JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

No. 3

MINISTRY OF AGRICULTURE AND LIVESTOCK
THE REPUBLIC OF PARAGUAY

THE MASTER PLAN STUDY
ON
THE INTEGRATED AGRICULTURAL AND LIVESTOCK DEVELOPMENT PROJECT
AT
LOWER CHACO
IN
THE REPUBLIC OF PARAGUAY

FINAL REPORT
(MAIN REPORT)

MARCH 1994

JAPAN AGRICULTURAL LAND DEVELOPMENT AGENCY
(JALDA)

PREFACE

In response to a request from the government of the Republic of Paraguay, the government of Japan decided to conduct a study on the Integrated Agricultural and Livestock Development Project at Lower Chaco in that country, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team headed by Hisashi Terakado of the Japan Agricultural Land Development Agency to the local site on four occasions between October 1991 and August 1993.

The team held discussions with the officials concerned of the government of Paraguay, and conducted field surveys in the plan target area. After the team returned to Japan, further studies were made and the present report was completed.

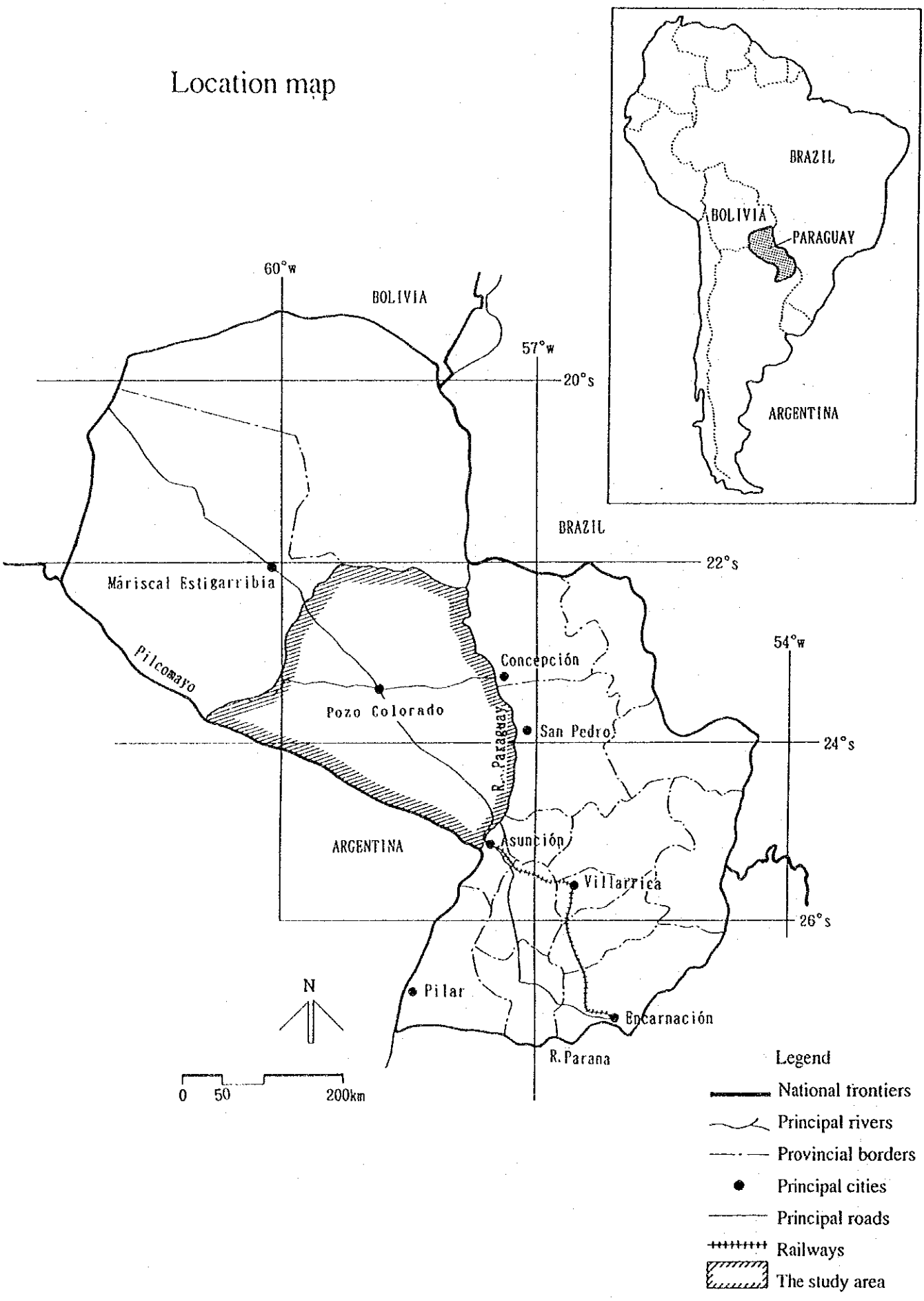
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to all those who extended their cooperation and support to the team.

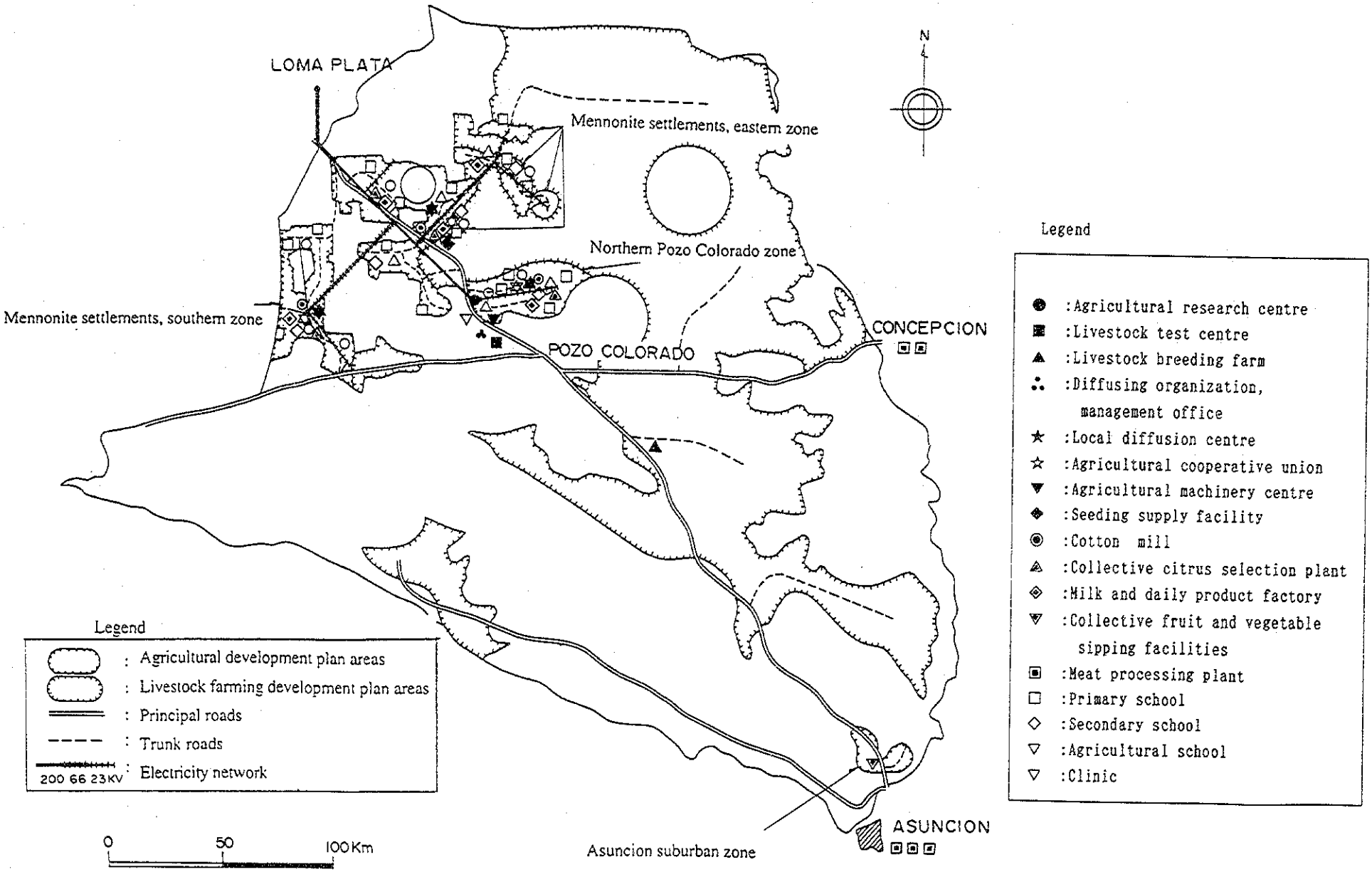
March 1994

Kensuke Yanagiya
President
Japan International Cooperation Agency

Location map



General plan



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OUTLINE

OUTLINE

1. BACKGROUND AND PURPOSE OF THE STUDY

As one means of implementing policies for its short-term 2-year socio-economic development plan of 1989-90, Paraguay is aiming to improve productivity and environmental conservation in its eastern part (which is already developed), while aiming to contribute to a balanced development of land, an increased production of export crops, and measures for small farming by promoting development in the western Chaco region.

Thus it was that in May 1990 the government of Paraguay requested the assistance of the Japanese government in formulating an Integrated Agriculture and Livestock Development Project at Lower Chaco in the Republic of Paraguay. In response to this, the Japanese government in December 1990 signed a scope of work with the Paraguayan Ministry of Agriculture and Livestock to implement the "Study for an Integrated Agriculture and Livestock Development Project at Lower Chaco in the Republic of Paraguay", and the study was started in October 1991.

The purpose of this study is to create an Agricultural Master Plan for the area corresponding to the Lower Chaco Region of Paraguay (i.e. the whole of Departamento Presidente Hayes).

2. AN INTRODUCTION TO PARAGUAY

1) Natural environment

Paraguay is a land-locked country with a total area of 407,000 km^2. It lies more or less in the centre of the South American continent, and is surrounded by Brazil, Bolivia, and Argentina.

The Rio Paraguay runs down the centre of the country from north to south, dividing it into eastern and western parts. In general, the eastern part comprises a topography of plains and gentle undulating hills, with forests of tall-standing trees. The western part, in other words the Chaco region, accounts for 60% of the total land area, and has an extremely flat topography with plains sloping very gently downwards towards the east. The forests in this region consist of low-lying trees and scrub.

The climate is tropical in the north of the country and semi-tropical in the south.

2) Current social situation

As of 1991, the population of Paraguay stood at about 4 million, with a population density of 10.5 per km^2. The population is extremely unevenly distributed towards the east, where the density is 26.3 per km^2, compared to 0.27 in the western region.

The special characteristic of Paraguayan society is that the culture and language of the indigenous Guarani people are respected, and are harmoniously integrated with the culture brought over by the Spanish. This is known as "Guarani-Spanish Culture", and forms the foundation of Paraguayan society.

3) Current economic situation

Paraguay is a rural country that has made agriculture and livestock farming the pillars of its national economy. After achieving historic economic growth in the 1970's, from the early 1980's economic activity started to slump little by little. This depressed Paraguayan economy is being propped up, as ever, by its agriculture and livestock farming sectors. However, the Paraguayan economy, with its heavy dependence on the two international commodities of cotton and soya beans, is highly vulnerable to external factors.

4) National development plan

The 1989-90 Emergency Socio-Economic Development Plan, which gave guidelines for economic management by the new government after the change of regime in 1989, is the most recent national development plan. In addition, for agriculture and livestock farming, the "Guidelines to Agricultural Policy" were formulated in early 1991. Particularly characteristic of this is the realistic recognition that the burden of agricultural work is borne by corporate farmers groups, traditional medium and small cash-crop producing farmers groups, and two types of small farmers groups (namely landowning and non-landowning).

5) The current state of agriculture and livestock farming

(1) Agriculture

Agriculture forms the pillar of Paraguay's national economy, and in 1990 accounted for 17% of its GDP. Moreover, exports are based around agricultural produce, the two big export commodities (cotton and soybeans) accounting for 62% of the monetary amount in 1992. Farm land takes up 10.8% of the country, the majority of this (exclusively short-term crops such as cotton, soybeans, maize, and others) being concentrated in the eastern part.

(2) Livestock farming

Livestock farming accounted for about 8% of the country's GDP in 1990, representing

28% of that in the agricultural and livestock farming sectors. Thus, alongside agriculture, this is a vital industry. About half of the national land is used for beef cattle rearing. According to an agricultural and livestock farming consensus taken in 1991, 7,627,000 head of cattle were being reared at that time, showing that beef cattle farming bears an important role in terms of the country's economy and land utilization.

(3) Forestry

The speed at which forests are disappearing in Paraguay has doubled from an annual figure of 200,000 ha over the last two years, and it is claimed that, if this trend were to continue, all forests would be wiped out in twenty years' time.

The destruction of the forests is mainly due to a conversion to livestock farming, the felling and shipment of pulpwood logs for the lumber industry, and the cutting of firewood.

6) International relations

(1) MERCOSUR (South American common market)

MERCOSUR has the objective of establishing a common economic sphere in order to promote economic and social development within a given area (Argentina, Brazil, Paraguay, Uruguay). An agreement to this end was signed in March 1991 and came into effect in November. A deadline of December 1994 has been set for the abolition of tariffs on virtually all products within the area. As far as Paraguayan agricultural products are concerned, this is expected to have an impact on sugarcane and others, though it will not effect the main export commodities of cotton and soybeans.

3. AN OUTLINE OF THE STUDY AREA

1) Natural conditions

The study area is in the south of Paraguay Chaco (corresponding to the Departamento Presidente Hayes in terms of administrative districts). It has an area of 73,000 km^2 and an extremely flat topography.

The average annual temperature is between 23.1 and 24.6°C, while the average annual rainfall is around 1,350 mm in the eastern part of the area and about 700mm in the west, showing an uneven distribution.

2) Current social and economic conditions

(1) History

Although Lower Chaco has been Paraguayan territory since before the Chaco War, the history of its development is still comparatively recent, starting with tannin extraction activity from around the end of the 19th century. Agricultural and livestock farming activity also started up around that time, and colonization by the Mennonite people was started in 1927. This marked the start of development in agricultural and livestock farming sectors in Chaco. Then in 1961 the Trans-Chaco Highway, the great central artery connecting east and west, was opened. This highway is of great significance as the motivating force behind the development of the western region.

Meanwhile, the Chaco area is controlled by the military, for both historical and administrative reasons.

(2) Society and culture

The western region (Chaco) is an area where population is sparse. The population of the study area is 53,000, the highest in Chaco, taking up 55% of that area as a whole.

Broadly speaking, the inhabitants of the area belong to one of three different social or lifestyle systems. These are (i) creoles (of Spanish descent) and mestizos (of mixed Spanish and Indian descent); (ii) the indigenous people; and (iii) the Mennonites. These three preserve societies and fundamentally different cultures according to their respective independent communities. It is unknown for these to intermix or become integrated.

(3) Industry

The principal industry in the area is livestock farming, mainly of beef cattle, though in the Mennonite settlements in the north of the area dairy farming is undertaken on a scale that is not found elsewhere in the country. Crop farming within the area is limited only to the Mennonite settlements and the outskirts of the capital in the south.

The industrial sector includes a steelworks in Villa Hayes in the south of the area, and a sugar refinery, an alcohol distillery, and others in Benjamin Aceval. Meanwhile, in the Mennonite settlements there is a dairy processing plant, and factories for cotton ginning, oil extraction, animal fodder, palo santo essential oil extraction, and others.

3) Infrastructure

(1) Roads and airports

There are three national highways in the study area, the most important of which is Route

No. 9 (Asuncion - Eugenio Garay). This has a perceived role of linking the Pacific and Atlantic coasts as part of the Pan-American Highway. Apart from these there is also a road currently being built between Pozo Colorado and Concepcion.

