This shows that the rice production in the latter 5 years became twice that of the previous 5 years. This seems to be due to the advancement of mechanized agriculture in large size farms and the appearance of new zones for growing rice. Large-scale paddy rice cultivators who occupy the main position in rice cultivation operate large-size tractors, combines and driers. They also plant seeds by machine. Medium-scale and small-scale farmers cultivate paddy rice in the fields with sufficient water supply or fields in the valley. They use oxen and horses as well as tractors, and plant seeds by hand.

At present, crop rotation is usually conducted in paddy fields rice and others as follows; two croppings of paddy rice and three cropping for stock raising, or three croppings of paddy rice and three croppings for stock raising.

This method of cultivation is adopted for the purposes of weed disposal as well as for growing rice without using fertilizer and agricultural chemicals.

It is recognized that the amount of red rice increases by the repeated cultivation of paddy rice. This is a remarkable phenomenon occurring in this district. Rice husks are red colored, and the commodity value of rice goes down.

As a measure coping with this problem of red rice, there is a plan to set up the seed services center in the national agricultural experiment stations for the purpose of distributing seed to the farmers.

All the varieties of rice for cultivation belong to the line of Indica, of which CICA No. 6, No. 8 and No. 9 constitute the main varieties.

The average yield of rice in Paraguay is 2.9 ton/ha, wherein no fertilizer is used.

By fertilizing the soil with manure (125 kg/ha) prior to planting seeds, there was an increase of production by 1.5 ton/ha (result of 1981 experiment).

The soil of these experiment stations consists of planosols, and acrisols in part.

3.2.7 Tobacco

Caaguazu, San Pedro, Alto Parana and Gordillera Department which are placed in the central part of the Eastern Region are the department producing tobacco. Transition of tobacco cultivation is shown in Table 3-8, Fig. 3-8 in Appendix.

Tabacco production in Paraguay is great, and the natural conditions are suitable for tabacco cultivation to give rise to fine quality tobacco leaves.

There is a large demand from overseas, and it is an important item next to cotton and soybeans in the amount of exports.

Upon the basis of importance as such, the Government set up a National Tobacco Project in 1967 and has been propelling the expansion of tobacco production.

However, tobacco cultivation has been conducted by small farmers in most cases, and they do not have sufficient funds to expand its production. The national agricultural

experiment stations (I.A.N.) have been carrying out the followings under the financial support by the Central Bank of Paraguay etc.

1. Introduction of new varieties of tobacco and the performance of their adoption experiment
2. Extension of the established cultivation techniques to the farmers (method of fertilization, application of insecticides and others)
3. Survey of domestic and international markets

3.2.8 Sugar Cane

Depending on the purpose, sugar cane is classified into that to be used for sugar manufacture and the other to be used for alcohol production. It is also cultivated for feed as a special purpose.

Guaira and Paraguari Department constitute the main zone of its production, of which cultivation area and also yield occupy over 80% of those of Paraguay.

Sugar cane is cultivated on the premise of existence of sugar and alcohol plants, in addition to roads, electrical and other infrastructures for operation of these plants.

Its main production zone center is located in the so-called triangular zone which connects Asuncion, Encarnacion and Stroessner. This zone is the most developed region in Paraguay. And since it satisfies the above-mentioned conditions, it must have become the main production zone of sugar cane.

The state of annual sugar cane cultivation is indicated in Table 3-9 & 10, Fig. 3-9 & 10 in Appendix.

The Government paid attention to the resources for biomass as a substitute of petroleum energy. And in order to

propel sugar cane production, it commenced the Programa de Coma de Asucar para la Produccion del Alcohol by the Regulation No. 206 in July 1979. Also the Government founded a modern sugar cane alcohol manufacturing factory belonging to the Alcohol Central Bureau at Mauricioj Joroche in Guaira Department, which is under operation at present. (Its alcohol production capacity is 120,000 l/day).

This factory requires a cultivation area extending more than 25,000 ha.

Experimental research into varieties of sugar cane is mainly progressing in the national agricultural experiment stations, however, Tucuman 2645, Caner A-1, Poj 2878 and Caramelo are widely cultivated recently as the crude materials for sugar manufacture.

The yield of sugar cane is about 47 ton/ha in Guarra Department and 40 ton/ha in national average at present. However, it is proved that in the experiments of the national agricultural experiment station (I.A.N.) its yield can be increased up to 70 120 ton/ha by adopting fertilization and by improving cultivation techniques.

3.2.9 Peanut

Peanuts constitute an important agricultural product in the Western Region where the production is still low in crop cultivation. Peanut production in Western Region occupied 32% of the national peanut production for 1979. Peanuts are produced in the Eastern Region as well. But these are mainly used for the farmers' private consumption, and the rest are shipped to oil manufacturing factories and consumer markets.

Peanuts are grown twice a year, that is, the first planting is done during August through September and

harvesting is done during December through January, and the second planting is done during December through January and harvesting is done in March.

The Western Region gives the heaviest yield of 1.4 ton/ha, which exceeds the national average by 40%.

3.2.10 Potatoes

Potatoes are cultivated twice a year, that is, the first planting is done in March and harvesting is done in May, and the second planting is done during July through August and harvesting is done during November through December.

Potatoes are the important agricultural products for the daily life in Paraguay, therefore their domestic need is also large. And their domestic production shows an increase of 160% during the past 5 years. However, the yield of potatoes is not sufficient to satisfy the domestic need, thereby a large volume of them is imported from Argentina at present.

The causes of harm to the increase of domestic production of potatoes are imported potatoes from Argentina which are fine in quality and low in price, and the lack of facilities to preserve potatoes for a long period.

The yield per is 9 ton/ha in national average, which is below the 10 ton/ha of Caaguazu and Paraguari that are the principal producing departments.

3.2.11 Tomatoes

There are no statistics relevant to the cultivation area and the yield of tomatoes, therefore we offer the outline of tomato cultivation from our survey of the farmers around Asuncion and the Japanese immigrant zone of Yguazu.

Tomatoes are the crops bearing good profits per hectare and are cultivated twice a year. The first planting is done during March through April and harvesting is done during June through July. The second planting is done during July through August, and harvesting is done during November through December. The first cultivation is performed chiefly for the export purposes, and the second for shipping to the domestic markets.

In tomato production attempted for domestic markets, the periods of cultivation of tomatoes nearby Asuncion do not always agree with those of local production areas. And the farmers are shifting their cultivation periods according to the demands of tomatoes. This is because tomatoes are crops which can be grown throughout the year as long as there is no frost damage. The period of harvesting tomatoes for export falls between July and September. And since there is not much supply of tomatoes to the markets of Argentina during this time, these become important markets for tomatoes from Paraguay. Tomato cultivation for export is rather speculative due to issues such as the exchange rate and other problems in Argentina at present. It is therefore not necessarily stable.

The yield of tomatoes is quite high at 50 ton/ha by adopting fertilization and agricultural chemicals under normal climatic conditions.

3.2.12 Melons

There are no statistics relevant to the cultivation area and the yield of melons, therefore we offer the outline of melon cultivation from our survey of the farmers around Asuncion and the Japanese immigrants zone of Yguazu.

The production zone for melons is the area around Asuncion. Melons are the crops bearing high profits per unit and can be cultivated three times a year on average. The standard cultivation system of melon is as follows: The first planting is made during April through May and harvesting is done during July through August; the 2nd planting is made during August through September and harvesting is done during November through December; and the 3rd planting is made during December through January and harvesting is done during March through April. These are certain differences in the cultivation periods between the area around Asuncion and the local producing area, therefore they try to grow melons in the way whereby these can be harvested and shipped to the markets during off seasons.

Melon harvested in July - August are for export. This is also the period when melons can be sold at high prices in the domestic markets.

The market price of melons varies radically from 600 Gs/15kg/case to 2,000 gs/15kg/case.

3.2.13 Onions

Onions are one crop that cannot satisfy the domestic need, thereby the shortage is filled by imported ones every year.

Domestic markets center around Asuncion and the cities, and the production zone is concentrated in Caguazu and Paraguari Departments.

The planting of onions is made during March - April, transplanting during April through May, and harvesting during July through August. Imported onions are sold in the markets of Asuncion up to June when no domestic onions are available.

There is a plan to construct a low temperature storage stock house in Asuncion in order to stabilize the food provisions for the people.

3.2.14 Fruitstree

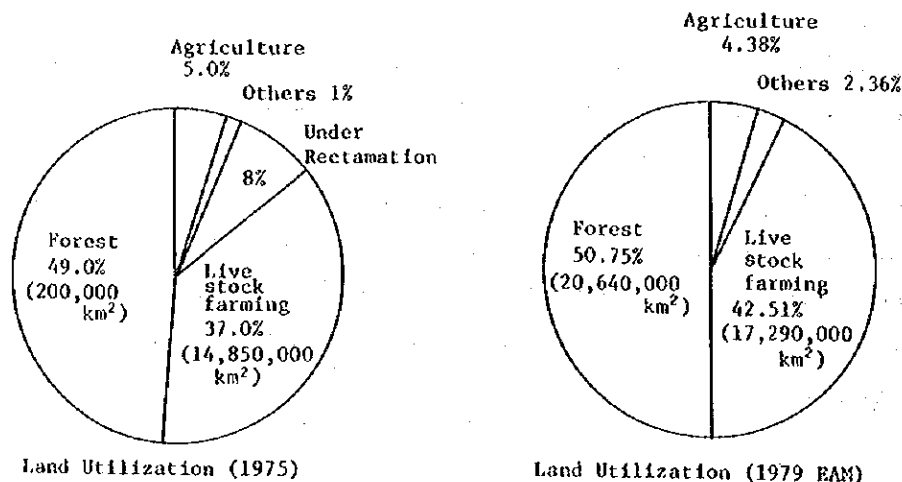
The main fruits are grapefruit, orange, banana, pineapple and vine. These are generally grown in the area around Asuncion, and those cultivated in the areas remote from Asuncion are meant only for the private consumption.

The production of fruit is shown in Table 3-11 and Table 3-12 in Appendix.

Fruit cultivation is popular in the part of Colmena where the Japanese have immigrated. They have a agricultural cooperative and a factory for manufacturing wine. They classify fruit into fresh fruit for eating and those for processing. Major fruits are vines and plums.