The roads that link these trunk roads to the various farms are impassable in rainy conditions, and because the area becomes flooded in the rainy season, aeroplanes are a vital means of transport for the study area. Therefore, private airfields are well developed in the area; there are 327 of these, or 72% of the total in Chaco as a whole.

(2) Electricity and communications

In the study area, the only places where there is an electricity supply are a few towns such as Villa Hayes and Benjamin Aceval in the south of the area. As of 1991, this involved 4,418 households. In the Mennonite settlements, power is privately generated using lumber gas and diesel oil, creating a source from which power is supplied to most of the union members via their own independent power transmission network. In other parts of the area there are some farms that generate their own power using oil. There are plans to set up a high-voltage power transmission to Loma Plata from Vallemi in Departamento Concepcion, and this is due to be completed in 1995.

Telephone communications used to be restricted to cable telephones in the outskirts of the capital to the south of the study area, but now four stations for microwave communication facilities have been installed in the area. Meanwhile, a UHF communications network is also being developed towards the port towns along the Rio Paraguay, and two stations have been built.

4) The position of Chaco development in various national development policies

The main issues for the agricultural and farming production sector in Paraguay's Socio-Economic Development Plan for 1985-1989 (drawn up in 1984) are improving income levels of the rural population by raising productivity, diversifying types of agricultural produce, increasing employment opportunities, conserving the natural environment, and making effective use of natural resources. The next plan (1989-90) that took over from this has set its sights on self-sufficiency in food, encouraging employment, preserving natural resources, a fair allocation of land, setting appropriate prices for agricultural produce, organizing producers, intensifying trial research, and so on.

On the basis of these national plans, the government is aiming to realize the development of a balanced national land by pushing the development of Chaco. It also wants to promote the expansion of employment opportunities that will accompany the increased production

of export commodities, as well as small farming measures and various agricultural policies that will contribute to these.

The request from the government of Paraguay to the Japanese government for assistance in forming the Integrated Agriculture and Livestock Development Project at Lower Chaco in the Republic of Paraguay arises out of the above circumstances. The development of Chaco is prioritized on the basis of the objectives of developing a balanced national land, expanding exports of agricultural produce, increasing employment opportunities, and others.

Since then, no socio-economic plans have been formulated. In February 1992, "Socio-Economic Guidelines" (from the socio-economic point of view) and "Agricultural Guidelines" (from the agricultural point of view) were formulated by the Ministry of Agriculture and Livestock. These are regarded as equivalent to national plans, and in the agricultural and livestock farming sector the course of agricultural and livestock farming in national plans hitherto has not changed. Therefore, there is no change in the position of the Chaco development.

5) Existing development plans

Although military bases in the Chaco region have conventionally been developed over the whole region in view of its importance to national defence, in 1977 the National Committee for the Development of the Chaco Region (CNDRCH) was set up. The aim is to develop this region by making rational use of its natural resources.

A total of 18 projects (including research projects) in the Chaco region have been registered to date in the Planning Agency of the President's Office; of these, 3 have been completed, 6 are currently underway, and 8 are under negotiation or pending, including those which are expected to be implemented in future. The contents and definitions of these projects are many and various.

6) The current state of agriculture and livestock farming

Land utilization in the study area mainly involves grasslands, forests, and marshes; arable land accounts for a mere 2.7%. The main areas for cultivation include the Mennonite settlements and the outskirts of Asuncion, but apart from these there is hardly any crop farming at all. The main agricultural crops include cotton, sugarcane, peanuts, sorghum, and castor beans.

In the Mennonite settlements (the most agriculturally developed part of the area), cotton,

peanuts, castor beans, and others are cultivated, but in recent years the focus of production has been moving away from agriculture towards livestock farming.

The study area (in other words the Departamento Presidente Hayes) is the largest livestock producing province in Paraguay, and, according to the agricultural and livestock farming census of 1991, 1.73 million head of cattle (23% of the national total) are reared here. As well as this, there are 64,400 sheep, 30,800 goats, and 34,500 horses, representing 18.0%, 30.1%, and 10.8% of the respective national totals. The numbers of sheep and goats are the highest in the country. On the other hand, there are only 132,000 pigs and 76,400 chickens, a comparatively small 1.3% and 0.7% of the respective national totals.

Apart from the mainly dairy-based Mennonite settlements, the principal form of land use in the Chaco region is livestock farming on natural grasslands.

The reason for the large amounts of sheep and goats raised is in order to remove weeds and undergrowth on beef cattle pastures, and for self-sufficiency purposes by small farmers and the indigenous people.

In the study area there are a lot of melliferous plants, and these furnish the most suitable natural conditions for apiculture in the whole of Paraguay.

Forestry in the Chaco region mainly involves the supply of raw materials for tannin and palo santo essence extraction, small-scale lumber industry in the Mennonite settlements, and wood used inside the area for firewood, charcoal, fences, and so on.The amount of timber used in Chaco is said to be about 2% of the national total.

The Chaco region is underdeveloped and forestry is at a low ebb because usable timber resources are meagre. All tannin and palo santo essence produced in Paraguay comes from the Chaco region, and this is said to take up almost half of the region's forestry production. Recently the production of charcoal has been increasing in response to the start of operations at the Acepar steelworks, among others.

4. DEVELOPMENT POTENTIAL AND FACTORS RESTRICTING DEVELOPMENT

1) Land resources

(1) Potential for development

The study area is sandwiched between two rivers, the Rio Paraguay and the Rio Pilcomayo, and highly fertile xerosols and regosols are distributed in the northwestern part, even though the fertility level is inferior to that of the eastern part of the region, where acrisols are distributed.

The soil in the study area has a high concentration of hydrogen ion in solonetz and planosols which show a strong alkalinity, but the other soils have low alkalinity or are neutral or mildly acidic. Meanwhile, substitute coal (Ca0) is rather sparse in the regosols, though it is contained in the other soils to an adequate degree. Substitute potassium (K20) is comparatively abundant except in the regosoles, while substitute magnesium (Mg0) is extremely high. Trace elements, on the other hand, are characterized by adequate quantities of hydrothermal soluble boron (B) and soluble copper (Cu), while very low values are shown for easily reducible manganese (Mn) and soluble zinc (Zn). Thus, in terms of its soil, this area has high potential for development.

(2) Factors restricting development

About 75% of all the soil in the study area is taken up by solonetz, a type of saline soil that is distributed widely from the centre to the southern part. The area in which solonetz is distributed is, in topographical terms, extremely flat, and since it also has a high viscosity water drainage is poor; thus the area is beset by difficult conditions. In the Mennonite settlements located to the north of the study area, problems of salt accumulation in the soil arise on account of the way in which the land is used and managed, thus meticulous care needs to be given to conservation.

2) Water resources

(1) Existing quantities of water resources

a) Rio Paraguay

The total annual output of the Rio Paraguay reaches about 10 billion tons (at Concepcion), while the minimum flow rate is 1,500 m^3/s even at dry times, making this water resource extremely useful for irrigation.

b) Rainfall

The amount of rainfall differs greatly between the west and the east of the study area,

with an annual average of 1,300 mm in the east, declining to 800 mm as we go further west. Apart from being used for field crops as natural water, rainwater is also a useful water resource for tajamar reservoirs and as drinking water.

c) Groundwater

The patiño stratum that is distributed in the outskirts of Asuncion is estimated to have a cultivation volume of 14-28 x 10^3 m^3/km^2, and is available as drinking and irrigation water through the use of deep wells.

(2) Restricting factors on water resources

a) Rivers in the area

Since the river water contains large quantities of salt base, there is a high risk of contamination from natrium and saline concentrations, thus in terms of water quality it is not suitable for irrigation or drinking water.

b) Rio Paraguay

While there is no problem with the water quality or existing volume, water cannot be taken naturally because it flows at low levels, and thus it has to be pumped up.

c) Rio Pilcomayo

This is a flood river accompanied by large quantities of sand sedimentation, making its route unstable. The volume that flows through the area is small because it passes through swampy land in its upper reaches, while in the dry season it has a high salt concentration. Apart from this, it will be difficult to incorporate it into the plans in this study as it is an international waterway.

d) Natural water

Rainfall is 800 - 1,300 mm annually, with a pattern that varies from year to year. Thus when carrying out natural water agriculture care needs to be given to the possibility of drought.

e) Permanently flooded areas

Because this is a basin area with an extremely shallow water depth, it is difficult to assess the usable volume. This also has a great impact on the environment and water cannot easily be used for irrigation.

f) Groundwater

Although the Chaco layer is abundant in quantity, with aquiferous sandy strata

distributed over several layers, it has a high salt concentration and is difficult to use for agriculture or drinking water.

Since the Chaco layer is distributed around the patiño aquiferous layer that is found in the southernmost part of the study area, caution is needed as there is the risk of salt water from the Chaco layer being drawn when water levels are low due to excessive exploitation.

3) Human resources

(1) Development potential

As available human resources, throughout the country there are 7,962 landless farming households (excluding the study area), 247,616 small farming households, and a surplus farm labour force of about 98,800. Against this, in the study area there are 3,484 farming households (of which, small farms: 955, landless farms: 211), and about 4,000 indigenous households.

(2) Factors restricting development

The indigenous people have formed their own unique societies and speak different languages, thus have difficulty in communicating with members of other ethnic groups. In addition, farming technology is meagre and there is no capital power. Small farmers and those with no land have no funds and their technical ability is low, while surplus labourers have hardly any experience of farming as well as having no funds.

4) Agriculture

(1) Development potential

(i) Climatic conditions such as temperature and hours of sunshine are favorable, and many types of crop can be cultivated.

(ii) As land suitable for agricultural development, it is possible to secure land of a prescribed size. As well as this, the land is flat and there is little soil erosion.

(iii) In this land, the soil is highly fertile, consisting of xerosols, regosols and others. The soil properties are also suitable for cultivation, with a comparatively large proportion of coal substitute (K20) and a very large substitute magnesium (Mg0) content that help to create favorable circumstances for crop cultivation.

(2) Factors restricting development

(i) Rainfall is irregular, patterns varying greatly from year to year. Therefore, the conditions for short-turnover crops tend to be unstable.

(ii) If water is used and managed inappropriately, farmland could deteriorate as a result of salt damage.

(iii) Wind erosion is highly likely if plantation fields are left fallow during the winter season, but there are few suitable winter crops which could be commercialized. During agricultural development, it is possible that the fertile topsoil could be lost through wind erosion or stubble burning.

(iv) The small and landless farmers who will be responsible for development have little in the way of capital or technical capability.

(v) The state of roads is bad, and there are problems with the inward and outward transportation of agricultural production machinery and produce.

(vi) The domestic market is limited, while even on the export side freight is expensive because of the country's land-locked nature. Thus only agricultural produce with a high added value can be considered, making it difficult to select crops.

5) Livestock

(1) Development potential

The study area has a high productivity of livestock as it enjoys a favorable natural environment. For example, (i) pasture grass does not wither even in winter frosts, due to the existence of water in low swamplands; (ii) the mineral composition of the soil (such as phosphorus and natrium) is high; and (iii) Chaco has many leguminous and fodder plants that lead to improved nutrition for livestock in terms of protein.

Secondly, there is a large latent potential for the development of beef cattle and dairy farming. This is because (i) the low population density is suited to a non-labour intensive, land-use intensive industry such as beef cattle farming; (ii) a free-ranging form of farming making use of the natural grasslands is possible, thus production costs are low; and (iii) brushwood such as quebracho is available as material for pasture fences, which thus have the advantage of being cheap to obtain.

Finally, there is also potential for the development of beekeeping, for reasons such as (i) there are abundant existing resources of melliferous plants such as water hyancinths, palms, and algarrobo; (ii) initial investment is low, and this will also be useful in making effective utilization of surplus family labour; and (iii) it is highly profitable.

(2) Factors restricting development

(i) Because the basic infrastructure such as roads and electricity is underdeveloped, the inward and outward transportation of livestock and production equipment is difficult.

(ii) Measures for livestock hygiene are difficult, due for examples to factors such as the large numbers of wild animals that carry livestock disease viruses, the high humidity, the proximity of the southwestern part to the border with Argentina, and the underdevelopment of roads.

(iii) There is a limited range of pasture grass types and of strains of fodder crops that are available for introduction, due for example to the large amount of poor draining land and the high saline content in the soil.

(iv) The mineral composition of the soil is high in phosphorus, natrium, and others compared to the eastern region, but in some parts of the area the copper content is low.

(v) The annual distribution of rainfall is uneven, making the cultivation of pasture grass unstable, and thus leading to a drop in livestock productivity.

(vi) The systems for improving livestock and supplying breeding stock as well as diffusion and guidance on farm management are weak.

6) Market and economy

(1) Latent development potential

In the study area, the production of milk can be mentioned as having a high potential for expansion in future. Promise can also be seen in oil crops as export agricultural produce for which demand is growing worldwide.

(2) Factors restricting development

The following can be given as factors that will restrict development.

(i) The Paraguayan economy has a structure that depends solely on agricultural and livestock industries, making the economy as a whole highly vulnerable to climatic fluctuations and trends in international market prices.

(ii) It is vulnerable to the economic vicissitudes of its two giant neighbours, Brazil and Argentina, with which it is in competition for agricultural and livestock produce.

(iii) There are few agricultural and livestock products that are comparatively superior.

(iv) Because the country is land-locked, it suffers inconvenience in accessing international markets.

7) Other restricting factors

(1) Land ownership

As regards land ownership, 68% of the land in the area is owned by landowners of 10,000 ha or more, who represent a mere 6% of the population of the study area. However, most of these are absent landlords and the land is not being used effectively. Moreover, they are not inclined to release their land since the degree of land ownership is linked to social status in Paraguay. Neither can it necessarily be said that the Rural Welfare Law or the Farm Land Law are functioning effectively. It is difficult for some settlers and small farmers to continue farm management, owing to the harsh natural and distribution conditions. Therefore they have no option but to release their land, leading to a vicious circle whereby this land is then acquired by farmers who already own large areas of land, which as a result grow even larger.

(2) Environment

Ample discussions and liaison need to be conducted with the government authorities in Paraguay, paying all due consideration to various limitations on development in connection with environmental protection, and the fact that the study area is beset by delicate natural environmental conditions.

5. THE BASIC CONCEPT FOR DEVELOPMENT

1) Development strategy

(1) Policies on national planning and agricultural development

Although no national socio-economic plans have been formulated since 1991, in the agricultural sector the "Agricultural Guidelines" of February 1991 have become the basis of agricultural policies instead of these. These are the policies that are implemented by the Ministry of Agriculture and Livestock. The "Guidelines" clarify policies such as the following.

(i) Agricultural sector

a. To ensure the nation's food supplies
b. To diversify exported products
c. To provide medium and small farmers with the ability to improve production efficiency

(ii) Livestock farming sector

a. To encourage livestock farming amongst small farmers

b. Measures for medium- and large-scale livestock farmers: research and development for improving productivity and diffusing the technology for this, and enhancing the management of livestock hygiene

(iii) Forestry and environmental sectors

To aim to develop the socio-economy while maintaining a favorable environment. To this end, attention is to be given to protecting the environment and natural resources.

(iv) Farmland reforms

a. To secure land for the settled habitation of 40,000 landless farm families by 1993.

b. To review and promote laws and ordinances related to agriculture.

c. To elucidate the situation of land ownership.

(v) Measures for small farmers

a. Organization

b. To encourage and support mutual complementation between raw material producing sectors and agricultural industry sectors.

Meanwhile, in May 1992, the development of the western region (Chaco) based on the "Development of a balanced national land" in previous socio-economic development plans (1985-89 and 1989-90) and within various policies for the development of agriculture and livestock farming was further clarified by the "Strategy for the sustained development of Chaco" formulated by a Presidential ordinance. In this, "sustained development" with a priority on environmental conservation is clearly outlined as a strategy for development.

(2) Prerequisites for development and strategies to accommodate them

The "sustained development" that is indicated as a framework for the shape of Chaco development in the various Paraguayan policies related to agricultural and livestock farming development is also the inevitable conclusion that emerges from the study results, and thus will form a prerequisite in planning development.

In this integrated development plan, all due consideration will be given to this prerequisite, and its measures will be incorporated from a variety of angles. But, in brief, comprehensive consideration will be made from the various angles of (i) land use, (ii)

conservation of the environment and farm land, (iii) farm management systems, (iv) cultivation technology, and (v) forest management.

(3) Development targets and strategies for meeting them

a) Development targets

The development targets of this integrated development plan will comprise the following five items, in accordance with national policies for the development of agriculture and livestock farming.

(i) Self-sufficiency in the national food supply
(ii) Increased exports of farm produce
(iii) Creation and expansion of employment opportunities
(iv) Measures for small farmers and those with no land
(v) Ensuring a stable way of life for rural residents

b) Strategies for achieving the targets

(a) Agriculture

(i) Combining management with livestock farming

In order to avoid the risks involved in single product cultivation, the basic form of management of farms will be one of combined management with livestock farming.

(ii) Diversification of crops

Exports of farm produce are the mainstay of the country's economy, and taking steps to diversify exports of agricultural products on the basis of market forecasts from a global point of view will lead to an expansion in exports. Therefore, we will study supply sources with a priority on commercial viability, and will attempt to diversify the crops that can be accepted into farm management.

(iii) Crop production according to various forms of farm management, in keeping with the subject of management

The human resources that will be responsible for the development of agriculture and livestock farming are extremely imbalanced in the productivity of their crop production. As far as this is concerned, we will devise various forms of rational farm management in order to achieve a prescribed level of production and profit in keeping with these diverse human resources.

(b) Livestock farming

The development of the study area will mainly involve that in livestock farming, since this is the ideal type of development in conformity with the agricultural environment of the area. The following two strategies will apply for livestock farming, in connection also with the methods of land use in view of the natural and ecological environment.

(i) Organized beef cattle management

Steps will be taken to raise productivity in the currently existing form of pasturage, though care will be taken to restrict the impact on the environment to the absolute minimum.

(ii) Dairy, beef cattle, and medium/small livestock management

While aiming for stability of management by combining various forms of breeding and types of livestock, we will encourage participation in livestock farming by small farmers.

(c) Forestry management

We will retain and preserve existing forests as well as creating new forests in forms such as wind barriers, and will contribute to the protection of the environment by managing these appropriately. In this sense, we will study forests which have the purpose of protection of the environment and farmland.

(d) Giving added value to agricultural and livestock produce

Paraguay's international trade is being continued in a form whereby it exports primary products and then re-imports them as processed products. In order to improve the structure of this country's economy, the central pillar of which is formed by exports of agricultural and livestock products, processing industries will have to be promoted. However, as the raw materials for processing are agricultural and livestock products, we will also study supply sources from this angle by analysing their market viability, and will place priorities on the production of agricultural produce.

(e) Production infrastructure

Crop cultivation in agricultural production has the objective of achieving high yields, and as far as possible it should be possible to manipulate the cultivation environment artificially. Therefore we will create farm land in order to facilitate cultivation management, and aim to develop infrastructure such as irrigation and drainage in accordance with the selected crops.

(f) Settlement

We will establish settlement areas for people who will migrate to and settle in the area in order to take over the agricultural and livestock farming development in this plan.

The settlers will primarily be farmers and indigenous people within the study area, supplemented by landless farmers, small farmers, and ordinary citizens from across the country in case there is a shortage.

(g) Social infrastructure

In order to encourage permanent settlement by migrants and to secure stable livelihoods for them, we will develop health care facilities, communication facilities, rural electrification, domestic water facilities, and educational facilities in the settlement area.

(h) Nurturing human resources

We will set up facilities for education and carry out training for farmers with a low level of agricultural technology. While equipping them with agricultural technology we will strengthen the diffusion of technology as well as aiming to improve agricultural technology and the contents of management.

(i) Agricultural support

Of those who will be responsible for agricultural and livestock farming development, small farmers and the indigenous people are particularly poor in technical ability, while their management base is also fragile. Therefore, we will study various support measures that ought to be taken in terms of technology, funds, and so on.

2) Selection of the development plan target area

(1) Selection of areas suitable for development

a) Criteria for selecting areas suitable for development

The criteria for selection have been identified as (i) the fertility of the soil and the degree of risk of salt damage and (ii) areas that are flooded throughout the year (to be excluded from the areas suitable for development because their potential for development is low and they require environmental protection).

b) Categories of land use plans

In accordance with the policies and principles of Paraguay, we have excluded the following five types of area (including areas in which the potential for development

is low) from the above areas suitable for development or areas in which the development potential is low, and will assume them to be excluded from the object of the development plan: (i) areas designated as national parks; (ii) environmental protection areas, (iii) historical ruins and others designated as cultural treasure conservation areas, (iv) areas settled by the Mennonites, and (v) some indigenous reservations near the Mennonite settlements.

As a result of still more comprehensive studies in which attention was paid to the natural environmental conditions, the development plan target area is to encompass 2,993,000 ha (41% of the study area), while the area excluded from the development plan will extend to 4,307,000 ha (59% of the study area). A diagram of the categories of land use plans is shown in fig. 1.

c) The development plan target area

(a) Agricultural development plan areas

The following four zones have been selected as agricultural development plan areas.

(i) Asuncion suburban zone: 9,000 ha

(ii) Pozo Colorado northern zone: 76,600 ha

(iii) Mennonite settlements southern zone: 68,000 ha

(iv) Mennonite settlements eastern zone: 68,000 ha

The agricultural development plan areas thus cover 338,000 ha, or about 38% of the study area. In these zones the agricultural development plans are expected to involve farming based on the cultivation of peanuts and others, with the addition of dairy farming.

(b) Livestock development plan areas

The remaining 2,655,000 ha of the above development plan target area excluding the agricultural development plan areas comprises livestock development plan areas, which will mainly involve beef cattle farming.

(3) Carriers of farm management

Carriers of farm management will be reflected in each plan in the following five basic groups.

(i) Those who possess production technology in agriculture and livestock farming, who would be able to undertake development individually, and who can continue farm management.

(ii) Those who are equipped with the level of agricultural technology needed to produce agricultural products for export in accordance with modern farming methods, and who have a certain amount of start-up capital.

(iii) Those who are equipped with levels of farm technology with which they can respond to the requirements of the domestic market.

(iv) Those who are not equipped with a level of farm technology with which they can respond to the requirements of the domestic market.

(v) Indigenous people.

6. DEVELOPMENT PLANS FOR EACH SECTOR

1) Land use plans

The area excluded from the development plan target will be 4,307,000 ha (59% of the survey area), while the development plan target area will be 2,993,000 ha (41% of the survey area). We will classify the development plan target area into (i) farmland areas, (ii) swampland areas, (iii) forest areas, (iv) public land, (v) rivers and lakes, and will formulate land use plans for each of the agricultural development plan and livestock development plan areas.

The farmland area in the land use plan is planned with 74,000 ha of ordinary fields, 10,400 ha of orchards, 92,700 ha of fodder crop fields, 479,100 ha of improved grasslands, 1,274,600 ha of natural grasslands, 183,700 ha of swamplands, and 703,100 ha of forests. 33,800 ha of public land is planned for agricultural development plan areas and 132,800 ha for livestock development plan areas.

2) Infrastructure plans

(1) Farm roads and agricultural development plans

Roads will be divided into principal roads, trunk roads, feeder roads, and field access roads. Of these, construction work in this plan will in principle not be carried out on principal roads. The structure of roads will be gravel surfaces for trunk roads and unsurfaced for feeder and field access roads. Trunk roads will basically be routes leading from the principal roads to the areas suitable for development; 16 routes of about 700 km are planned within an area of 5 km from agricultural development plan areas (as the crow flies) and 30 km from livestock development plan areas.

The target area for the agricultural development plan will be 177,100 ha, for which we shall plan feeder roads, field access roads, branch drainage channels, small drainage channels, and intersecting drains as works for subsidiary facilities.

Although the cultivation and farm management plans feature various different sizes of plantations in ordinary fields, in this plan we will concentrate on two types of 100 ha and 10 ha as standard field sizes.

(2) Grassland and fodder crop cultivation and management plans

We will vastly increase the number of livestock reared by introducing pasture grasses such as pangola, estrella, and gatton panic to the improved grasslands and raising the pasture productivity per unit area. As well as this, in order to maintain productivity in natural grasslands, we plan grassland management by carrying out a rigorous removal of undergrowth and weeds.

As a fodder crop we aim to introduce sorghum. Although this is currently cultivated without fertilizer, we plan to manage fertilizer cultivation in order to maintain production volumes of dried provisions.

(3) Water resource plans

(i) In tajamar development using former rivers, we plan to store rainwater for the purpose of providing drinking water for livestock.

(ii) We plan to use the patiño layer groundwater for irrigation.

(iii) It is possible to draw 50m³/s of water as the volume of flow from the Rio Paraguay.

(4) Irrigation and drainage plans

(i) Irrigation and drainage plans on the west bank of the Rio Paraguay

(ii) Irrigation plans for the northern Pozo Colorado zone and the southern and eastern Mennonite settlements, which use the Rio Paraguay as their water resource.

(iii) Irrigation plans for the Asuncion suburban zone, which uses groundwater as its water source.

Having studied these three on the basis of model designs, (i) and (ii) are financially difficult in current planning, due to their high project costs. Therefore, (i) the right bank of the Rio Paraguay will be excluded from the agricultural development plan areas and included in the livestock development areas, while (ii) will not be irrigated and we will plan farming with the use of natural water. As well as these we will also include (iii) in this project, as it has a strong potential for materialization.

Drainage plans will be carried out in each zone of the agriculture development plan areas.

(5) Rural improvement plans

We will plan the following social infrastructure facilities for each zone (settlement area), taking the increasing population as the justification for medical, educational, and domestic water facilities, and the existing and increasing number of households as the justification for electrification and communication facilities.

Item	Unit	South Men.	East Men.	North Pozo	Asun. subs.	Live-stock
(i) Medical facilities						
• New clinics (125m²)	buildings	1	3	1	-	-
• Existing clinics (supplementary equipment)	sets	1	1	-	-	-
(ii) Educational facilities						
• New primary schools (120m²)	schools	2	9	4	-	-
• New secondary schools (280m²) (supplementary equipment)	schools	1	3	1	-	-
• Existing facilities	schools	9	6	1	-	-
(iii) Electrification	sets	1	1	1	1	-
(iv) Communication facilities	sets	1	1	1	-	-
(v) Domestic water facilities	sets	2	4	3	-	-
(vi) Housing	buildings	430	790	530	390	1,640

(6) Farm land conservation plan

The farm land conservation plan will be in two parts, namely a windbreak forest plan and a salt accumulation prevention plan.

a) Windbreak forest plan

In view of the importance of measures against wind erosion in the agricultural development plan areas, we shall install windbreak forests for ordinary fields, fodder crop fields, orchards, and improved grasslands in these areas.

b) Salt accumulation prevention plan

(i) We will carry out drainage plans in the agricultural development plan areas in order to improve drainage.

(ii) We will cope with peripheral drainage through plantation technology.

(7) Environmental protection measures

a) Designating areas to be excluded from the development plan target

(i) Areas designated as national parks

(ii) Environmental protection areas

(iii) Historical ruins and other areas specified for cultural treasure conservation

(iv) Rivers, lakes, and permanently flooded areas

(v) Mennonite settlements and parts of the indigenous reservations in their vicinity

b) Environmental protection measures based on the Forestry Resources Law

Restrictions on forest-related activity are stipulated in the Forestry Resources Law (draft bill), including provisions in connection with agriculture. In this development plan we shall pay attention to environmental protection in deference to these.

3) Agriculture and livestock farming plans

(1) Agricultural plans

Agricultural plans shall take the form of cultivation and farm management plans. In the cultivation plans the following crops shall be selected according to suitability (this shall include the newly introduced crops of macadamia nuts and jojoba, for which at present little cultivation experience has been accumulated). At the same time we will plan cultivation systems for each crop, and systems of planting through combinations of crops.

- Short-term field crops: (for export) Cotton, peanuts
  (for domestic consumption) Sorghum
  (for self-sufficiency) Cassava, poroto
- Short-term oil crops: Sunflowers, sesame, saffron, castor beans
- Vegetables: Watermelons, melons, tomatoes, cabbages, garlic, asparagus, cucumbers
- Fruits: Citrus fruits (sweet oranges, mandarins, grapefruits), tropical fruits (bananas, papayas, pineapples, mangoes), macadamia nuts
- Permanent cultivation industrial crops: jojoba

In the farm management plans respective farm plans will be drawn up for the following types of farm management:

a) Agricultural development plan areas

(a) The southern and eastern parts of the Mennonite settlements and the northern part of Pozo Colorado

(i) Peanuts + cotton + sorghum + dairy farming
(ii) Short-term oil crops + sorghum + dairy farming
(iii) Permanent cultivation industrial crops + dairy farming
(iv) Dairy farming
(v) Cotton + sorghum + fruits + dairy farming + medium/small livestock (sheep) (specialized from the outset)
(vi) Cotton + sorghum + fruits + dairy farming + medium/small livestock (goats) (specialized from the outset)
(vii) Cotton + sorghum + fruits + dairy farming + medium/small livestock (sheep) (specialized during implementation)
(viii) Cotton + sorghum + fruits + dairy farming + medium/small livestock (goats) (specialized during implementation)
(ix) Cotton + sorghum + medium/small livestock (sheep) + apiculture

(b) The Asuncion suburban area
(i) Fruit + dairy farming
(ii) Fruit + vegetables
(iii) Fruit

b) Livestock farming development plan areas
(i) Exclusively beef cattle farming (large-scale)
(ii) Exclusively beef cattle farming (smaller scale)
(iii) Medium/small livestock + apiculture

(2) Livestock farming plans

Livestock farming plans entail plans for livestock improvement and breeding, husbandry management, and livestock business management.

Plans for livestock improvement and breeding involve plans to improve breeding, mainly of beef and dairy cattle. For beef cattle, improvement will mainly be a question of introducing breeding stock, with plans to cross-breed European types with zebu strains for commercial beef production. For dairy cattle, the plan will be to introduce base stock from an outside source and to breed on this basis, while improvement plans will entail cross-breeding between European and zebu types, as above.

Husbandry management will involve measures to eliminate shortages of fodder in the dry season by introducing improved grasslands and so on. Plans will revolve around subdividing pastures, measures for hygiene by setting up corals etc., and improving propagation success rates.

Livestock business plans will entail measures to spread risks in agricultural production, vulnerable as it is to unstable climatic conditions, by raising dairy cattle and medium/small livestock such as sheep, goats, and bees, in combined management with agriculture in the agricultural development plan areas. In livestock development plan areas, the plan will be based on developing existing beef farms and achieving more concentrated beef cattle production by beef producing farms already in operation, by means such as creating improved grasslands and replenishing shortages of livestock farming facilities and farm implements.

(3) Trial research and agricultural support plans

a) Trial research plan

For the system of trial research in the agricultural sector, we will make positive use of existing organizations such as the Chaco Central Agricultural Test Centre (EECC). Meanwhile in this plan we will aim for development based around the livestock farming sector.

(i) Enhancing and developing the Chaco livestock farming test centre

(ii) Establishing stud farms

b) Agricultural support plan

We shall aim to develop facilities and establish systems as follows in connection with the various areas of improved production technology in farms, organized farming, and farm management support.

(i) Setting up a farmers research centre

(ii) Establishing a diffusion organizing system for the Chaco region

(iii) Promoting the organization of farm cooperative unions

(iv) Providing incentives for seedling supply facilities (SENASE)

(v) Establishing an organization for joint use of agricultural machinery

4) Social and economic plans

(1) Settlement plan

a) The planned settlement areas and number of settled households will be as follows.