3.3 Livestock

Paraguay is a landlocked country located slightly in the South of the central part of South America. Topographically, it is rather flat throughout the country, and it has been prospering through livestock farming since long ago.



From the number of cattle, etc., the most suitable industry in Paraguay is livestock farming centering around grass-eating animals (i.e. beef cattle), and they can utilize the national land of 407,000 km² with the population of 3,260,000 people. (Refer to Table 3-2, Fig. 3-1 and 2)

Table 3-3 Number of Cattle and Poultry

Division	Unit: 1,000 heads			EAM, Censo
	1975	1977	1979	1981
Cow	5,043.3	5,799.9	5,203.3	6,341.4
Pig	974.8	1,173.6	1,272.7	1,003.1
Horse	324.7	325.8	328.8	-
Sheep	366.3	374.1	423.0	-
Goat	107.8	113.2	125.6	-
Chicken	9,013.8	10,141.2	12,471.1	-

Table 3-4 Distribution of Cows and Pigs
by Department

Department	Number of cows	Number of pigs
Concepcion	467,055	43,888
San Pedro	515,933	122,511
Cordillera	203,328	42,831
Guaira	158,736	57,625
Caaguazu	305,423	140,830
Caazapa	266,841	66,526
Itapuá	262,721	166,384
Mission	391,444	24,241
Paraguari	446,563	64,788
Alto Parana	80,777	121,072
Central	116,992	26,681
Itembucu	402,528	14,057
Amambay	265,640	20,743
Canendiyu	74,414	68,027
Total Eastern Region	3,958,365	980,204
Pte. Hayes	1,896,668	16,045
Alto Paraguay	240,915	4,119
Chaco	9,520	179
Nueva Asuncion	6,408	3
Boqueron	229,508	2,531
Total Western Region	2,383,019	22,877
Total of The Country	6,341,384	1,003,081

Source: Prepared from Preliminary data of the General
Agricultural Census 1981, MAG.

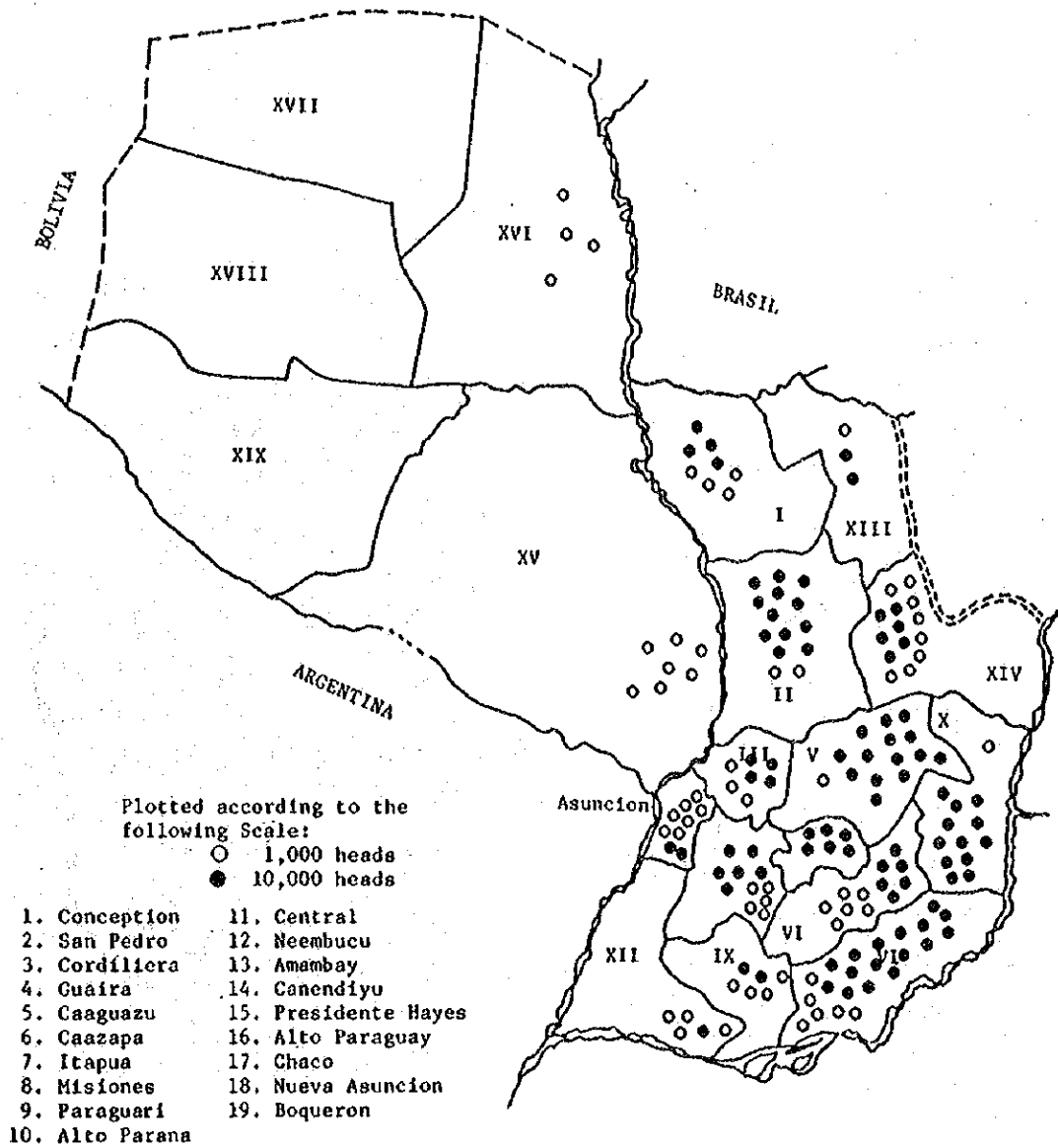


Fig. 3-1 Geographical Distribution of Number of Pigs (1980)

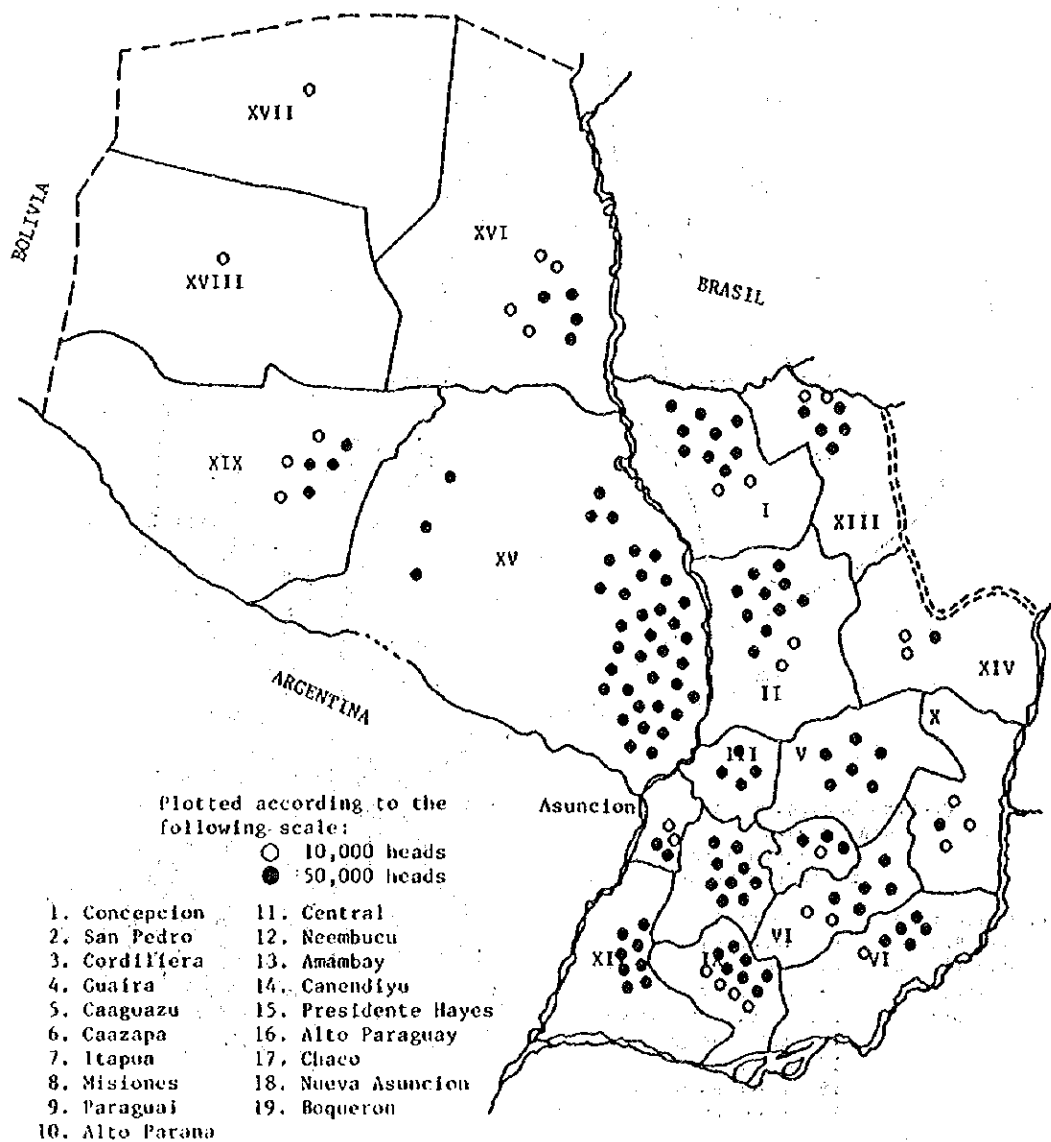


Fig. 3-2 Geographical Distribution of Number of Cows (1980)

3.3.1 Beef Exporting Conditions

Beef cattle and its processed goods monopolized 1/3 of the total amount of exports in 1973, and were therefore valuable in obtaining foreign currencies. The places of export are chiefly the European countries. Paraguay used to carry on active trade by utilizing the climatic positions of the Southern and Northern semispheres. Since 1974, however, Paraguay has been affected by the economic policies of E.C. nations, particularly by their common agricultural policies, and beef exports of Paraguay have suffered a severe blow.

After 1976, the places for export shifted from the European countries to neighbouring Latin American countries such as Brasil and Argentina, which however, very radically depending on the political situations and economic fluctuations. Also, the domestic consumption of beef is tending to increase.