Zone	Area (ha)	No. of estates	No. of settled households
Southern Mennonite settlements	68,000	1	640
Eastern Mennonite settlements	185,000	3	1,360
Northern Pozo Colorado zone	76,000	1	630
Asuncion suburban zone	9,000	1	390
Livestock development plan areas	2,655,000	3	2,260

b) The settlers will be selected primarily from farmers and indigenous inhabitants in the plan area, secondly from those in the study area, and thirdly from farmers throughout Paraguay, although ordinary Paraguayans and foreign nationals may be eligible providing they fulfil certain conditions.

Meanwhile, the criteria for settlers for each scale of management will be (i) for beef cattle management: a current land ownership area of 300 ha or more; (ii) for a scale of 200 ha: current land ownership area 60-300 ha; (iii) for a scale of 45-60 ha: farmers who currently own 0-60 ha; and (iv) for a scale of 10 ha: indigenous people.

c) Settlement projects shall be undertaken by IBR and INDI as national projects within the framework of the Farm Land Law. In addition, prior training shall be held for settlers other than those concentrating exclusively on beef production.

d) As far as land ownership is concerned, since this plan is at the stage of a master plan, it is thought appropriate that measures for radical solutions should only be considered after ascertaining future trends. Therefore it should suffice here to suggest the following methods.

(i) Designating plan areas, or other measures that have the same effect
(ii) Value added tax on farm land
(iii) Exchange purchases or expropriation of land
(iv) Rented land or shared profit farming
(v) Apart from these, it is considered possible to encourage land ownership and land use along the lines of the project objectives by introducing a road use tax, levying fees for the use of water, or by effectively combining these measures.

(2) Distribution and processing plans

The main agricultural and livestock commodities whose production is to be increased in this plan are cotton, peanuts, oil crops, vegetables, fruits, milk, and beef. Cotton, peanuts, and oil crops are agricultural products for export. Although cotton mills will need to be set up in the agricultural development plan areas, peanuts and oil crops can be handled in existing processing plants around the survey area and therefore can be transported outside the area in seed form. While fruit and vegetables are divided into those for export and those for domestic consumption, since the producers are small-scale farmers, fruit selection centres will be set up inside the agricultural development plan areas in the form of joint shipment facilities. Milk and beef will be directed at export once the domestic consumption has been filled. Of these, milk cannot be handled by

existing processing plants except for those in the outskirts of Asuncion, therefore milk processing plants will be set up in the agricultural development plan areas. It will be difficult to locate a beef processing plant inside the survey area, thus live beef cattle will have to be transported outside the area, necessitating a new beef processing plant in the surrounding area.

Installation plans for distribution and processing facilities are as follows.

- Northern Pozo Colorado: 1 cotton mill, 1 citrus fruit sorting plant, 1 milk & dairy products plant
- Southern Mennonites: 1 cotton mill, 1 citrus fruit sorting plant, 1 milk & dairy products plant
- Eastern Mennonites: 1 cotton mill, 2 citrus fruit sorting plants, 4 milk & dairy products plants
- Asuncion suburbs: 1 combined fruit and vegetable sorting plant
- Whole area: 5 meat processing plants

(3) Agricultural credit plan

The agricultural credit plan includes details such as required monetary amounts and conditions connected to loans for agricultural processing facilities, and agricultural credit projects that form one aspect of agricultural support.

The objects of loans for farm management are divided into individually borne amounts for land and agricultural infrastructure project costs in the form of project investments, and purchase costs for facilities, farm equipment, and others in the form of farm management investments. Moreover, construction costs such as those for constructing distribution/processing facilities or machinery shall be taken as being eligible for loans. The economic conditions in the survey area are extremely harsh, and in order to proceed with development while sustaining farm management, we will need to give special consideration to farm management support by for example introducing long-term, low-interest funds. Therefore, since it will be difficult to handle this with existing financial institutions, the "Chaco Region Integrated Agricultural Development Fund" (provisional name) will be set up as a new banking facility.

7. THE INTEGRATED AGRICULTURAL DEVELOPMENT PLAN

1) Priority development zones

Priority agricultural development zones have been studied on the basis of (i) water resources, (ii) natural conditions, (iii) access, (iv) the shape of the zone, (v) the contribution

to measures for small farming, (vi) spreading effects, (vii) social infrastructure, (viii) the contribution to exports, (ix) the creation of employment. The results of economic analysis were further added to these before our final selection. As a result, we reached the priority sequence of (i) the northern Pozo Colorado zone, (ii) the southern Mennonite settlement zone, and (iii) the eastern Mennonite settlement zone. Meanwhile, the Asuncion suburban zone, due to its special characteristics, will be a top priority development zone in the same bracket as the northern Pozo Colorado zone.

Livestock farming development plan areas, meanwhile, have been selected on the basis of the distance (30 km as the crow flies) from (i) principal roads (existing national highways), and (ii) from planned trunk roads.The order of priority for the development of agricultural development and livestock farming development plan areas is shown in fig.2.

2) Zone-specific projects and priority projects

(1) Zone-specific projects

Agricultural and livestock farming development must furnish land for the production of crops as well as the conditions for crops to be produced on that land; and they must give expectations of a return from that production. Taking these conditions as a basis, we will consider factors such as the climate, soil, water and land resources, conditions of land use, etc. for each zone of the development plan target area as selected in the land use plan. The zone-specific project items are as follows.

Item	South Mennonites	East Mennonites	North Pozo Colorado	Asuncion suburbs	Livestock dev't zones
Farmland development and improvement	O	O	O	O	O
Grassland development and improvement	O	O	O	O	O
Farm roads	O	O	O	O	O
Irrigation	-	-	-	O	-
Drainage	O	O	O	O	-
Cultivation/management	O	O	O	O	O
Settlement	O	O	O	O	O
Social infrastructure	O	O	O	O	O
Distribution/processing	O	O	O	O	-
Agricultural credit	O	O	O	O	O
Agricultural support	O	O	O	O	-

Apart from this, there are trial and research facilities, agricultural seedling supply facilities, agricultural machinery joint use organizations, agricultural schools, meat processing facilities, and others for all of the zones.

(2) Priority development projects

Projects which need to be given priority in advance of development projects in the individual zones include trials and research, study and training, and agricultural support. These are key projects that will require a long time for objectives to be met, in order to materialize agricultural and livestock farming production in the survey area at the earliest juncture. Priority projects for each individual development zone will be based on and continued from the implementation of these projects.

(3) Pilot projects

Pilot settlement projects will be implemented in advance of the full-scale settlement projects, with studies of systems for developing and accumulating technology, displays of model farm villages, and so on.

8. PROJECT IMPLEMENTATION PLANS

1) Project implementation system

Currently existing systems centred on the Chaco Development Committee will be used for the project implementation system. As part of the Development Committee, a Technical Committee will consist of representatives from government and non-government organizations concerned with the development of Chaco, and will be obliged to participate positively in the development.

2) Execution plans

This project will be implemented over a span of 20 years. First of all, the foundations for a system of implementation will be built in advance of trial research and the development of agricultural support facilities. The works for development of the agricultural production infrastructure and the like will be executed in sequence, starting with the priority zones. The execution plans are shown in fig.3.

3) Maintenance plans

Roads will be managed by the Municipal Highways Department of the Public Works Ministry. The system for management will adhere to the existing system. The equipment in the works office in Pozo Colorado will be improved.

Irrigation facilities in the Asuncion suburban zone will be managed by regional agricultural cooperative unions, with the maintenance costs levied from vegetable producing farms. While trunk drainage will be managed by agricultural cooperative unions in each zone, the maintenance costs will be economized through the use of existing equipment and materials.

4) Project costs

The project costs for this master plan will be US$715 million, as shown in Table 1.

5) Funding plans

We have calculated the project costs per year and per zone as well as the amount of funding needed for the provisionally named "Chaco Region Integrated Agricultural Development Fund".

9. PROJECT ASSESSMENT

1) Assessment of impact on the environment

Impact on the environment (forecast)

The impact that development will have on the environment is as shown in Table 2.

In implementing the plan, particular care will be needed in the following matters, as well as those mentioned under measures for environmental protection.

(i) Smooth transfers of rights to the planned land, and consideration towards the indigenous people.

(ii) Selection of settlers and correct implementation of farm management training etc.

(iii) Research into endemic diseases and establishment of systems for inoculation, healthcare and hygiene for people and livestock.

(iv) Environmental monitoring

2) Financial assessment

We have undertaken financial analyses for various individual types of farm management as well as for distribution and processing facilities. For our analysis index, we adopted the financial internal return rate (FIRR). The result of the analysis shows that this plan can anticipate an adequate level of profit even for individual units of management, with 13-20% for the various farm management types and 14-28% for distribution and processing facilities.

3) Economic assessment

For economic assessment, we have calculated all revenue and costs for agricultural and livestock production in this integrated development plan, and have calculated and analysed the economic internal return rate (EIRR) as an index. The result of the analysis shows that this will be 16.0%, thus we judge there to be a sufficiently high likelihood of implementation for the entirety of this integrated development plan.

In addition, as a sensitivity analysis we calculated and compared the EIRR for two cases, namely an increase in project costs and a decrease in revenue. The results show that it is extremely important that we implement trial research work, training, and other projects for improving the farm management technology of farmers, since a fall in revenue would have the effect of greatly reducing the EIRR.

4) The effects of the development project

(i) Increasing agricultural and livestock production

The following figures show production volumes of agricultural and livestock products at the point of greatest production under the plan, and their ratios to production volumes in Paraguay as a whole.

Peanuts: 24,300 tons, 71%. Cotton: 46,600 tons, 7%. Oil crops: 27,000 tons, 240%. Citrus fruits: 5,580 ha, 38%. Tropical fruits: 1,170 ha, 13%. Vegetables: 90 ha, 1%. Cattle: 2,010,000, 26%. Sheep & goats: 250,000, 50%. Milk: 255,000 tons, 110%.

The estimated increase in exports is about US$110 million, while the added value reached by subtracting production costs from production value will be US$185 million, equivalent to 12.5% of GDP in the agricultural and livestock farming sectors.

(ii) Creating and expanding employment opportunities

The number of people employed in connection with agricultural and livestock produce farms, agricultural and livestock produce processing facilities, trial research, and agricultural support as a result of the implementation of this plan will be about 6,500 per year. Further, a considerable amount of employment is expected to accompany social infrastructure sectors and various construction works during the period of the project.

(iii) Contribution to measures for small farmers and landless farmers

Allocating land to settlers, engaging them in farm management, and aiming at stability of lifestyles through various agricultural support measures will bring effects in the distribution of income as well as contributing to these measures.

(iv) Ensuring a stable way of life for rural inhabitants

Development will be carried out in such a way that there is basically no disruption to the living environment by the rural development project. Also, a stable way of life will be managed by setting income targets at the levels for eastern region farmers and city dwellers.

10. CONCLUSION AND RECOMMENDATIONS

1) Conclusions

(i) This study has the objective of drawing up a integrated agricultural development plan (master plan) for the Lower Chaco region of Paraguay (73,000 km2). The agricultural development master plan for this region as planned in this study is to be a starting point for agricultural development in the whole of the Chaco region and the western part of Paraguay.

(ii) The core of this master plan is a farm management plan through agriculture and livestock farming, with agricultural and livestock farm management supported by various individual plans such as for land use, infrastructure, trial research, agricultural support, settlement, distribution, agricultural produce processing, and agricultural credit.

(iii) The carriers of farm management will be divided into five groups, to be introduced primarily from within the region, and thereafter from the country as a whole in case there is a shortage.

(iv) Land use plans will classify the region into three types of area, namely (i) areas to be excluded from the development plan target, out of environmental considerations, (ii) agricultural development plan areas, and (iii) livestock development plan areas.

(v) The agricultural development plan areas will comprise zones in the suburbs of Asuncion, the north of Pozo Colorado, the east of the Mennonite settlements, and the south of the same. Settlements will be formed there, and the five groups of farm management carriers mentioned above will undertake their respective types of farm management corresponding to the various groups.

(vi) Livestock farming development in the livestock farming development plan areas will be aimed at improving productivity through pastureland improvement and facility development.

(vii) This masterplan shall be based on the precondition of continuous development, and while of course incorporating various measures for environmental and farmland conservation, apart from this we are also formulating policies with consideration for the environment in all areas within our plans for individual sectors.

(viii) There will be two priority zones, namely the Asuncion suburban zone and the northern Pozo Colorado zone, for development in the agricultural development plan areas. These shall then be followed by the southern Mennonite settlements and the eastern Mennonite settlements, in that order. In particular, the Asuncion suburban zone is currently making progress in transforming its local agriculture. Since its agricultural and socio-economic environment can be seen as an extension of those of the eastern region, once the conditions have been met we will start work here as soon as possible. In the livestock farming development plan areas, we will set 1st priority, 2nd priority, and 3rd priority livestock farming development zones.

Priority projects will be those related to trials and research, study and training, and agricultural support that are indispensable and common to all zones, plus development projects in the aforementioned priority development zones that will be carried out simultaneously and in parallel to these.

(ix) The period of implementation of this integrated development project will be 20 years.The 1st and 2nd years will be the period for implementation design, while the top priority projects will be those related to trials and research, study and training, and agricultural support, in addition to the various facility development projects for the priority development zones. The former of these is for years 2-5 and the latter for years 3-6.

(x) This integrated development project is to be implemented on the basis of a system which takes the Paraguay Chaco Integrated Development Committee as its central organization.

(xi) The total project costs according to this master plan are US$715 million.

(xii) The results of economic assessment of the master plan as a whole show an economic internal return rate (EIRR) of 16.0%, which will sufficiently exceed the capital equipment costs of 12%. Thus we judge that the plan has a high degree of practicability.

(xiii) In this master plan, we will set five target items as a framework for planning, and each of these will have significance as a step towards these targets. The effects that are expected in relation to the targets as a result of this master plan will be approximately as follows.

A. Self-sufficiency in the nation's food supply: production of vegetables, fruit, milk, and meat for domestic consumption will be increased.

B. Increased exports of agricultural produce: production of cotton, peanuts, and oil crops will be increased, while the diversification of crops will be promoted by introducing new ones such as jojoba and macadamia nuts.

C. Creating and increasing employment opportunities: manpower for farm work, staff and manpower for trial research and agricultural support organizations, personnel for schools and hospitals, personnel and manpower for distribution and processing facilities, and construction personnel and manpower during the period of implementation of works.

D. Measures for small farmers and landless farmers: land will be distributed to settlers, and they will be engaged in farm management with the aim of stabilizing lifestyles through various measures for agricultural support. This will have the effect of distributing income, as well as contributing to these measures.

E. Ensuring a stable way of life for rural inhabitants: the living environment will be improved so as to remain basically undisturbed by rural development projects. Also, a stable living will be provided by achieving incomes with a set target of reaching the income levels of eastern region farmers and city dwellers.

2) Recommendations

(i) We recommend that the government urgently materializes a supply of funds and formulates studies and implementation plans needed for this, then starts work on implementing the project.

(ii) This plan is a master plan for integrated agricultural development in the Lower Chaco region, and detailed studies and plans are considered necessary in implementing the project.

(iii) In order to implement the project smoothly, the government must effectively manage the Paraguay Chaco Integrated Development Committee, as well as aiming to develop and enhance the organization and system of each project entity, and making utmost efforts towards a liaison between the administration, organizations, and established systems. In addition, it must maintain a close relationship with the regional administration of the Departamento Presidente Hayes.

(iv) The various plans and projects in this master plan are closely interrelated, while also supporting farm management plans by the agricultural and livestock sectors, which

represent the core plans for development. Therefore, all due care and attention needs to be given so that the flow of these plans and projects is not obstructed.