Table 3-5 Beef Commodities Weighing in Exports

Division	(1,000,000 GS FOB)					
	1972	1974	1975	1977	1979	1981
Total amount of exports	10,655	20,977	21,922	34,563	37,716	37,238
Beef commodities	4,190	4,921	4,263	3,465	1,478	856
%	39.2	23.4	19.4	10.0	3.9	2.3

Source: Boletín Estadístico No. 293 (Banco Central del Paraguay)

3.3.2 Structure and Form of Stock Raising

The form of ranch management in Paraguay mostly takes the manorial system peculiar to Latin America, and the family system of management of the company system of management adopted in the advanced nations is scarcely found. There are many fractionized pastures in the western Region, but the Eastern Region has many small-scale ranches.

The majority of these ranches are natural meadows enclosed by fences. The areas of management are vast, but are under the extensive control, and it is extremely rare to find ranches that are attempting to rationalize and modernize themselves by improving their breed and fodder.

Table 3-6 Number of Ranches by Scale of Feeding

Type of ranch	Head of cattle	No. of ranches	%
1. Self-supporting ranch	Up to 20	66,116	(77.72)
2. Ranch size specialized ranch	Up to 100	15,746	(18.5)
3. Small size specialized ranch	Up to 1,000	2,932	(3.4)
4. Large size specialized ranch	Over 1,000	279	(0.4)
Total	-	85,073	(100.0)

3.3.3 Varieties of Cows

Spanish people brought in Andaluza to Paraguay via Peru in 1568. This was the first introduction of cows to Paraguay. After then, various varieties of cows were introduced from European countries, and the native varieties came to be depended upon going through the process of weeding out by selection. Brahman and Nellore that belong

to the line of Zebu were introduced from America and Brasil after 1940, and there occurred grand scale crossing of them with the native varieties to produce varieties called Criollo that are resistant against piloplasma and heat.

The cows of the European line now introduced to Paraguay for the sake of improvement of beef cattle are Hereford, Aberdeen Angus, Charolais and Limousin, etc. Those coming from Brazil and Argentina are Nellore, Gir, Guzerat, Indo-Brazilian, Santa Gertrudis and Brahman.

3.3.4 Pastures and Their Usage

Ranch management in Paraguay is extensive in general with enclosed natural pastures but rotation and the improvement of grasslands are hardly performed. The capacity of pasturage varies greatly depending on the season, and its capacity goes down in winter as grasses wither away. This is the main feature of natural pasture.

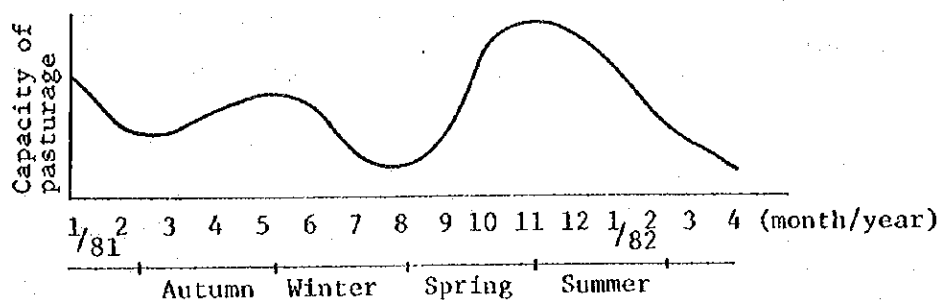


Fig. 3-3 Variation of the Capacity of Pasturage by Month (Type Graph)

Rotation is a method for effectively using grassland. However, since barbet-wire for enclosure is expensive in Paraguay, only the external fence alone is enclosed with it.

It is technically possible to process hay and silage during the spring when there is a large capacity of pasturage, but it is not commercially practicable in a country where the price of beef cattle is low and the prices of machines and fuel are high.

Some ranches are therefore trying to improve grasslands by introducing improved varieties of grass such as Pangora grass Colonial, Buffalo, Sudan grass, and Star grass, etc. The majority of ranches which make use of natural pastures try to ship 10 - 15% of total head of cows in order to cope with the decrease of pasturage during the winter. (Price of beef cattle hangs low in the autumn when the shipment of cows is intensified.)

Major grasses growing in the natural pastures are as follows:

Table 3-7

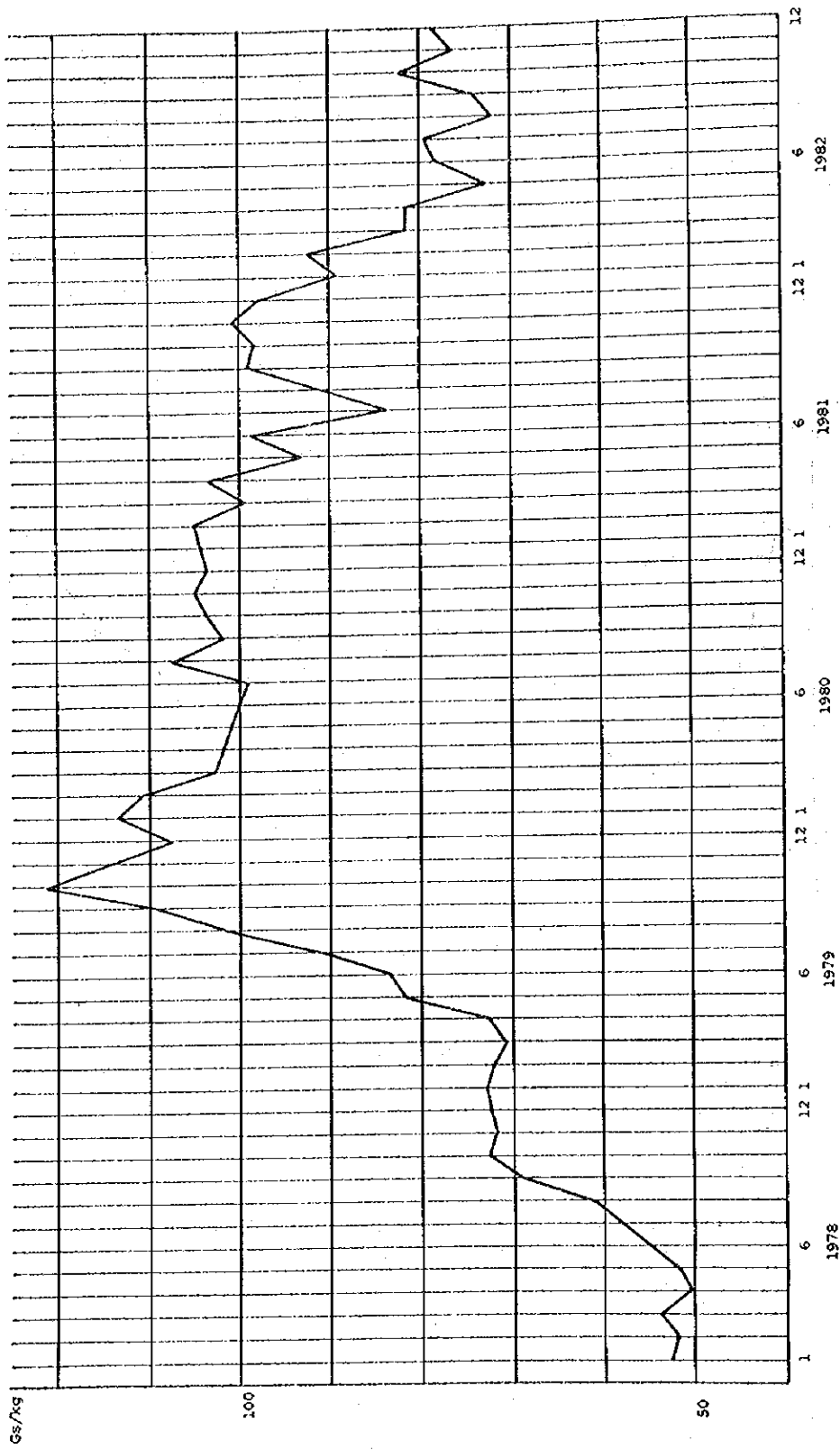
Paraguay name () is English name	Botanical name
1. Pasto Capi-i pe Cabayu (Bahia grass)	Paspalum Notatum
2. Pasto Tesuita (Carpet grass)	Axonopus Coonpresus
3. Capi-i Pyta	Andropogon Iateralis
4. Capi-i Pe-i (Bermuda grass)	Cynodon Dactylon

* There are no wild grasses in the pulse family that are suitable for improvement.



Source: Proniega Informe Anual 1981 (M.A.C.)

Fig. 3-4 Increased Weight of Cattle in Natural Pasture by Month (1981)



Source : SECRETARIA TECNICA de PLANIFICACION (M.A.G.)

FIG. 3-5 MARKET PRICE OF BULLOCKS GS/KG

3.4 Production Cooperatives

Based on the Union Act (Regulation No. 349), 161 cooperatives and 33,415 cooperative members are registered in the Cooperative Bureau of the Ministry of Agriculture and Livestock as of November 30, 1980.

Types of cooperative and cooperative's members in Paraguay and two departments concerned with the development shown in Table 3-7. These cooperatives established a federation such as Central Cooperativas Nacional (CREDICOOP), Union Paraguay de Cooperativas (UNPACO), Federacion de Cooperativas de Produccion (FECORROD) and Central Cooperativas Regional Oriente del Paraguay. Central Cooperativas Nacional mainly offers guidance relevant to agricultural production along with credit loan, accommodation of funds and agricultural management. Union Paraguay de Cooperativas is a federation of considerably large-scale unions that have circulation and processing facilities of agricultural products. Federation de Cooperativas de Produccion belongs to the German immigrants.

The organization of federations also offers guidance relevant to accommodation of funds, production techniques and cooperative activities.

The advancement of organizing agricultural cooperative associations is propelled by SEAG, CAH and BNF. In the settlements planned and implemented by IBR, the promotion of organizing agricultural cooperatives is propelled by IBR as a means to assist small-scale farmers to become self-supporting.

The management and activities of cooperatives are in general low-toned, excluding the unions organized by the immigrants from overseas. And the Government is trying to propel the formation of organizations of small-scale

farmers so that they will become independent in management. Itemization of the cooperatives by the scale of cooperative members is shown in Table 3-8.

From the standpoint of type, production cooperatives and transportation service cooperatives chiefly consist of medium size cooperative members, but saving credit cooperatives consist of large size and medium size cooperative members.

Among cooperative associations, production cooperatives have a number of cooperatives. Table 3-9 shows the itemization of production cooperatives by the varieties of cooperatives. As naturally expected, agricultural cooperatives stand at the top in the number of union and members, and Itapua Department occupies 25% of these totals in Paraguay.

There is also an farmer's organization called AUCA which is a sole agency to accept the credit from the Agricultural Credit Union. It is organized by 20 25 households of fermers. And extension workers in local offices of the Agricultural Credit Union offer scrupulous services of technical guidance to AUCA.

Table 3-8 Types of Cooperatives

As of November 30, 1980

	Paraguay			Total			Itapua		Misiones	
	Number of unions	Number of union members	Number of unions	Number of union members	Number of Unions	Number of union members	Number of union members	Number of unions	Number of union members	
Production cooperative	(59.0) 95	(33.7) 11,259	21	2,913	20	2,876	1	37		
Savings credit cooperatives	(30.4) 49	(60.9) 20,336	5	3,027	2	1,794	3	1,233		
Consumers' cooperatives	(5.6) 9	(4.5) 1,517	1	35	1	35	-	-		
Transportation service cooperatives	(5.0) 8	(0.9) 303	1	42	1	42	-	-		
Total	(100.0) 161	(100.0) 33,415	28	6,017	24	4,747	4	1,270		

Source: Direccion General de Cooperativa MAG

(Note) The number of union members of the following unions is unknown: 5 unions in production cooperative, 2 unions in consumers' cooperative, and 1 union in transportation service cooperative.

Table 3-9 Itemization of Cooperatives by
the Scale of Union Members

Scale of union members	Production cooperative (Unions)	Savings credit cooperatives (Unions)	Consumers' cooperatives (Unions)	Transportation service cooperatives (Unions)
Below 30	34	1	-	4
31 100	35	4	5	2
101 500	15	31	1	1
501 1,000	3	10	1	-
Over 1,001	3	3	-	-

Source: Direccion General de Cooperative MAG.

Table 3-10 Itemization of the Production Cooperatives

Items	Paraguay		Total		Itapua		Misiones	
	Number of unions	Number of union members	Number of unions	Number of union members	Number of Unions	Number of union members	Number of unions	Number of union members
Agriculture	72	10,587	19	2,880	18	2,843	1	37
Vegetable	4	79	-	-	-	-	-	-
Fruit	1	29	-	-	-	-	-	-
Stock raising	2	47	-	-	-	-	-	-
Poultry	2	17	-	-	-	-	-	-
Dairy farming	2	180	-	-	-	-	-	-
Wine manufacture	2	120	-	-	-	-	-	-
Forestry	6	150	1	18	1	18	-	-
Industry	4	50	1	15	1	15	-	-
Total	95	11,259	21	2,913	20	2,876	1	37

Source: Direccion General de Cooperative MAG

(Note) The number of union members of the following unions is unknown: One union each in agriculture, vegetable culture, poultry farming and industry.

3.5 Experimental Station, Research Institute and Extension Organizations

3.5.1 Organizations Relevant to Agriculture

The experimental stations, research institutes and extension organization belongs to the Department of Agriculture and Forestry Experiment and Department of Agriculture and Livestock extension under the Ministry of Agriculture and livestock. (Refer to Fig. 3-6) Experiments and research in agriculture are conducted by (Instituts Agnomico National I.A.N.) the National Agricultural Experimental Station at Caacupe in Cordillera Department. It is experimenting on the aptitude of cultivation of soybeans, cotton, tobacco, fruit trees, pasture grasses, cassava and peanuts. Its branch which performs the experiment of tobacco cultivation is located at Chore in San Pedro Department.

There is a regional agricultural experiment center (CRIA) at Capitan Miranda in Itapua Department. Requested by the Government, JICA is considering the importance of this area as an agricultural production zone, particularly the rich soil zone of teralasia by the Parana River, and dispatches its specialists in cultivation and soil, etc. to CRIA. CRIA mostly conducts experiments on the cultivation of soybeans, wheat and rice.

Regarding rice, the land of 151 ha was allotted to experiment at Eusebio Ayula in Cordillera Department in 1980, wherein aptitude experiment and selection experiment have been performed by importing fine varieties of rice from South America and Asia, etc. Also an experimental farm is provided at Carmen del Parana in Itapua Department, wherein the selection experiment of rice is going on by CRIR's staffs.

These institutes carry out cultivation and aptitude experiments in the main. They try to selected and fix

varieties by introducing fine varieties from overseas and various regions in Paraguay in order to establish a proper cultivation system. But the development of new varieties of seeds by breeding technique has not yet been performed. Besides the governmental organs mentioned above, there is the Paraguay Agricultural Experiment Station of JICA at Yaguazu (Alto Parana Department), which is conducting an experiment and extension to the Japanese immigrants and Paraguayan farmers around Yaguazu.

The Paraguay Agricultural Experiment Station of JICA has the farm of 116.5 ha, and its branch in Alto Parana Department has the farm of 100 ha.

These stations consist of 4 staff members and 2 specialists who are dispatched from Japan and 4 local staff members.

The principal contents of experimental research are: (1) Improvement and stabilization of beef cattle feeding. (2) Improvement of the productivity of upland farming, and the stabilization of production. (3) Improvement of the productivity of vegetables and the stabilization of production. (4) Maintenance and increase of the fertility of upland soil. This experiment station carries out on the cultivation experiment of rice and soybeans, etc. in cooperation with the national agricultural experiment station and the Regional agricultural experimental Center. Beside these bodies, there is the mechanization center at Caacupe in Cordillera Department, which has a duty of offering the training and guidance of agricultural machinery techniques. Also an agricultural machinery center was founded at Cema in Itapua Department in August 1982 by the cooperation with JICA.

Regarding the extension organs, there is SEAG which has Asuncion Central Office, with 11 local control offices and

105 local offices, in view of extending the techniques of agricultural management.

3.5.2 Organization Relevant to Livestock Farming

The central organization relevant to livestock farming is the Experiment Extension Bureau in the Ministry of Agriculture and Livestock, to which the following seven departments belong as its substructures, i.e. Department of Agriculture and Forestry Experiment, Department of Livestock Farming Experiment, Department of Livestock Farming Development, Poultry Farming Department, Bee Culture Department, and National Seeds Service. Agriculture and Livestock Epidemic Prevention Bureau which is responsible for the hygienic duties relevant to animals and plants has the following substructure, i.e. Department of Agricultural Epidemic Prevention (works on plant quarantine), Livestock Department of Epidemic Prevention (works on animal quarantine), Department of Epidemic Prevention Survey Research (works on the survey of the causes of diseases and vaccine inspection), and Slaughterhouse Inspection Bureau, etc.

1) Department of Livestock Farming Development

This department which is responsible for the part of development sector in the livestock promotion project in Paraguay has its office in Asuncion, and controls the Livestock Artificial Insemination Center and Barrerito Experiment farm. Its main duties consist of granting permits for selling semen produced in this center and pasture and baby cows born here, and handling accounting.

In Barrerito Experiment farm, which is of the size of 10,000 ha, 7,000 heads consisting of Nellore,

Brahman, Santa Gertrudis varieties, are fed out. This governmental farm distributes newly born cows as seed bulls throughout the country and it conducts the aptitude survey, breeding and the survey of the yield of pasture grass, etc. Also, this farm has a huge project of training 30 - 40 artificial inseminators every year.

It is still at a beginning stage as a national project, but the training and the test of productivity are performed by using 700 sheep of Corriedale Hampshire varieties (2,000 sheep in the final project).

The Centro de Inseminacion Artificial (A.I. Center) is located at San Lorenzo which is 12 km far from Asuncion. It stands next to the Asuncion National Veterinary College.

The A.I. Center feeds 15 varieties of seed bulls, collects semen twice a week, manufactures semen in granulated form, distributes it to farmers and diary farmers, and gives guidance relevant to crossing, etc. (improvement of the physical conditions of cows, establishment of a law relevant to the prevention and removal of diseases related to reproduction and improvement of breeding, etc.)

Servicio Nacional de Salud Animal (SENACSA) was founded by the Regulation No. 1267 on September 9, 1967. It was formerly an organ that worked on the measures of mouth and foot disease, and performs a project by BIDS's accommodation of funds. It is not under the direct line of the Ministry of Agriculture and Livestock, but it is functionally tied to it, and performs reserarch, survey and epidemic prevention activities of four diseases, i.e. mouth and foot disease T.B., Bullsela and rabies in cooperation with the neighbouring countries.

(Réference)

Asuncion University

Besides the education of students, Asuncion University conducts experimental research and extension guidance. Professors of this university offer the program of travelling college several times a year for the small-scale farmers. The University thus performs activities which are strongly tied up with the farmers by way of offering lectures and practical guidance. This is due to the reasons that the absolute number of technicians is deficient, but actually the idea of industry-university cooperation is quite fitting to the reality of this country. The educational method is also strongly tied with the farmers. They have established a system for the senior students to practise in the appointed farm for a long period, so that they can gain immediately useful capacities by experiencing the realities of livestock farming. This is, on the other hand, an educational method yielding an advantage of extending new knowledge and techniques to the farmers.

3.6 Land Utilization

3.6.1 Land Utilization in Paraguay

(1) Outline

Paraguay has a suitable agricultural condition in terms of temperature, precipitation, topography, and soil. Her recent agricultural land development shows a great growth. The agricultural land for cultivation occupied 953,000 ha in 1971, but in 1979 it became 1,780,000 ha. The growth rate reached 187% during 9 years, especially, since 1975, more than 100,000 ha of the agricultural land for cultivation has been increasing each year.

Further, the grassland area has increased 130% in the same period. This clearly indicates the significant growth rate of the agricultural land development.

However, the percentage of the agricultural land for cultivation in Paraguay is still only 4.4% in 1979. Even if it is compared with the suitable agricultural area ratio of 22% (approx. 9,000,000 ha) figured by the Ministry of Agriculture and Livestock, at present only 19% of the suitable agricultural land for cultivation is used for the purpose. Therefore, a large scale agricultural land development will be expected.

(2) Agricultural land

The following table shows the growth history of the land use in each fiscal year.