(v) The indigenous people shall be included in this plan as one of the carriers of farm management, in line with the results of the "Preference Survey" conducted in this study. All due consideration has been given to the method of doing this, but more suitable consideration will be needed at the stage of implementation of this plan.

(vi) The formation of settlements is conditional upon the prior acquisition of land, and measures are required to ensure that this proceeds smoothly.

(vii) The feasibility of development depends on the success of farm management. Support projects are indispensable in order to establish farm management, and settlement and farm management should only be started when adequate systems have been developed for these projects.

(viii) This master plan takes continuous development as a precondition, and in the various individual plans environmental considerations shall be made as a basic policy. Development projects other than this master plan that are to be planned in the study area in future must have their compatibility with this master plan studied and confirmed.

(ix) Since the land distributed to settlers includes forests for environmental protection, this will have to be taken into account when considering the responsibilities of the settlers.

(x) In order to implement this master plan smoothly, pilot projects, improvement projects for data that contribute to the diversification of crops, and follow-ups in order to diversify processed agricultural products will have to be undertaken as soon as possible.

(xi) The government should consider methods of stimulating agricultural and livestock farming production through policies in which special rates are applicable for the electric power used in agriculture and livestock farming.

(xii) Pilot projects should be implemented along the lines of the contents of these recommendations as well as detailed surveys and plans.

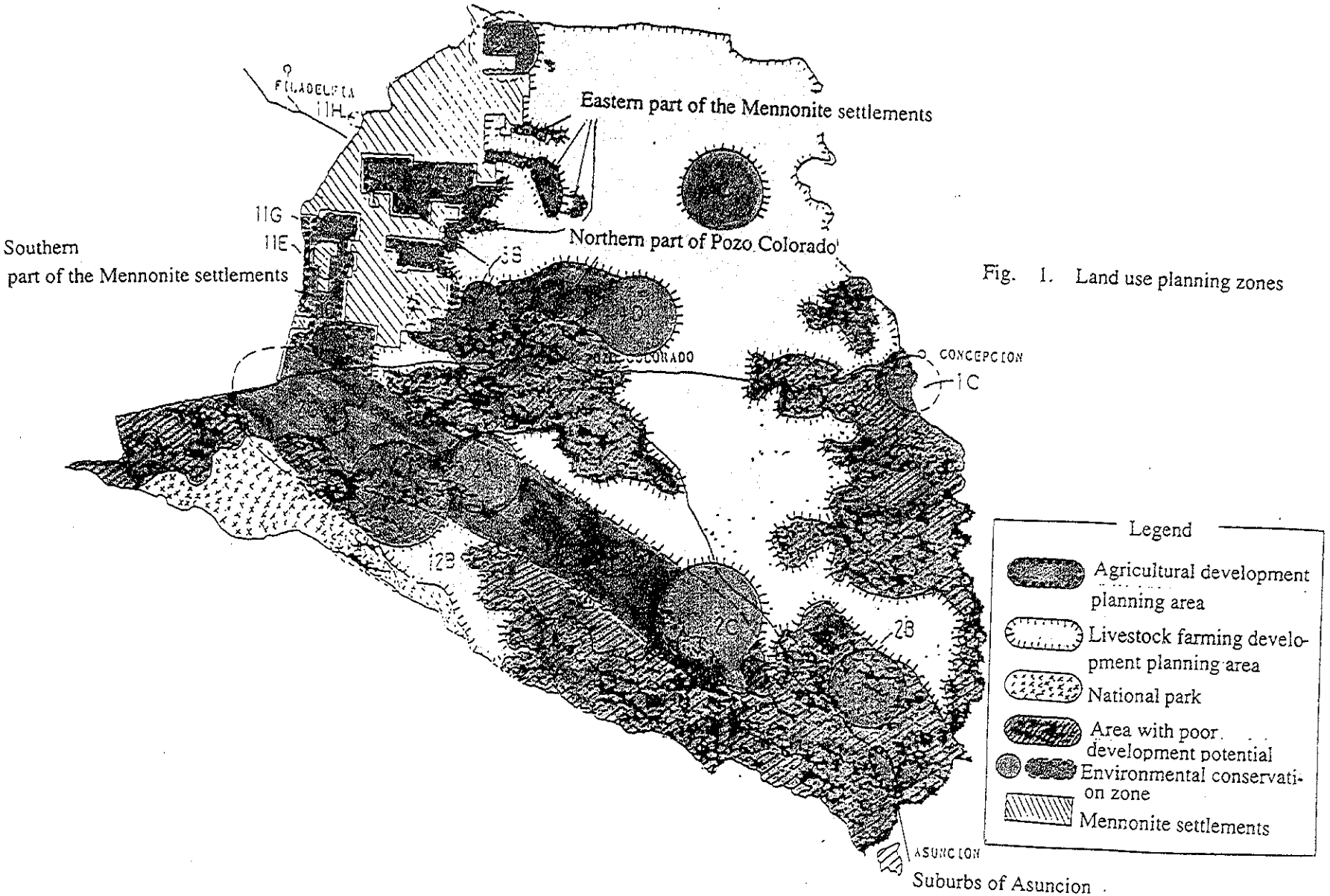

Fig. 1. Land use planning zones

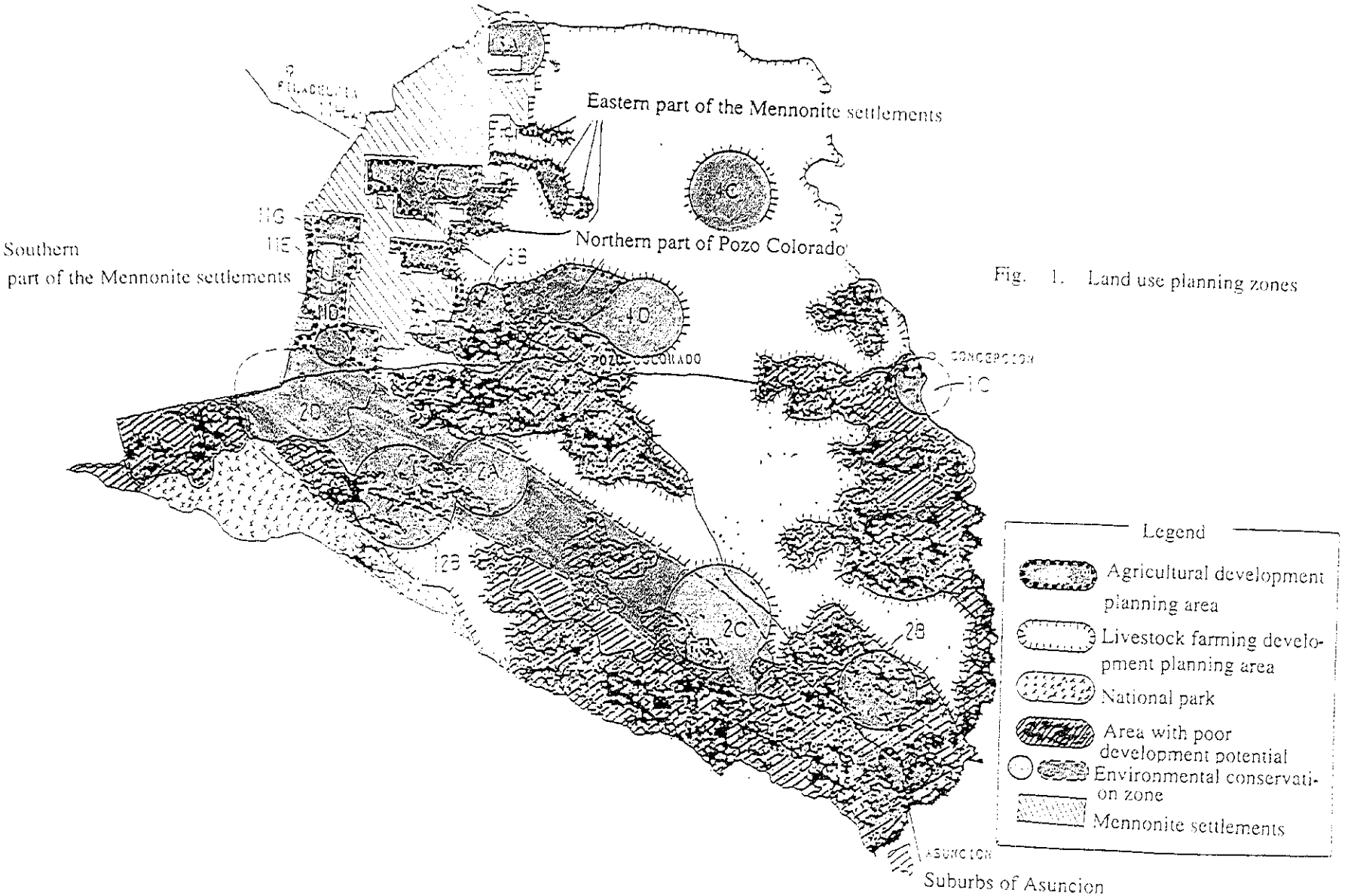

Fig. 1. Land use planning zones

Fig.2 The order of priority for the development of agricultural development and livestock farming development plan areas

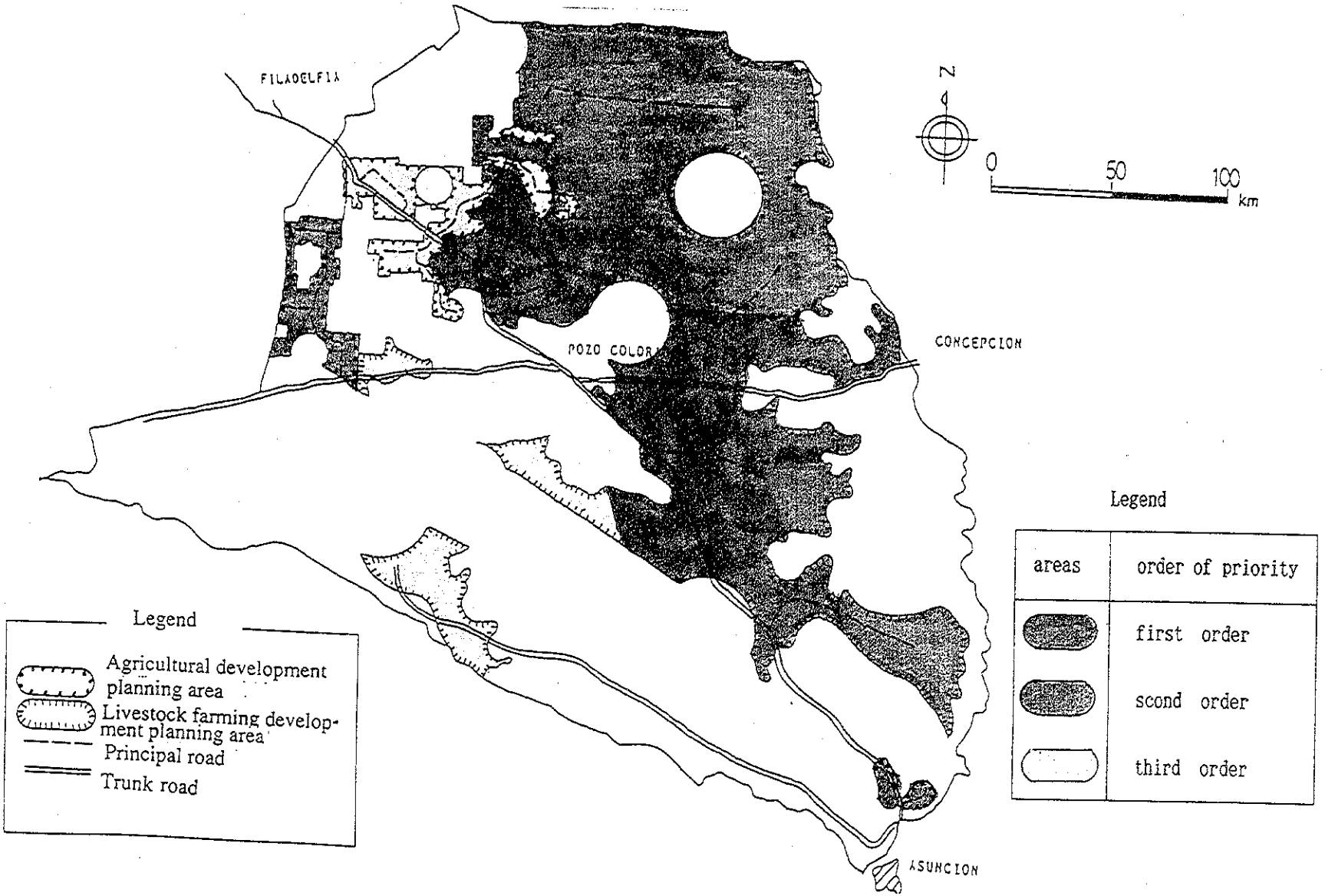

Fig.2 The order of priority for the development of agricultural development and livestock farming development plan areas

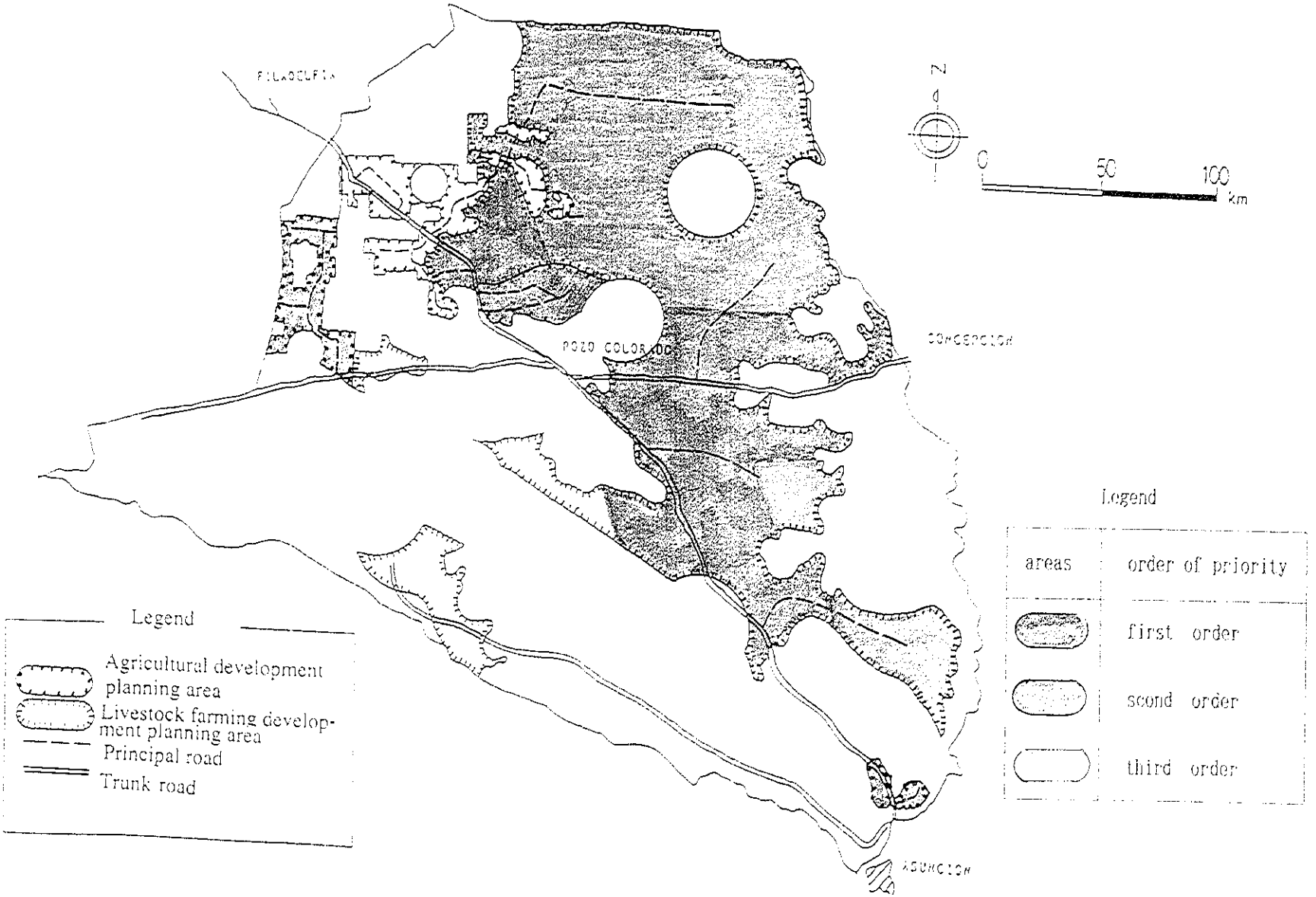

Fig. 3 Execution Scheme for Integrated Agricultural and Livestock Development Plan in the Lower Chaco Region