Table 3-11 The Land Utilization

1,000 ha

Fiscal year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Item										
Single year crop				799	1,193		1,392	1,475	1,604	
Vegetable				5	5	-	5	5	6	
Permanent crop	953	953	958	155	156	-	167	170	170	
Sub total	953	953	958	959	1,354	-	1,564	1,650	1,780	
Pasture	14,849	14,849	14,849	14,849	15,644	-	15,653	17,041	17,291	
Forest	23,929	23,929	23,924	23,924	22,725	-	22,504	21,030	20,643	
Water surface and others	944	944	944	944	954	-	953	954	960	
Total	40,675	40,675	40,675	40,675	40,675	40,675	40,675	40,675	40,675	40,675

MAG ENCUESTA AGROPECUARIA POR MUESTREO
 Not surveyed in 1976.
 Not publicized in 1980.

As shown in the table, the agricultural land for single year crop has made a significant growth. Its area of about 800,000 ha in 1974 has become 1,600,000 ha during five years, which is 200% increase.

The main reason for this growth is that in the major crops the soybean became 8.7 times of the original level, and the cotton became 7.8 times, and the corn with large cropping area, has become twice of the area in 1971, that is, from 190,000 ha to 376,000 ha in 1980.

These crops were included in the encouraged crops as a part of the development policy of the agricultural process industries enforced since 1971. It is considered that the policy has shown the actual effect with the preferential loan program to these crops by the National Hypothec Bank.

National Program for Soybean	(Programa Nacional de Soja)
National Program for Tobacco	(Programa Nacional de Tabacco)
National Program for Cotton	(Programa Nacional de Algodon)
National Program for Wheat	(Programa Nacional de Trigo)
National Program for Grassland Development	(Programa de Desarrollo Ganadero)

National wheat program seems to be focusing on the yield increase plan as the second crop after the soybean. However, there is difficulty to increase the cropping area due to the damage caused by various diseases, and the precipitation and frost at the harvesting time. Since the history of the wheat cropping is rather short, the regional agricultural experimental center (CRIA) has been engaged in the stabilization of the wheat cropping as the important project. The early introduction of the better varieties is expected.

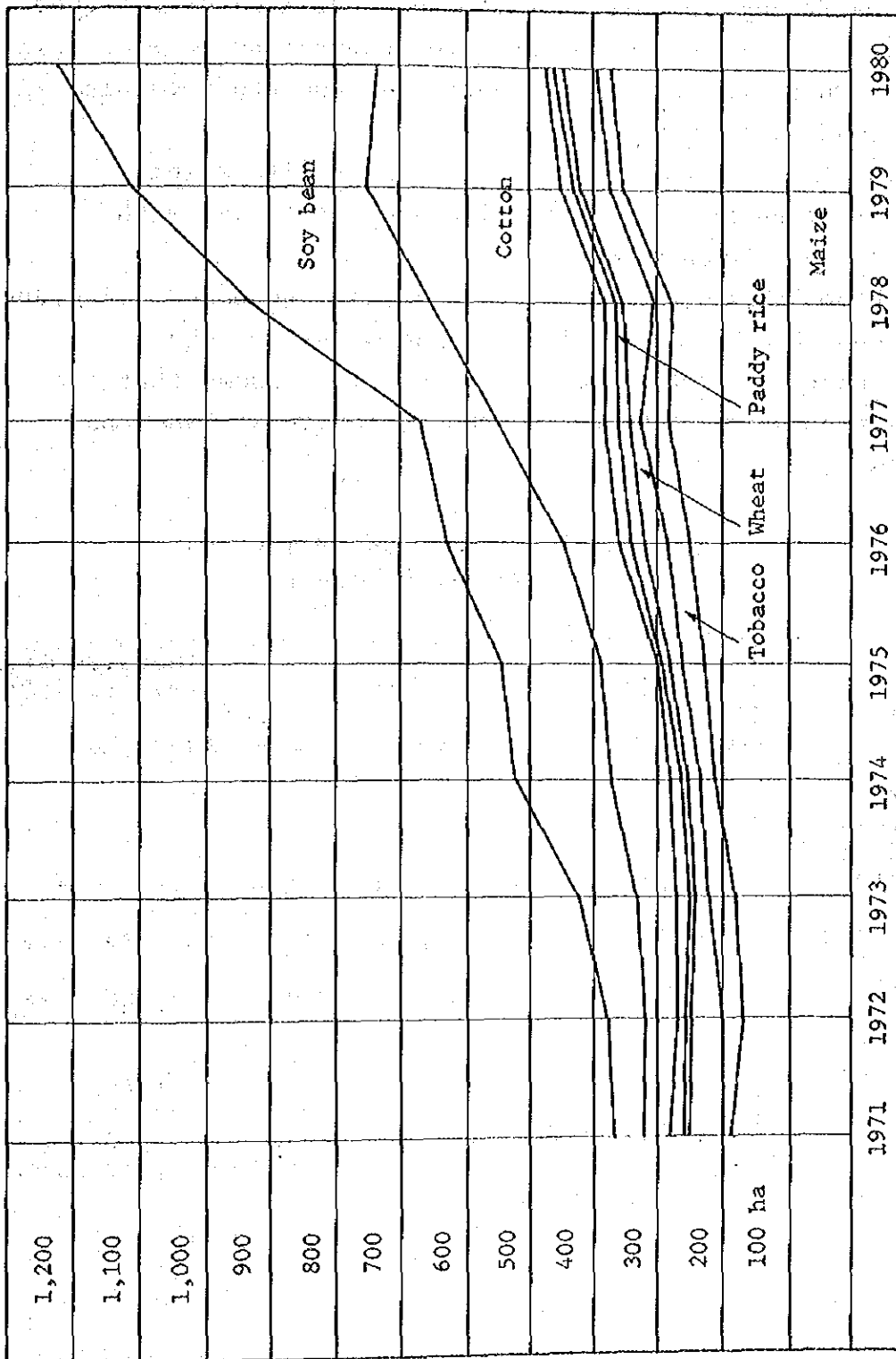


Fig. 3-7 Cultivated Area for Major Single Year Crop

(3) Pasturage

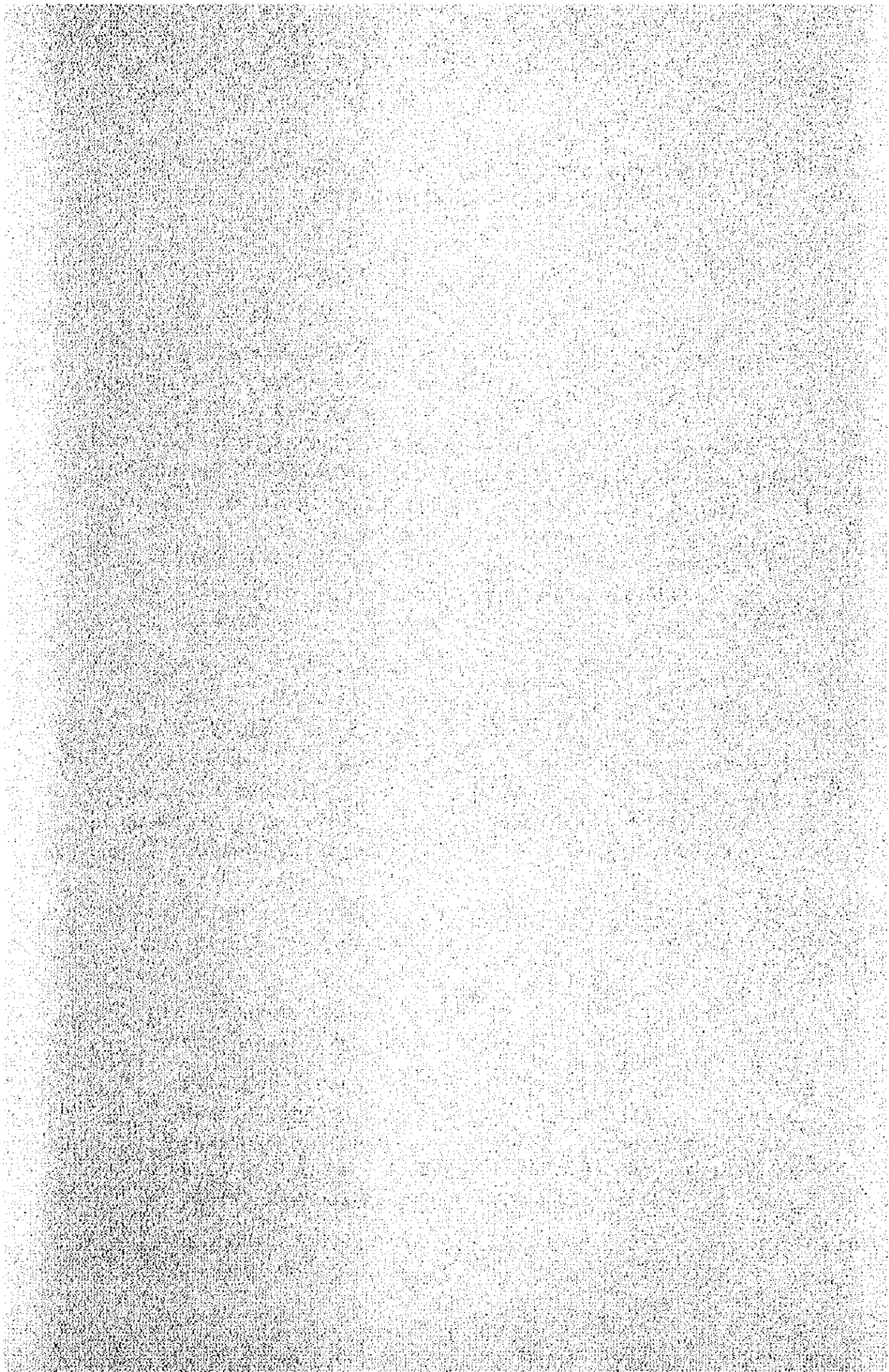
The pasturage occupies 40% of the total area of Paraguay where the climate is suitable for stock-farming with rain and high humidity, and it shows that the stock-farming is the leading industry.

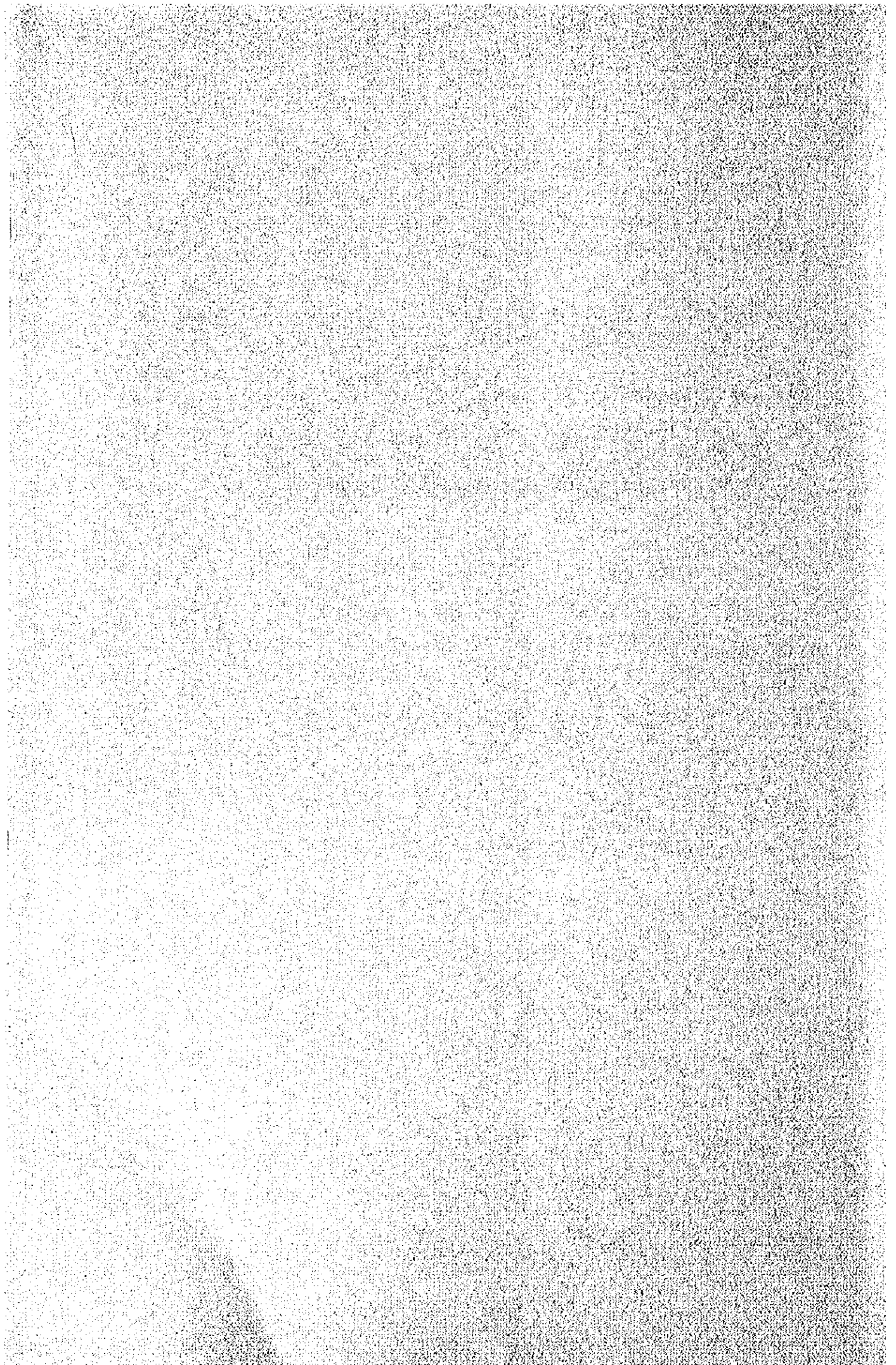
The most parturage of is the grassland with mainly Espatillo and partially the improved grassland with Setaria and Pangola grass.

In these 10 years the pasture area has increased 2,442,000 ha, and this is three times of the growth of the agricultural land for cultivation. This shows that the forest has been shifting to the agricultural land and pasturage.

Table 3-12 Transition of The Land Use in Paraguay

	1971		1979		Increase from 1971 to 1979	
	1,000 ha	%	1,000 ha	%	1,000 ha	%
Agricultural land for cultivation	953	2.3	1,780	4.4	+ 827	+ 2.1
Pasturage	14,849	36.5	17,291	42.5	+ 2,442	+ 6.0
Forest	23,929	58.8	20,643	50.8	3,286	8.1
Rice field and others	944	2.3	960	2.3	+ 16	0
Total	40,675	100.0	40,675	100.0	0	





CHAPTER 4 THE YACYRETA DAM AND THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT

4.1 Outline of Yacyreta Dam

4.1.1 Location

The construction site of Yacyreta Dam is located near Ayolas, about 80 km downstream of the Parana River from Encarnacion in Paraguay and Posadas in Argentina. The main dam will close the Parana River at the downstream portion of Yacyreta Island. The right bank will consist of the main embankment which runs all the way to San Cosme y Danián. The equalizing dam is planned to be located 80 km downstream from Yacyreta Dam at the line connecting Coronel Panchito Lopez in Paraguay and Ita Ibate in Argentina (see Fig. 4-1).

4.1.2 Outline of the project

The main purpose of the construction of Yacyreta Dam is the generation of electricity, but at the same time, the development of a transportation system using the navigation of 2,000 ton class ships in the Parana River is also planned. In this connection, the construction of Ita Ibate Dam is planned on the downstream side of Yacyreta Dam to equalize the downstream water level of the Yacyreta Dam. There is also a plan to taking irrigation water at 108 m³/sec (maximum) from Yacyreta Dam by Paraguay and Argentina, respectively.

(1) Various features of the Parana River in the vicinity of the Yacyreta Island

Catchment area	975,000 km ²
Mean discharge	11,720 m ³ /sec
Past maximum flood	45,000 m ³ /sec (in 1905)
Past minimum discharge	5,293 m ³ /sec (in 1980)
Design maximum flood	95,000 m ³ /sec

(2) Principal dimensions of the Yacyreta Dam

Table 4-1

Name of Dam Dimensions	Yacyreta Dam	Ita Ibate Dam
Full water area (km ²)	1,720	800
Storage capacity (million m ³)	21,000	2,180
Normal water level (m)	E.L. 82.0	E.L. 59.0
Maximum water level	E.L. 84.5	E.L. 64.8 (95,000 m ³ /sec at the time of dis- charge)
Length of the main embankment (km)	69.6	9.75
Crest elevation (m)	E.L. 86.0	66.5
Maximum crest height (from the foundation)	33.0	30.0
Maximum discharge (m ³ /sec)	95,000 Main river 55,000 Ana-Cua branch river 40,000	95,000
Capacity of the embankment (filles section) (4m ³)	57,900	7,259
Capacity of the embankment (concrete section) (4m ³)	3,300	599

(3) Navigation lock (planned in Yacyreta, Ita Ibate Dam respectively)

Width	27.0 m
Length	270.0 m
Maximum water depth	3.65 m
Water level difference at Yacyreta Dam	24.0 m
Water level difference at Ita Ibate Dam	8.0 m

(4) Electric generation

Maximum water head	24.4 m
Minimum water head	17.0 m
Normal output (First stage)	2,700 4KW
Number of generators (First stage)	20
Type of turbine	Kaplan
Diameter of turbine	9.50 m
Electric output at 20 m head	125 HW
Rotation number	71.4 rpm
Generator	13.2 KV, 3 phase, 50 Hz
Normal electric generation	135 MW
Efficiency	0.9

(5) Intake for irrigation

1) Paraguay side :

Maximum intake	108 m ³ /sec
Area (only irrigation area based on the outline of Yacyreta Dam)	100,000 ha

2) Argentina side :

Maximum intake	108 m ³ /sec
Area	6,000 ha

(6) Prevention of water inundation

In order to prevent impounding of water in the three tributary rivers of the Parana River by the construction of the dam (i.e., Aguapey, Tacuari, and Caraguata Rivers, located upstream of the dam con-

struction site and draining into the right bank of the Parana River,) the construction of embankments is planned near their mouths for the drainage of water by pump.

(7) Compensation work

1) Paraguay side

Railroad (including related facilities) $\ell = 93.4$ km
 Harbor (including related facilities) Whole set
 Road and bridge $\ell = 8$ km
 Sanitary facilities, electric facilities, telephone facilities, and others.

2) Argentina side

Railroad (including related facilities) $\ell = 31$ km
 Harbor (including related facilities) Whole set
 Road and bridge $\ell = 9.5$ km
 Sanitary facilities, electric facilities, telephone facilities, and others.

(8) Relocation compensation

Table 4-2

	Paraguay	Argentina	Total
Number of houses	3,132	4,100	7,232
Number of families	2,990	4,257	7,247
Number of affected persons	14,556	18,440	32,996

4.1.3 Organization executing the project

The construction of Yacyreta Dam will be executed by the Yacyreta Public Corporation (Entidad Binacional

Yacyreta) established in 1974 by the agreement of the "Yacyreta Treaty" between Paraguay and Argentina. The corporation is responsible for the investigation, design, construction and management of the project and offices are located in both Paraguay and Argentina. The main office in Paraguay is located in Asuncion and the site offices at Encarnacion and Ayolas.

4.1.4 Construction schedule of Yacyreta Dam

The original construction schedule of Yacyreta Dam is as shown in Fig. 4-2. The construction was planned to start in November 1979 and to be completed in November 1989. However, the awarding of the contract has been delayed because of some procedural problems after the bidding for the construction work of the dam body. Agreement was reached for the restart of the construction work in December 1982 and there is the prospect that the work will start again in the latter part of 1983. Modifications to the construction schedule are now being made.