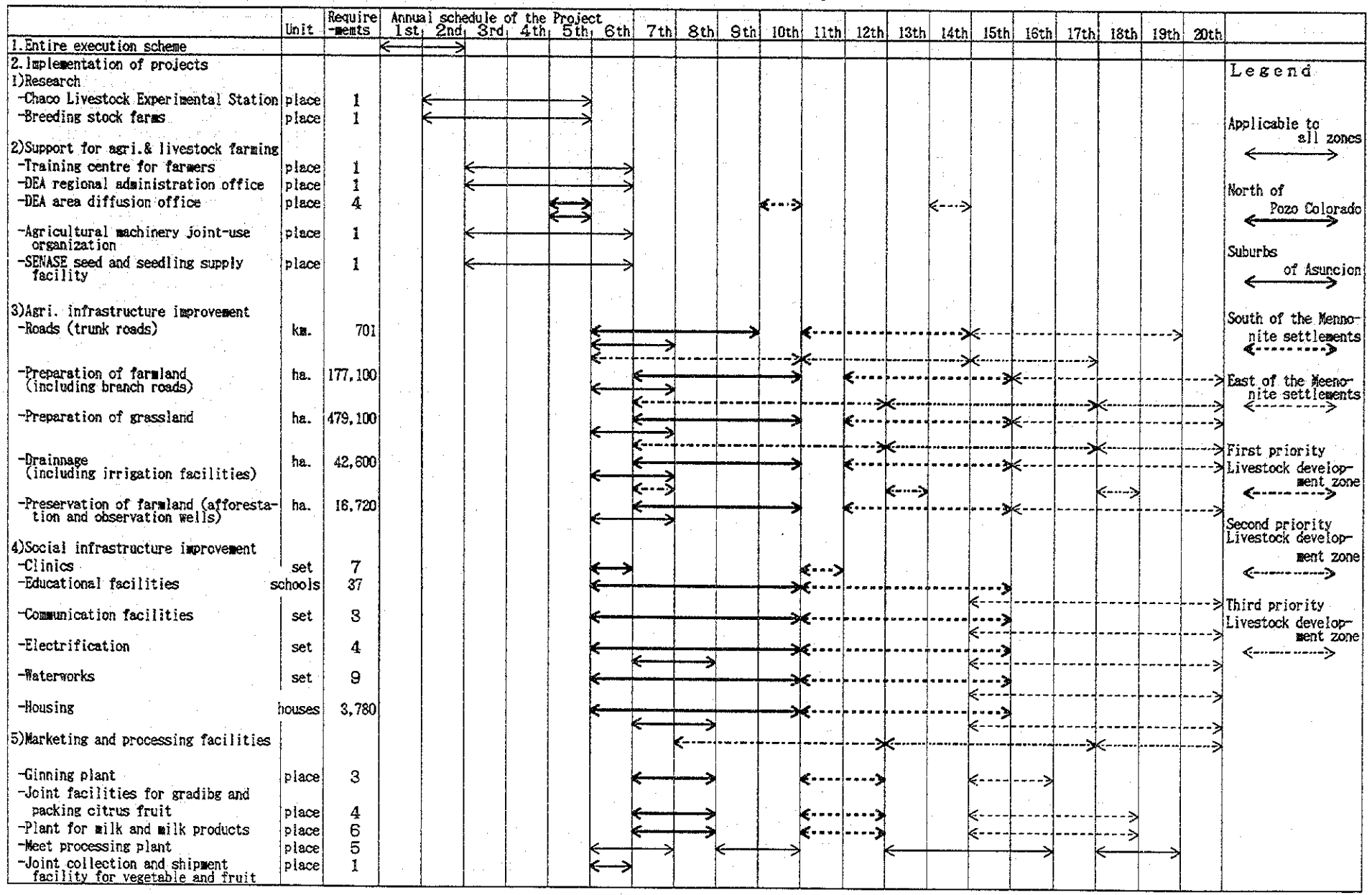

Table 1. Summary of Project Costs for Integrated Agricultural and Livestock Development Project at Lower Chaco

Unit : US$ 1,000

Items	Unit	Northern part of Pozo Colorado		Suburbs of Asuncion		Southern part of the Menhonite settlements		Eastern part of the Menhonite settlements		Livestock farming development area		Applicable to entire region		Total	
		Require-ments	Project costs	Require-ments	Project costs	Require-ments	Project costs	Require-ments	Project costs	Require-ments	Project costs	Require-ments	Project costs	Require-ments	Project costs
1. Implementation Costs			370		50		320		690		800		310		2,540
2. Project costs															
1)Research															(6,990)
Chaco Livestock Experimental Station	place											1	1,610	1	1,610
Operating costs for the above													3,790		3,790
Breeding stock farms	place											1	1,590	1	1,590
2)Support for agricultural and livestock farming															(24,220)
Traning centre for farmers	place											1	2,470	1	2,470
Operating costs for the above													2,940		2,940
DEA regional administration office	place											1	710	1	710
DEA area diffusion office	place	1	180	1	180	1	180	1	180					4	720
Agricultural machinery joint-use organization	place											1	13,850	1	13,850
Operating costs for the above													700		700
SENASE seed and seedling supply facility	place											1	1,610	1	1,610
Operating costs for the above													1,220		1,220
3)Agricultural infrastructure improvement															(337,450)
Roads (trunk roads)	km.	79	7,070	16	1,550	97	8,810	211	19,370	298	26,480			701	63,280
Maintenance and administration costs for the above			1,150		180		860		700		1,420		5,000		9,310
Preparation of farmland (including branch roads)	ha.	25,400	15,130	2,200	1,740	26,200	15,610	38,100	25,510	85,200	46,550			177,100	104,540
Preparation of grassland	ha.	12,000	2,250	300	60	15,100	2,830	24,000	4,500	427,700	80,270			479,100	89,910
Drainage (including arrigation facilities)	ha.	15,700	23,700	2,200	2,700	4,200	6,300	20,500	31,200					42,600	63,900
Maintenance and administration costs for the above			40		130		70		30						270
Preservation of farmland (afforestation and observation wells)	ha.	4,364	1,630	292	110	4,819	1,790	7,245	2,690	-	20			16,720	6,240
4)Social infrastructure improvemrnt															(62,050)
Clinics			80				110		270						460
Educational facilities			500				310		1,200						2,010
Communication facilities			550				960		1,590						3,100
Electrification			8,940		630		12,980		15,260						37,820
Waterworks			1,430				960		1,910						4,300
Housing	hauses	530	2,010	390	1,480	430	1,640	790	3,000	1,640	6,230			3,780	14,360
5)Marketing and processing facilities															(80,600)
Ginning plant	place	1	2,600			1	2,600	1	2,600					3	7,800
Joint facilities for grading and packing citrus fruit	place	1	1,100			1	1,100	2	2,200					4	4,400
Plant for milk and milk products	place	1	6,600			1	6,600	4	26,400					6	39,600
Meat processing plant	place											5	27,500	5	27,500
Joint collection and shipment facility for vegetable and fruit	lugar			1	1,300									1	1,300
Total project costs			74,980		10,060		63,720		138,610		160,970		62,800		511,300
3. Engineering service fees			11,240		1,510		9,560		20,790		24,150		9,450		76,700
4. Phisical contingency			8,660		1,160		7,360		16,010		18,590		7,280		59,060
5. Price contingency			9,520		1,280		8,100		17,610		20,450		8,000		64,960
Grand total of project costs			104,750		14,060		89,060		193,710		224,960		88,030		714,570
Fund for Integrated Agricultural and Livestock Development at Chaco															
Land acquisition funds															5,820
PRoject investment funds															100,050
Farming investment funds															41,250
Funds for Marketing and processing facilities															12,730
Total funds															159,850

Note : The costs for aglicurtural infrastructure projects include individual shares of costs for farmland development, preparation of grassland, and irrigation and drainnage projects. These individual shares have also been appropriated as loan funds for the Fund for Integrated Agricultural and Livestock Development at Chaco.

Table 2. Name of Project: Study of Integrated Agricultural and Livestock Farming Development Project at Lower Chaco in Paraguay

Second Phase Local Survey/Environment Sector

Environmental impact associated with development and measures for reducing the impact on the environment

Environmental elements	Environmental impact	Measures for reducing the impact on the environment
I Social environment		
1. Social lifestyles		
(1) Residential lifestyles		
1. Systematic relocation	A.... Settlers	Development of social infrastructure, establishment of system for supporting livelihoods and production
2. Forced relocation	B.... Indigenous people	Confirmation of intentions of indigenous people
3. Change in lifestyle	B.... Settlers	Provision of thorough guidance for living
4. Discord amongst inhabitants	A.... Acquisition/allotment of lots for settlement	Smooth acquisition of lots planned for development and proper evaluation and allotment of settlement lots
5. Indigenous people/minority races/nomads	B.... Living rights for some indigenous people (membership rights, etc.)	Social and economic considerations and measures based on wishes of indigenous people
(2) Population problems		
1. Population increase	B.... Social systems and customs	Development of social and economic infrastructure and establishment of system for supporting lifestyles in consideration of growth in population
2. Drastic changes in population structure	B.... Social systems and customs	Development of social and economic infrastructure and establishment of system for supporting lifestyles in consideration of growth in population
(3) Economic activity of inhabitants		
1. Transfer of base for economic activity	A.... Transfer of rights to estates due to development	Smooth coordination with landowners concerned for transfer of rights and establishment of compensation measures
2. Shift in economic activity and unemployment	B.... Indigenous people	Thoughtful consideration for indigenous people
3. Increase in earnings differentials	B.... Indigenous people	Thoughtful consideration for indigenous people

Environmental elements	Environmental impact	Measures for reducing the impact on the environment
(4) Systems and customs		
1. Readjustment of rights to water and fishing	D.... Study is required (indigenous people's customs of hunting and fishing)	
2. Change in social structure including establishment of organizations	B....Formation of new villages by settlers	Support for autonomous and collective activities of settlers
3. Reform of existing systems and customs	B....Formation of new villages by settlers	Support for autonomous and collective activities of settlers
2. Preservation of health and hygiene		
1. Increase in amount of agricultural c hemicals used	B.... Effect on people and livestock	Diffusion of and instruction in techniques for prevention of damage from disease and pests
2. Occurrence of endemic diseases	B.... Study is required in connection with settlement plan	Establishment of disease-prevention and hygiene system
3. Spread of infectious diseases	B.... Increase in human and livestock traffic	Establishment of disease-prevention and hygiene system
4. Accumulation of residual toxicity and agricultural chemicals	D.... Special attention is required in the long run	Guidance for selection of agricultural chemicals
5. Increase in amount of residual toxicity and excrement	D.... Special attention is required in the long run	Guidance for disposal methods in consideration of safety, health, and environment
3. Historical sites, cultural heritage, and scenery		
1. Damage and destruction of historical sites and cultural heritage	D.....	To be excluded from development plan
2. Loss of valuable scenic sights	D.....	To be excluded from development plan
3. Underground deposits of resources	D....Archaeological deposits	Preservation measures are required if such deposits have been found (Cultural Properties Law ...Law No. 946)

Environmental elements	Environmental impact	Measures for reducing the impact on the environment
II Natural environment 4. Areas where valuable wildlife and ecological systems exist		
1. Changes in vegetation	B.... Shift in land utilization	Preservation of fixed size of forests, natural grasslands, and wetlands in accordance with Forest Resources Law
2. Valuable species and fauna and flora indigenous to the region	B.... Ecological study is required	To be excluded from development plan as environment preservation zones. Periodical study of ecology
3. Variety of species of wildlife	B.... Shift in land utilization	Preservation of fixed size of forests, natural grasslands, and wetlands in accordance with Forest Resources Law
4. Penetration and propagation of harmful animals	B.... Spread of infectious diseases among live stock, abnormal increase in harmful animals	Establishment of measures for preservation of livestock health, establishment of harmful animal control system
5. Extinction of wetlands and peaty soil	D...	Preservation to be considered through land use planning
6. Extinction of tropical forest wild land	D.... Observation is required	Preservation to be considered through land use planning, periodical study of ecology
5. Soil and land (1) Soil		
1. Soil erosion	B.... Wind erosion	Provision of shelterbelts
2. Salinization of soil	B.... Deterioration of productivity of land	To be considered in drainage plan, periodical observation of groundwater level and salt (simple observation holes, farm management)
3. Deterioration of soil fertility	B.... Deterioration of productivity of land	
4. Soil contamination	D.... Special attention is required in the long run	Diffusion of and instruction in safe usage of agricultural chemicals
(2) Land		
1. Dilapidation of land (including desertification)	D... Special attention required	Application of Forest Resources Law, implementation of measures for preserving environment
2. Dilapidation of hinterland, woodland, grassland	D	Application of Forest Resources Law, provision of shelter belt (conservation forest)

Environmental elements	Environmental impact	Measures for reducing the impact on the environment
6. Hydrology, quality of water		
(1) Hydrology		
1. Change of flow condition of surface water	C.... Minor effect	
2. Change of flow condition and level of groundwater	B.... Periodical observation required	Periodical fixed-point observation
3. Occurrence of submergence and flooding	D.... Minor effect	
4. Accumulation of earth and sand	D.... Special attention required	
5. Lowering of riverbed	C	
(2) Quality of water and water temperature		
1. Water pollution and deterioration of quality	D.... Minor effect (observation required)	
2. Eutrophication	D.... ditto (ditto)	Periodical fixed-point observation
3. Penetration of salt water	D.... ditto (ditto)	
4. Change in water temperatures	D.... ditto (ditto)	
(3) Atmosphere		
1. Air pollution	C	

Notes: 1. The symbols used in the environmental impact column represent the degree of environmental impact.
A: Seriously affected
B: Deemed to be seriously affected
C: Not seriously affected
D: Unknown or deemed not to be seriously affected
2. Expected effects are shown in the environmental impact column.

Abbreviation List

ALADI : Asociación Latinoamericana de Integración
ANDE : Administración Nacional de Electricidad
ANNP : Administración Nacional de Navegación y Puertos
ANTELCO: Administración Nacional de Telecomunicaciones
APAL : Administración Paraguaya de Alcoholes
APROSEMP: Asociación de Productores de Semilla del Paraguay:
ARP : Asociación Rural del Paraguay
AUCA : Asociación de Usuarios de Crédito Agrícola
BCP : Banco Central del Paraguay
BID : Banco Interamericano de Desarrollo (IDB)
BIRF : Banco Internacional de Reconstrucción y Fomento
BNF : Banco Nacional de Fomento
CACEX : Carteira de Comercio Exterior (Brasil)
CAF : Centro de Armadores Fluviales
CAH : Crédito Agrícola de Habilitación
CAPECO : Cámara Paraguaya de Exportadores de Cereales y Oleaginosas
CAPNS : Comisión de Asesoramiento del Programa Nacional de Semillas
CAPSA : Compañía Algodonera Paraguaya, S.A.
CE : Comunidad Europea
CEDEFO : Centro de Desarrollo Forestal
CEMA : Centro de Mecanización Agrícola
CEPAL : Comisión Económica para América Latina
CEPEX : Centro de Promoción de las Exportaciones, MIC
CIAT : Centro Internacional de Agricultura Tropical
CIFA : Comando de Ingeniería de las Fuerzas Armadas
CIMMYT : Centro Internacional de Mejoramiento de Maís y Oleaginosas
CFPAN : Consejo de Fomento de la Producción Agrícola Nacional
CNDCH : Comisión Nacional de Desarrollo del Chaco
CORPOSANA: Corporación de Obras Sanitarias
CRDR : Centro Regional de Desarrollo Rural
CREDICOOP: Central Cooperativa Nacional Ltda.
CRIA : Centro Regional de Investigación Agrícola
DAMA : Dirección de Administración del Mercado de Abasto
DCEA : Dirección de Comercialización y Economía Agropecuaria, MAG
DCEA : Dirección de Censo, Estadísticas Agropecuarias, MAG
DEAF : Dirección de Enseñanza Agropecuaria y Forestal, MAG
DGA : Dirección General de Aduanas
DGJV : Dirección General de Juntas Viales

DGV : Dirección General de Vialidad
DIEAF : Dirección de Investigación y Extensión Agropecuaria y Forestal, MAG
DII : Dirección de Impuesto Inmobiliario, MH
DINAC : Dirección Nacional de Aeronáutica Civil
DSEAG : Dirección de Servicio de Extensión Agrícola y Ganadera, MAG
FAO : Food and Agricultural Organization
FCPCAL : Ferrocarril Central Presidente Carlos Antonio López
FECOPROD: Federación de Cooperativas de Producción
FEPRINCO: Federación de la Producción, la Industria y el Comercio
FF.AA. : Fuerzas Armadas
FG : Fondo Ganadero
FIDA : Fondo Internacional de Desarrollo Agrícola
FLOMERES: Flota Mercante del Estado
FMI : Fondo Monetario Internacional (IMF)
GT : Gabinete Técnico, MAG
GTZ : Gesellschat Tecnishe Für Zusamenarbeite
HCNCE : Honorable Consejo Nacional de Coordinación Económica
IAN : Instituto Agronómico Nacional
IBR : Instituto Bienestar Rural
ICB : Instituto de Ciencias Básicas
IDM : Instituto de Desarrollo Municipal
INDI : Instituto Nacional del Indígena
INTAL : Instituto para Integración Latinoamericana
INTN : Instituto Nacional de Tecnología y Normalización
IPVU : Instituto Paraguayo de Vivienda y Urbanismo
IPS : Instituto de Previsión Social
IRRI : International Rice Research Institute
JICA : Japan International Cooperation Agency
KfW : Kreditanstald Für Wiederaufbau
MAG : Ministerio de Agricultura y Ganadería
MDN : Ministerio de Defensa Nacional
MEC : Ministerio de Educación y Culto
MH : Ministerio de Hacienda
MHP : Molinos Harineros del Paraguay
MI : Ministerio de Interior
MIC : Ministerio de Industria y Comercio
MIT : Movimiento Intersindical de Trabajadores
MOPC : Ministerio de Obras Públicas y Comunicaciones
MRE : Ministerio de Relaciones Exteriores

MSPyBS : Ministerio de Salud Pública y Bienestar Social
OEA : Organización de Estados Americanos
OECF : Overseas Economic Cooperation Fund
OFAT : Oficina de Fiscalización de Algodón y Tabaco, MAG
ONCAP : Oficina Nacional de Coordinación y Administración de Proyectos de Desarrollo
ONUDI : Organización de las Naciones Unidas para el Desarrollo Industrial
OPE : Oficina de Programación y Evaluación, DIEAF
PETROPAR: Petroleos Paraguayos
PIDAP : Proyecto Integrado de Desarrollo Agropecuario del Paraguay
PIEA : Programa de Investigación y Extensión para el Algodón
PRONIEGA:Programa Nacional de Investigación y Extensión Ganadera
PTPA : Proyecto de Tecnificación para Pequeños Agricultores
SEAG : Servicio de Extensión Agrícola Ganadera, MAG
SECIP : Secretaria de Coordinación Institucional del PIDAP
SENACSA: Servicio Nacional de Salud Animal, MAG
SENASA : Servicio Nacional de Saneamiento Ambiental, MSPyBS
SENASE : Servicio Nacional de Semillas
SFN : Servicio Forestal Nacional, MAG
SGS : Societe Generale de Surveillance S.A.
SNPP : Servicio Nacional de Promoción Profesional
STP : Secretaría Técnica de Planificación
UIP : Unión Industrial Paraguaya
UNA : Universidad Nacional de Asunción
USAID : United States Agency for International Development
UNDP : United Nations Development Program

Terminology, Weights & Measures, Exchange Rates

Terminology

Departamento: unit of political administration, equivalent to "province".

District: smallest administrative unit, equivalent to "county".

Municipality: seat of local government of a District.

Western region: a region of 246,925km^2 on the western side of the Rio Paraguay; also known as the Chaco region.

Eastern region: a region of 159,827km^2 on the eastern side of the Rio Paraguay; includes the special administrative area of the capital Asuncion.

Weights and Measures

1 bag:	60 kg
1 foot:	33 cm
1 mt::	1 metric ton
1 hectare (ha):	10,000 m^2
1 hectolitre:	100 litres

Exchange Rates

Japanese yen:	¥1.00 = US$0.0080 = Gs. 12.88
US dollar:	US$1.00 = Gs. 1,601 = ¥124.30
Guarani:	Gs. 1.00 = ¥0.078 = US$0.00062

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 HISTORY AND BACKGROUND

From 1989 to 1990 the Government of Paraguay instituted a two-year socio-economic plan, the principle aims being to improve the welfare of the populace, boost production and create employment opportunities. The five specific targets of the plan were to:

1: boost production of assets and services
2: create employment
3: balance the national budget and stabilize prices
4: redress the deteriorating balance of international payments and stabilize the exchange rate, and
5: carry through comprehensive agricultural reforms.

In agriculture (including livestock farming), the mainstay of the Paraguayan economy, the plan sought to bring about self-sufficiency, boost employment and conserve natural resources. Specific policies included structural reform, better coordination between the public and private sector, fair land distribution, a more equitable pricing structure for farm produce, the creation of producer organizations, more research and testing, and conservation of natural resources.

The government strove to maintain balanced development by pushing ahead with building and development projects in the Chaco region to the west, while emphasising environmental conservation and land productivity in the more advanced east. This complemented existing agricultural policies of boosting exports and assisting small-scale farmers. As part of the development in the Chaco region, it was decided that a comprehensive agriculture and livestock development program including a modern road network was required in Departamento Presidente Hayes, with its relatively high rainfall and advanced infrastructure.

Since June 1990 Paraguay has sought assistance from Japan in formulating a 'Comprehensive Agricultural Development Plan for the Lower Chaco Region'. The Government of Japan commissioned a Development Study from the Japan International Cooperation Agency (JICA), which then dispatched a Preliminary Study Group to Paraguay in December 1990. The Group finalized a detailed Scope of Work for the 'Integrated Agriculture and Livestock Development Project at Lower Chaco: Preliminary Study', covering the 73,000-km^2 Lower Chaco region of Presidente Hayes, with the Paraguayan Ministry of Agriculture and Livestock.

1.2 OBJECTIVES

The present study is designed to provide an overall assessment of conditions in Presidente Hayes, for use in drawing up regional development projects. Specific activities will be coordinated with national development projects and policies for social and economic progress, and then combined in a 'Integrated Agriculture and Livestock Development Project' (master plan).

Technical skills and knowledge will be transferred to local personnel during the processes of study and investigation.

1.3 SUMMARY

Due to the lack of past data and the size of area to be covered, the study will run over three years, divided into two phases.

1) Phase 1

Three preliminary studies will provide data for planning overall agriculture development. Past data on natural and social conditions, social infrastructure, agriculture, livestock farming, agricultural economy, and the environment will be collated and analyzed. We will examine coordination with land classifications from remote sensors, development of land and water resources, and the suitability of different crop types. The findings will then be incorporated in an overall agricultural development plan for the region.

2) Phase 2

A master plan for agricultural development will be formulated by examining the findings from Phase 1 in detail, and obtaining extra materials and/or supplementary data as necessary. Specific plans will cover land use, farm management, cultivation techniques, infrastructure development, support policies, processing and distribution facilities, and project implementation, management and maintenance. The master plan will also include construction designs for principal facilities, profit and expense calculations for each project, environmental impact assessments, project evaluations and advice where appropriate.

A meeting will be held in the third and final year in order to present and discuss the draft final report. The final report will be produced in the same year.

CHAPTER 2

PARAGUAY : A GENERAL OUTLINE

CHAPTER 2 PARAGUAY: A GENERAL OUTLINE

2.1 NATURAL CHARACTERISTICS

2.1.1 Geography

1) Location and size

Paraguay is a land-locked country of 407,000 km^2, stretching from latitude 19°18' to 27°37' south and longitude 54°19' to 62°38' west. Situated roughly in the centre of the south American continent, it shares borders with Brazil, Bolivia and Argentina.

2) Geography

The entire country belongs to the La Plata river basin. The Rio Parana forms the eastern border with Brazil and southern border with Argentina, and the Rio Pilcomayo the south-western border with Argentina. In addition the Rio Paraguay flows north-south through the centre.

Natural geography, vegetation, and ecology differ markedly between east and west.

Some 40% of the total land area is bound by the Parana and Paraguay rivers in the east, with a topography of both tall forests and gently undulating plains and low rock hills. To the west of this region, along the Rio Paraguay, there are mostly flat plains, while to the east are found gently undulating plains and low mountain ranges no more than 600-800 metres above sea level. The remaining area to the south, a triangle enclosed by the Parana and Paraguay rivers, consists of hot, flat plains and flooded areas.

The other 60% of Paraguay, west of the Rio Paraguay to the Rio Pilcomayo and the border with Bolivia, is called the Chaco region. From the base of the Andes mountain range to the east are extremely gentle slopes, and flat plains rising to no more than 100-350 metres. Scrubland forests are also found.

2.1.2 Climate

To the north the climate is tropical, and to the south sub-tropical. The Tropic of Capricorn runs through the central region.

The yearly average temperature is 21-23°C in the south-east, and 24-26°C in the west. Summer runs from November to March. The hottest period is from December through to February, with maximum temperatures in the west reaching 38-40°C. Winter runs from

June to August, with monthly average temperatures 18-19°C in the east and 18-22°C in the west. Occasionally the temperature drops below zero and snowfalls are seen.

The temperature differential is more pronounced in the west: the record low is 7°C and high 44°C. The daily temperature range is considerable, especially in autumn and spring when differences of over 10°C between daybreak and midday are not uncommon. During summer and up until September, the temperature can drop suddenly depending on the wind direction. The depth of the daily and yearly temperature ranges has a significant bearing on the climate.

Humidity is high from autumn through to winter, and low from spring through summer. Average annual humidity is 67% in Asuncion and 58% in Estigarribia, gradually becoming lower from the south-east towards the north-west.

Yearly rainfall is 1700 mm at the eastern border with Brazil, 1800 mm in the central province of Asuncion, and 500 mm near the border with Bolivia, becoming lower from east to west. The monsoon season generally runs from September to April (encompassing summer) and the dry season from July to August (during winter), although the timing tends to vary from year to year.

The tendency of the Paraguay climate to vary considerably - in length and phase of the wet and dry seasons, temperature, yearly rainfall and distribution and rainfall patterns - has a significant effect on the agricultural industry.

Although rare in the north and north-east, frost forms about five times between May and September in the south-east and the west. Depending on the year, hail showers may also cause widespread crop damage.

2.1.3 Natural resources

Paraguay is not especially rich in mineral resources.

The principal source of energy is hydroelectric power.

Prior to the completion in 1969 of the Acaray Hydroelectric Power Station on a tributary of the Rio Paraguay, electricity was generated by burning timber and oil. With the construction of the Itaipu Power Station Dam jointly with Brazil, nearly all power now is provided by hydroelectricity.

Most of the water resources with potential are along the Parana river, which has an estimated storage power of 25,000 mW, a yearly output of 125,000 GWh. The high rainfall,

topography and geology of the east provides conditions are highly suitable for dams. The first hydroelectric power station in Paraguay was built on the Acaray river, while the Apa and Ipane rivers, both tributaries of the Paraguay, also have potential for small and medium-scale hydroelectric developments.

The western sections of the main Paraguay and Pilcomayo rivers within Paraguay are too flat for power generation.

Paraguay is rich in forest resources, which once covered 38% of the total land area. In a bid to stem indiscriminate deforestation and to protect and nurture natural forest resources, in 1973 the government enacted the Forestry Act, which prohibits exports of log timber.

2.1.4 Vegetation

Table 2.1.1 summarizes land usage for the entire country. Increased agricultural and livestock farming has reduced the forest area to 37%, of which 60% is located in Chaco to the west.

Table 2.1.1 Land usage in Paraguay as of 1990

Classification	Area (thousand ha)	%
Agriculture	4,389.9	10.8
Livestock farming	20,021.2	49.2
Forests	15,129.9	37.2
Rivers & others*	1,134.2	2.8
Total	40,675.2	100.0

* Includes towns & villages, rivers, dams, mountains, transport network

Source: Estimacion de la Agropecuario (1989-1990)
MAB, Direccion de Censo y Estadisticas Agropecuarios

Conditions such as temperature and rainfall, topography and soil type differ between east and west, as delineated by the Rio Paraguay, and this is reflected in the vegetation of each area.

The variation in average temperatures across the country is not significant enough to have a major impact on plant selection (except for those affected by frost). This is governed more by rainfall and soil type. The drop in rainfall as one moves from east to west is matched by a transition from evergreen to deciduous species, and from damp to dry forests.

The main types of vegetation in Paraguay have been classified below, alongside the percentage of total land area:

		%
i.	warm, damp forest & damp, deciduous species	19.1
ii.	grasslands & scrubland plains	2.6
iii.	arable land	8.6
iv.	damp forest	8.6
v.	swamp & marsh	15.7
vi.	copernicia swamp	7.4
vii.	silva forest	3.4
viii.	dense growth of cacti & prickly lianoids	32.0
ix.	fields of cacti & prickly lianoids	2.6

Vegetation in Eastern Paraguay consists chiefly of i. and ii. above. In some areas there are over 250 species of tree, with less in the west and the south.

1) Warm, damp forest and damp, deciduous species

Forests in the Alto Parana, Itapua, Amambay, and Canindeyu regions typically harbour a vast range of species. Many of these are used in construction and furniture-making, making the forests especially important.

Stretching west from the warm, damp forests is a wide north-south belt of damp, deciduous forest. Most of the trees shed their leaves during a single period of 3 to 9 weeks sometime between June and August. Typical of such species are lapacho (Tabebuia spp.) and jacaranda (Jacaranda sp.), whose defoliation period coincides with flowering.

Typical species include urundey para (Astronium fraxinifolium), lapacho (Tabebuia heptaphylla), and petereby (Cordia trichotoma). Pindo (Arecastrum romanzoffianum, or palm) and tacuara (Ganadua trinii, or bamboo) are typical of the vegetation found in these forests.

With advancing development in Paraguay these forests have been steadily disappearing, being converted into farmland, pasture or grasslands instead.

2) Scrubland plains and grassland

Within the north-eastern forest can be found islands of sparse scrubland vegetation and park-like grassland, including some very extensive tracts. Grassland, scrubland bushes and

small forests exist on pockets of highly sandy, non-arable soil. The yerbar plant grows strongly although not very high, and restricts available light to the undergrowth.

Typical species found in both east and west Paraguay are the very common yatai palm (Butia jatay), the kurupay (Andenanthera peregrina), and kaa mbara (Gochnatia polymorpha). Cactus (Discocatus hartmannii) is found only in pasture and areas of scrubland.