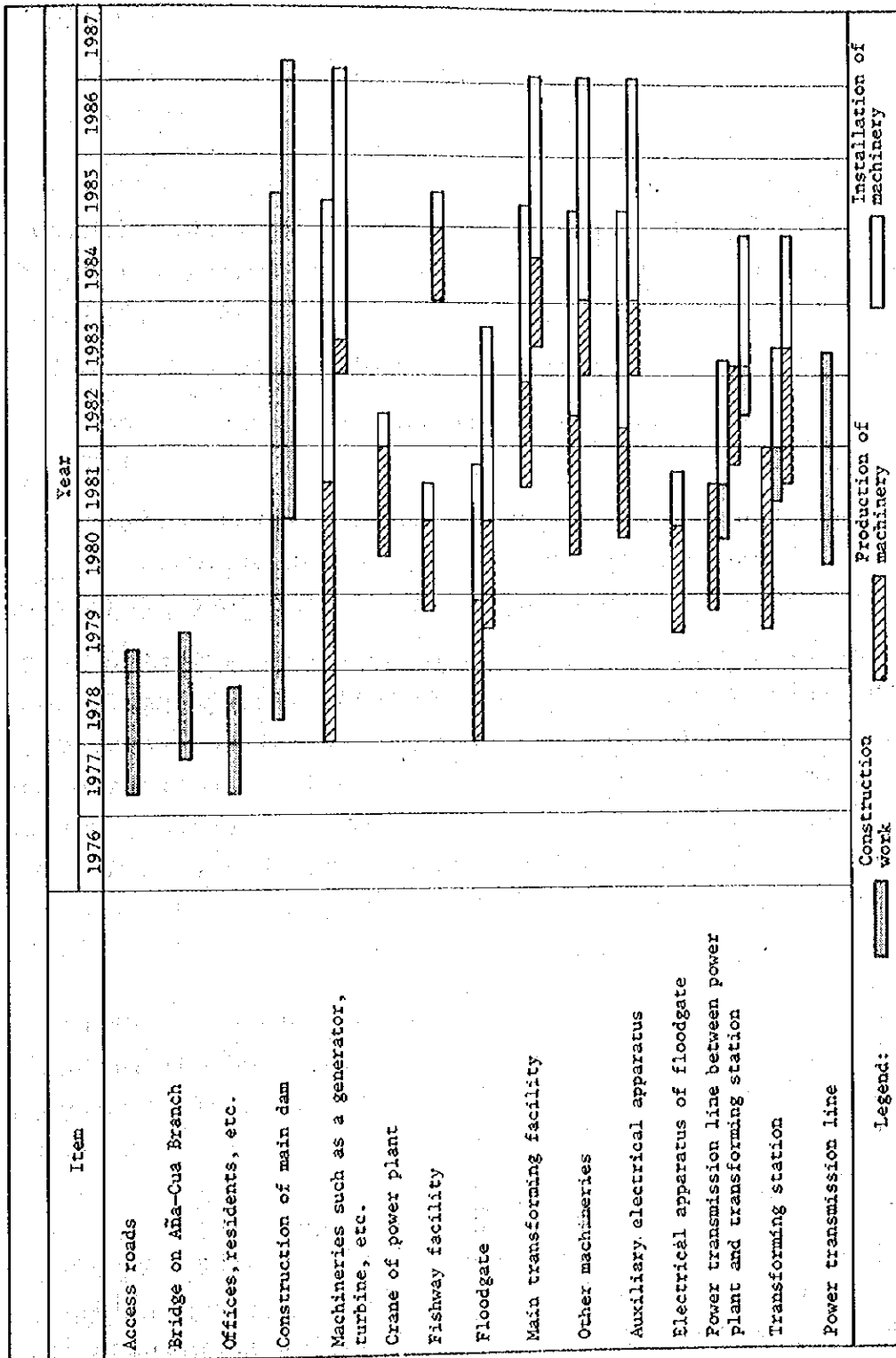
4.1.5 Progress of the construction work

The preparation work for Yacyreta Dam has progressed smoothly since 1978 and as of January 1983 most important temporary and preparatory work has been completed in Paraguay.

Preparation work is also in progress in Argentina to attain a level of work similar to that of Paraguay. Construction facilities which have been completed in Paraguay are as follows :

(1) Roads and bridges :

- 1) National road Route 1 ~ Ayolas
(Asphaltic pavement) $l = 45 \text{ km}$
- 2) Ayolas ~ Yacyreta Island
(Asphaltic pavement) $l = 4 \text{ km}$



Note: In accordance with Yacyreta Public Corporation data.

Fig. 4-2 Implementation Schedule

- 3) National road Route 1 ~ San Cosme y Damián
 $l = 27 \text{ km}$
 - 4) Ana Cua Bridge (a bridge to Yacyreta Island)
 $l = 1.6 \text{ km}$
- (2) Others :
- 1) Airport, Asphaltic pavement of a runway (which resists takeoff and landing of Boeing 737 class)
 $l = 1,850 \text{ m}$
 - 2) Houses for staff of Yacyreta 254
 - 3) Public corporation houses for engineer and labor concerned 1,000
 - 4) Educational and sporting facilities, clinic, Yacyreta Dam Public Corporation office, water service, electricity, telephone facilities.

Out of approximately 15 items which are expected to go for the international bidding, the following equipment contracts, in addition to the preparation work, have already been awarded. Generator, main sluice gate, main transformer, sluice gate for a fish ladder, wire for a generator, switchgear for gas insulation, low pressure switchgear, and control board.

4.2 Integrated Agricultural Project

The calculation of a maximum water intake of $108 \text{ m}^3/\text{sec}$ for irrigation on Paraguay in the Yacyreta Dam project is based on the report from the consultant, Harza-lahmeyer, as follows :

4.2.1 Agricultural development area

According to the general description of the dam project, the agricultural development area in Paraguay is 100,000 ha and the maximum water intake for irrigation is $108 \text{ m}^3/\text{sec}$, however, agricultural development area is

140,000 ha. Planned area for each agricultural crop is as follows :

Table 4-3

Proposed cultivated crop	Gross area (ha)	Net area (ha)
Rice	56,000	50,000
General crop	10,000	9,000
Irrigated pasture	24,000	22,000
Improved pasture (Drainage only)	50,000	45,000
Total	140,000	126,000

The agricultural development, irrigation is expected for 50,000 ha of paddy field, 9,000 ha of upland field, and 22,000 ha of irrigated pasture, leading to the total irrigation area of 81,000 ha.

The area of 72,000 ha for paddy field and irrigated pasture combined is based on the assumption of a rotation of rice and pasture with the ratio of rice and pasture being 7 to 3. Irrigation for rice and irrigated pasture will be done by gravity. Upland crops include peanuts, tomatoes, small vegetables, tobacco, potatoes, sorghum, grapefruits, green manure and others. Upland crops are planned to be irrigated by a sprinkler irrigation method.

4.2.2 Calculation of irrigation water

Monthly mean rainfall was calculated based on the meteorological data for 32 years from 1940 to 1971 at Encarnacion and 80% of each monthly rainfall was taken as probable rainfall. Evapotranspiration and consumptive water use by each crop were calculated by the Blaney-Criddle formula (USDA Soil Conservation Service.). Water requirement was calculated for each crop by obtaining the consumptive water use for each month in the growing period and sub-

tracting the effective rainfall for the month. Required irrigation water for each month is as follows :

Table 4-4

Month	Required water (million m ³)
January	144.2
February	78.9
March	50.8
April	14.0
May	1.9
June	0.2
July	2.5
August	11.6
September	12.6
October	29.1
November	85.3
December	146.3
Total	577.5

Note: Area concerned
Gross area
90,000 ha.
Irrigated area
81,000 ha.

4.2.3. Maximum water intake of 108 m³/sec

The maximum water requirement per ha at the peak calculated based on the irrigation interval for each crop is 1.35 l/sec/ha for the rice and irrigated pasture and 1.19 l/sec/ha for the upland crop, and the peak season is January and December, respectively. The calculation uses the irrigation efficiency of 0.7 and the canal loss of 0.1. The irrigation system was planned to employ concrete lining but the report remarks on the necessity for the examination of lower cost irrigation canals. The maximum water intake is :

Rice and pasture (irrigated) area	72,000 ha	97.4 m ³ /sec
General crop area	9,000 ha	10.7 m ³ /sec
Total		108.1 m ³ /sec

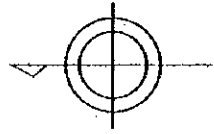
Thus, the maximum water intake came out to 108 m³/sec.

4.3 Water Intake Facilities

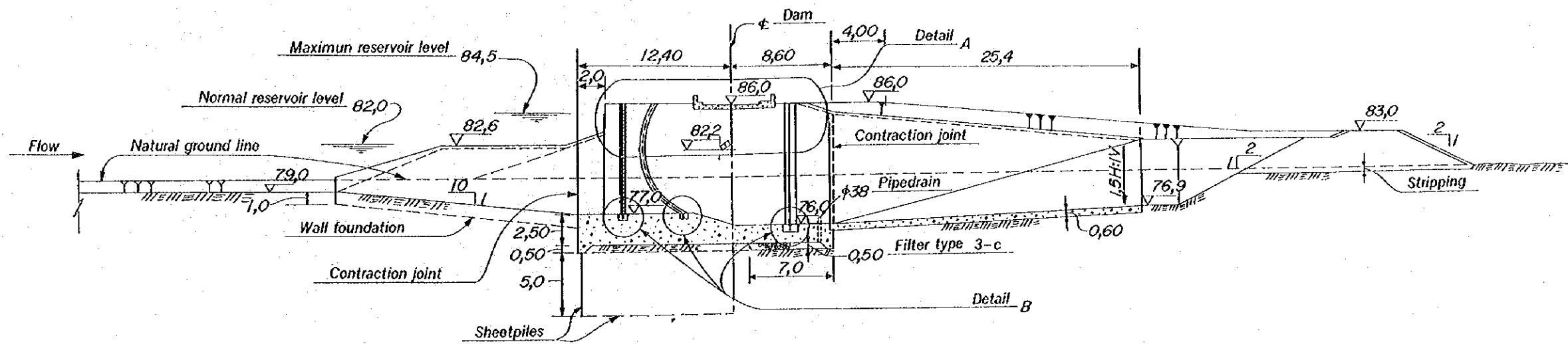
According to the water intake facility plan in the dam project, the facility is planned to be located on high ground in San Cosme y Damián where the main embankment along the right bank of the Parana River ends. The intake facility will be constructed at Km 6 + 171 of the dam body. The front part of the intake facility which has an elevation of about 80 m will be excavated to a depth of EL 79.0 m so that water would be guided and flow at right angles to the dam embankment. The intake facility is concrete structure with sheet pile cutoff walls and provided with three sluices each with a width of 8 m. (See Fig. 4-3, Fig. 4-4) The intake of water is planned at the high water level of 82 m. The Maximum flood water level is 84.5 m and the elevation at the bottom of the sluice is EL 77.0 m. The dam project includes the intake facility only and the sedimentation basin, main canal, and the division work are not in the plan.

4.4 Borrow Pit of Embankment Materials and Drain system on the Right Bank

On the right bank of the Parana River (Paraguay side) an area with a width of 1,000 m measured outside from the center line of the embankment has been secured for the planned dam site. The embankment material is planned to be excavated to a width of 300 m within the 1,000m-wide dam site but no exact location of the borrow pit has been determined yet. According to the standard cross-section map, the drain channel for seepage from the dam body and the drainage canal are planned at the center of the 300m-wide borrow pit. A detailed cross-section and longitudinal cross-section of the drainage canal, and the data which show the relationship between this drainage canal and other adjacent small rivers and existing drainage canal have to be prepared in the 2nd year survey.



Irrigation Intake



4.5 Influence of the Equalizing Reservoir

The equalizing dam will be constructed about 80 km downstream from the Yacyreta Dam. The main dimensions of the dam are given in 4.1.2. The Ita Ibate Dam, with a high water level of EL 59.0 m and the maximum water level of 64.8 m, affects to the area which extends about 2 km downstream from the confluence of the Atinguy River and the Parana River. Since the maximum water level of EL 64.8 m will be reached only when the maximum design flood of 95,000 m³/sec is discharged, it is estimated that the water level will not rise to that height during normal floods. However, this water level will change depending on the method of flood control of the equalizing reservoir (Ita Ibate Dam). The water level of the equalizing reservoir at the time of floods will change depending on the amount of discharge at the Yacyreta Dam and the Ita Ibate Dam and greatly affects the drainage of tributary rivers emptying into the Parana River, particularly, the Yabebyry River.

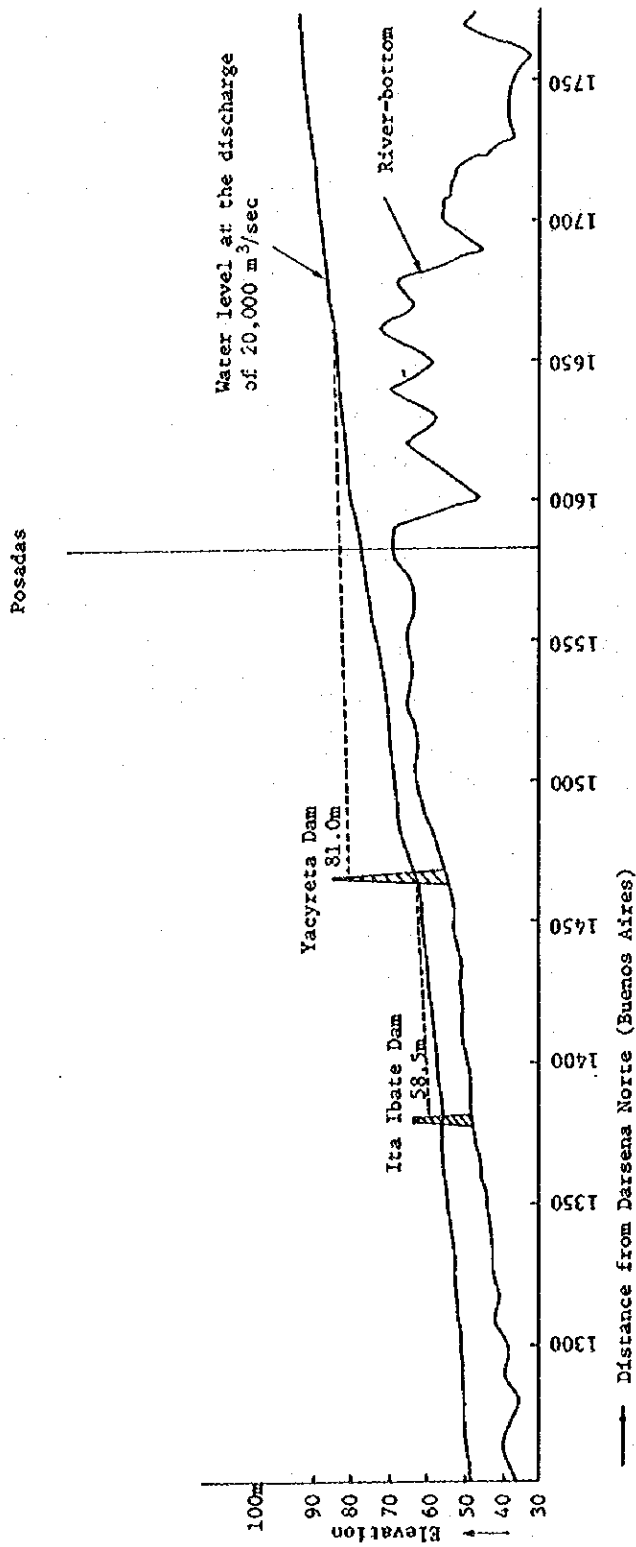


Fig. 4-5 River Gradient of Parana River and the Water Level at the Discharge of 20,000 m³/sec.

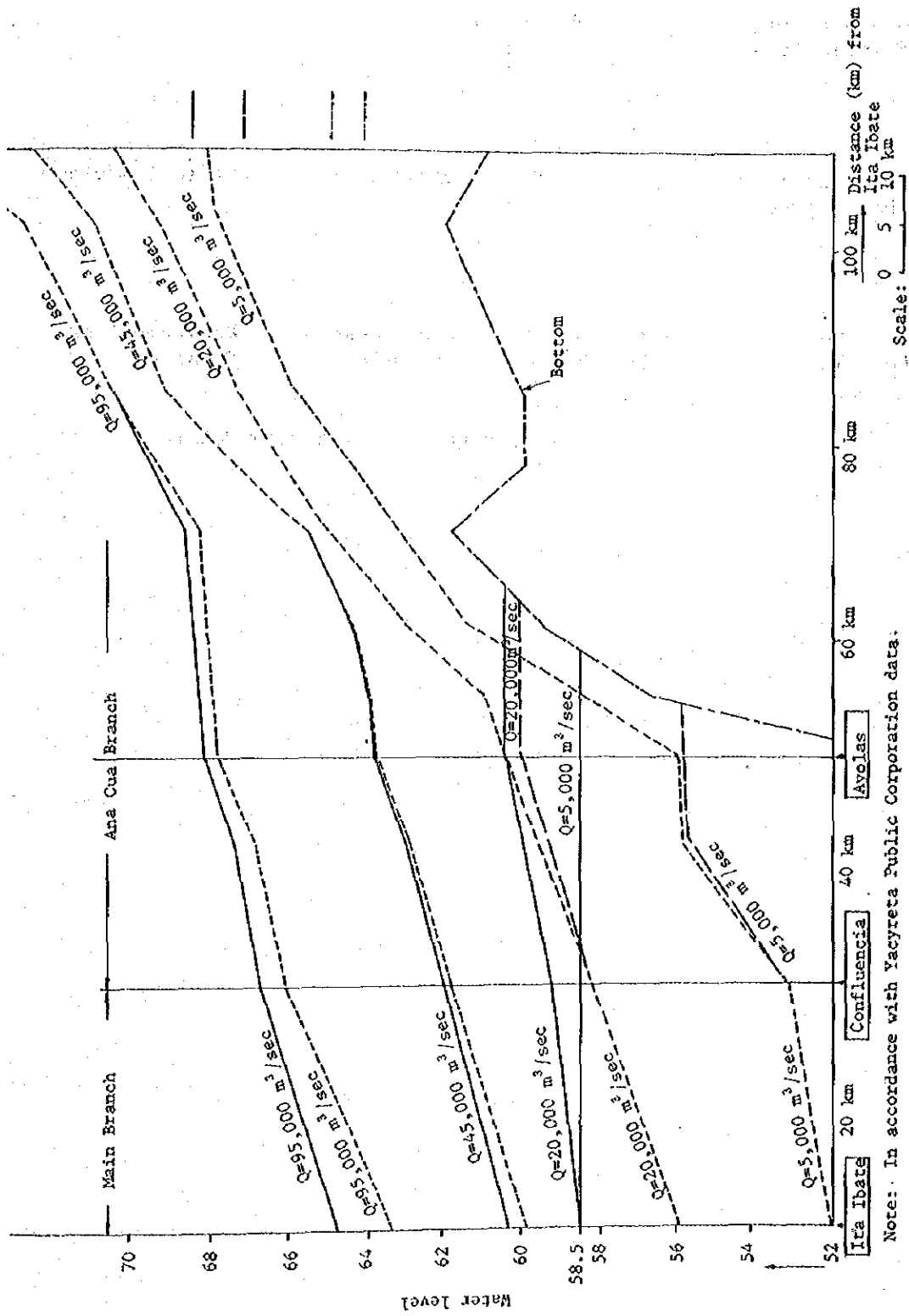


Fig. 4-6 Influence of Ita Ibaté Reservoir

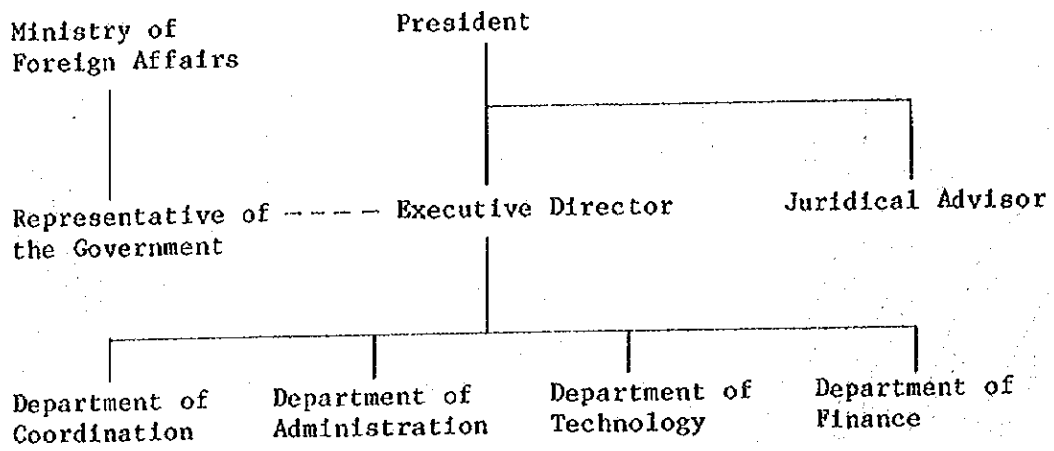


Fig. 4-7 Organization Chart of Yacyreta Public Corporation