3) Cultivated land

As of 1990, arable land accounted for some 10.8% of the total land area. Short-term crops include cotton, soybeans, maize, wheat, peanuts, poroto, and vegetables, while perennial and semi-perennial crops include sugar cane, castor beans, cassava, citrus and other fruits, mate, tung-oil and coffee.

4) Wet forests

Wet forests are common to the east of the semi-arid northern Chaco region (west of Pozo Colorado), but are not found in wetland areas. Predominantly shrubs, this type of vegetation is resistant to arid conditions. Tree height varies randomly between 15 and 25 metres, and typical species include quebracho colorado (Schinopsis balansae), Ybyra moroti (Calycophyllum multiflorum), quebracho blanco (Aspidosperma quebracho-blanco) and algarrobo (Prosopis spp.). Timbo (Enterolabium contortosiliquum) and lapacho (Tabebuia spp.) are also found to the east. The most common shrubs are soybean plants, followed by downy myrtle (mirtaceae). Herbaceous plants include pineapple (bromeliaceae), cactus (cactaceae), and various species of epifita, vines and parasite plants.

5) Marshes and swampland

In swamps, marshes and continually flooded areas in river basins of the Rio Paraguay and its tributaries can be found a number of swampland species such as duckweeds and seaweeds, the most common being water hyacinth (jacinto, or Eichhornia crassipes).

6) Copernicia swamps

Karanday palm (Copernicia alba) is found in small, exclusive groups, but is also dispersed sparsely throughout swamp belts. After three to nine months underwater, the palm forms combinations with other herbs or trees. Copernicia grows best submerged in salty water surrounded by non-humid conditions. Other common species include algarrobo blanco (Prosopis alba) and other Prosopis spp.

7) Tall species

These are found in the arid, permeable sandy eastern Chaco area, bordering with most other

vegetation types, including wet forest, copernicia swamps and marshes. 20-25 metre species such as quebracho colorado (Schinopsis quebra-colorado) and palo santo (Bulnesia sarmientoi) are distributed thinly, while algarrobal (a Prosopis spp.) grows thickly.

8) Dense growth of cacti & prickly lianoids

Typical of northern and central Chaco, this type of vegetation consists mainly of cacti and thorny shrubs.

Common species here include euphorbiaceae and bromeliceae, both of which are resistant against and highly adaptable to dryness and intense heat. The humidity in the air lends itself to epiphytic species and prickly lianoids such as Tillansia spp. pineapple. The most common tree species is samuhu (Chorsia insignis).

9) Fields of cacti and prickly lianoids

The vegetation here is mostly similar to 8) above. Cactus and other prickly varieties are more common, although sparsely distributed, and access is generally more difficult.

(Source: Plantas en el Paraguay, Dieter E. Stabler, 1987)

2.2 SOCIETY

2.2.1 History

The present land-locked Paraguay came into being in 1617, when the Peruvian kingdom under Spanish colonial administration was split into two separate territories, Nueva Extremadura and Santa Cruz de la Sierra. The latter was further divided into Paraguay and Rio de la Plata territories. Paraguay soon came under the control of the La Plata sub-kingdom, created under the Bourbon dynasty, which incorporated Bolivia, Uruguay, Argentina, Paraguay and part of present-day Peru.

The French Revolution and Napoleonic Wars of the nineteenth century accelerated movements toward independence in the Latin American countries.

The social structure under Spanish colonial administration consisted basically of a white ruling class governing the coloured class. Toward the end of the colonial period this began to break down. Increasing hostility between the Peninsular (Spanish-born) minority and white creole majority from the colonies, together with a rising population of mixed-blood Mestizos, combined to create a common seam of resentment, uniting the creoles with the indigenous population.

Major changes to the ruling structure, while experienced in other Spanish colonies, are particularly significant in Paraguay. The country was not highly valued by the Spanish due to its lack of gold, silver and other sought-after metals and its poor accessibility by sea. Due to the absence of a mining industry as such, there was no perceived need for enhanced agricultural production to provide food for workers, nor was there the feudal system of large-scale land ownership seen in other Spanish colonies. Furthermore, the indigenous people, the Guarani, were not as advanced as others such as the Maya or the Inca. Over several hundred years of colonial history these economic and social influences have created racial uniformity and a sense of uniqueness, a desire for an independent Paraguay one step removed from the mainstream.

After issuing a Declaration of Independence in Buenos Aires in 1810, Argentina attempted to annex Paraguay. The latter refused, gaining its own independence a year later via resistance to the Spanish monarchy in Paraguay and the new Argentine government. The struggle for complete independence continued until an administration was born under Jose Gaspar Rodriguez in 1814.

Rodriguez instituted a dictatorship, closing Paraguay off from the outside world. Although

this enabled him to retain the country's won independence, it had a devastating effect on the economy.

The following administration, headed by Paraguay's first President Carlos Antonio Lopez, re-opened the country and undertook an ambitious program to provide a modern infrastructure. However Lopez also made enemies of Brazil, Uruguay, and Argentina. The three countries combined in battle to crush Paraguay, shattering its first hesitant steps toward development and modernization and reducing the population and land area by half.

The political vacuum and economic and social chaos after the defeat, while disastrous on the surface, nevertheless provided the impetus for a complete reversal of economic policy. The government sought to rebuild national finances and stimulate the agricultural sector by disposing of large tracts of state-owned land, and actively encouraging foreign investment and increased settlement by foreigners. The present system of large-scale land ownership can be traced directly to this period.

After defeat at the hands of its three neighbours, and with domestic politics in disarray, the situation became increasingly difficult for the new administration in Paraguay, leading to war in Chaco. The 1880's saw the creation of two current political forces, the Colorado National Republican Party (Asociacion Nacional Republicana) and the Freedom Party, both with members from the army, business, and emerging large-scale landowner class.

In 1932, war with Bolivia broke out in Chaco. It lasted three years. Eventual victory by Paraguay brought an end to political turmoil and civil disturbances, strengthened solidarity and national spirit and helped foster a sense of mutual understanding among the Paraguayan people. However the economy was still in critical shape, particularly since the outbreak of the Chaco war had left no time to rebuild after the earlier defeat.

After the Second World War Paraguay was once more plunged into domestic crisis, this time in opposition to the dictator Higinio Morinigo. A coup d'état in 1954 installed General Alfredo Stroessner as President of a military government supported by the Colorado Party, which was to hold power for some 34 years until another coup by General Andres Rodriguez in February 1989.

The Stroessner administration was widely criticized for its use of force to maintain power, and for its excessive stay in office. The dictatorship also prevented the natural development of bureaucrat and technocrat classes. On the other hand, 34 years of relative stability finally allowed Paraguay to begin the task of economic and social modernization.

For the purpose of analysis the period under Stroessner can be roughly divided into three parts - the 1960's, 1970's and 1980's.

The first decade, from the late 1950's to the early 1960's, was spent quelling local resistance forces. In conditions of extreme poverty, and influenced by the 1959 Cuban revolution, anti-government forces and workers made repeated attempts to overthrow the military.

Real progress began during the 1960's. After successfully stabilizing the domestic political situation, the government found itself obliged to tone down its dictatorial policies. Stroessner responded positively to the American proposal of a 'Partnership for Progress', making moves towards democratization and tackling the domestic economic disparity. On the political front, opposition parties were recognized, a constitution promulgated (in 1967), and the two-house system of government formally adopted; new economic policies included the establishment of a farmer welfare system (Instituto de Bienestar Rural) and the promotion of small-scale rural operations, expansion of loans and finance systems to stimulate industry, increased foreign investment and accelerated infrastructure development.

The third period under Stroessner, the 1970's, was the golden age for Paraguay, which made solid progress despite the oil crisis and other economic hardships. The decade saw two separate national socio-economic plans, the start of construction on the Itaipu Dam jointly with Brazil, and a new Foreign Investment Act. Strong growth was reflected in the leading economic indices, all of which were positive. Of course, a large part of this was due to neighbouring Brazil, the economic giant in South America.

After peaking in the 1970's, economic growth fell away during the 1980s. The trade deficit, already negative since 1974, continued to fall, while the international balance of payments worsened, due in part to an exports slump. Although a number of factors combined to produce this stagnation, three in particular stand out: completion of the Itaipu Dam and with it the disappearance of a major stimulant for the domestic economy; poor agricultural output due to drought; and the imposition of tougher restrictions on international payments. The local economy was also affected by dire economic conditions in Brazil and Argentina: the traditionally supportive economic relationships with its two neighbours were now working against Paraguay.

The above gives a brief economic overview of an important period in Paraguayan history, the thirty-four years under Stroessner. Initially dependent on the military and the police, his rule brought political stability and economic prosperity to many, particularly the middle classes. This last point provides the key to his ability to retain power for so long.

2.2.2 Population

According to the Paraguay Economic Planning Agency, the population in 1991 stood at 4,276,000, an average of 10.5 persons per square kilometre. The population is concentrated in the east, with an average density of 26.3/km², as opposed to just 0.27/km² in the west. This remains largely unchanged from the 1982 census, when the west held 97% of the total population of three million at a density of 7.4/km². The population has grown 2.87% during this period.

A census conducted in 1950 found some 35% of the population living in urban areas. This figure gradually rose to 36% in 1962, 37% in 1972, 42% in 1981 and 47.2% in 1988 before levelling off (46.7% in 1989 and 47.4% in 1990). The rapid urbanization of the population seen in past decades appears to have lost momentum.

The 1990 urban ratio of 47.4%, far lower than the average 73% in comparable Latin American and Caribbean Island countries (Desarrollo Humano, Informe 1990, PNUD), indicates that a high proportion of the population is staying on the land, maintaining a solid base in the agricultural sector, the mainstay of Paraguay.

2.2.3 Society and culture

1) Society

Paraguayan society has been shaped by its unique history - the marriage of indigenous Guaranis with Spanish and the fierce pride of the resulting mixed bloods; the emphasis on Guarani language and culture; and the birth of a new Guarani-Español culture incorporating elements brought by the Spanish.

Unlike their colonial neighbours, the Paraguayan people have evolved into a single, uniform race of mixed-bloods with a keen sense of national identity. As mentioned earlier, this can be attributed to a number of unique factors, including the indigenous Guaranis' lack of an advanced civilization like the Inca or the Maya; the paucity of mineral resources; Spain's consequent lack of interest in Paraguay; and the absence of a feudal system of large-scale land ownership.

The official language is Spanish, although Guarani is also widely used throughout the country by people of all ages and classes. Religion is free in Paraguay, although the national religion is Catholicism and the majority of people are devout Catholics. Guarani-Español culture is defined by two cultures: on the one hand, the combination of Guarani ('fighters') and the Spanish who once sought worldwide supremacy, nomadic farming and the wet forests of the wild; and on the other hand Iberia, the mixed-blood alloy of east and west in a 'wild Europe'. Further, Catholicism permeates both of these.

In terms of social structure, the middle class is small in number, while the upper class is peopled by high-ranking military officials and sometimes entrepreneurs, as well as top-level bureaucrats and the occasional farm-owner.

2) Culture

The Paraguayan people love their music. Each of the Latin American countries has its own distinctive music and folklore, and Paraguay is no exception, where Spanish music has been adapted by the Guarani. The Guarani language itself, rich in sound effects and other sounds, is a lilting, musical tongue, said to resemble the noises of the forest. Typical Paraguayan folk ballads such as the polka and the galopa (Spanish poetic forms accompanied on the Spanish guitar or harp) owe their popularity largely to the teachings of missionaries. The original European forms have been transformed into uniquely Paraguayan musical styles.

The Guarani language is widely used in Paraguayan music. A good example of this is 'Guarani' by Jose Asuncion Flores, a piece said to embody the spirit of Paraguay, which has become a quasi-national anthem. The accompaniment is said to have an almost symphonic quality.

Of all the instruments introduced by the Spanish, the guitar is still referred to as a 'Spaniard's instrument' because of their legendary prowess. The folklore rhythm was born from the guitar. The harp, meanwhile, at one stage usurped the piano in Latin America. Unlike the guitar, however, its popularity was limited to selected countries, of which Paraguay is one.

Thus the music evolved into the current style seen throughout the country, a symbol of the blended Guarani-Español culture, using guitar and arpa (Paraguayan harp) to support lively, tuneful songs about nature, animals and local customs.

Literature in Paraguay is permeated with sentiments such as nationalism and attachment to one's town. Writers attract considerable admiration and respect, and many streets and town squares bear the names of well-known literary figures.

The people are highly aware of social issues. Novels on social themes are common, and are highly valued as artistic works.

Young writers focus on issues such as national traditions and identity, the younger generation's search for its own role, the development of society, and the difference between European Guarani ideology.

2.3 CURRENT STATE OF THE ECONOMY

2.3.1 Economy

As a land-locked country, Paraguay is supported primarily by agriculture and livestock farming. In 1973 agreement was reached with Brazil regarding the joint construction of the Itaipu Dam, the largest hydroelectric project in the world. The project, which began in 1975, provided a major economic boost to secondary industry in Paraguay and was partly responsible for the period of remarkable growth through to the early 1980s. Average annual growth in the 1970's was 8.1%, or 4.7% per person, a trend which continued up until 1981. In addition to the stimulus provided by the hydroelectric project, both agricultural production and export volume rose during this period.

1982 and 1983 were years of negative growth. The economy was slowed by the completion of the dam in September 1982, and by droughts and floods which devastated the crucial agricultural sector. Agreement was reached with Argentina in 1977 on a new hydroelectric project for Yacyreta, in the hope that this would maintain the economic momentum, but due to repeated delays construction did not begin until 1983. The project has been beset with funding problems, partly due to the deteriorating Argentine economy, and is not due for completion until 1995. It has not made anywhere near the same contribution to the Paraguayan economy as Itaipu, although the trickle-down effect on business is considerable.

Paraguay's monocultural economy, based on cotton and soybean production, is highly vulnerable to external conditions. Repeated devaluations by neighbouring heavyweights Brazil and Argentina force up prices for locally produced goods and erode competitive strength. The recession in developed countries and the deterioration in the international trade market since the oil crisis has affected cotton and soybean prices, and made machinery and other imports more difficult to obtain.

Following the change of government in 1989 there was considerable relaxation both politically and economically. Most notable was the February 23 standardization of the various exchange rate systems into a single floating market exchange system, and the abolition of the special rate for agricultural sector imports, whereby the BCP determined the FOB (AFORO) for agricultural produce. Interest rates on both savings and loans were also freed up. The new policies initially created soaring inflation, but this has since been stabilized more successfully than in Brazil and Argentina.

Some of the unique features of the development of the economy in Paraguay are:

1. The absence of an economic 'take-off'

According to Rostow, the prerequisites for a take-off are: massive investment in production; rapid development in manufacturing; and provision of a supporting political, social and structural framework for economic progress.

In Paraguay, where manufacturing hinges on agricultural produce, the primary and secondary sectors are strongly interrelated. Growth in the secondary sector after 1983 has closely matched that of the primary sector. But since most principal exports, such as cotton and soybeans, are sent out either unprocessed or as primary products only, the processing industry does not play a central role in the economy. In the present economic structure manufacturing is unlikely to develop and expand around agricultural processing; nor are there any suitable candidates for the manufacturing industry, ideally the driving economic force in a nation. In these conditions it seems unlikely that continuous, strong growth - a 'take-off' - can be achieved.

2. The failure to progress beyond an agriculture-based economy

In Paraguay there has been no sign of the ordinary pattern of economic progress, namely a structural change from agriculture-based primary industry to manufacturing-based secondary industry. The proportion of GDP occupied by secondary industry rose appreciably after the Itaipu Dam project got underway in 1975 but, since construction is not part of the production sector, fell again when the project finished in 1980 and remained low for some time thereafter. Fig. 2.3.1.1 illustrates the changes in the contribution by sector to overall GDP. After the slump in secondary industry, primary industry failed to rise again above 30% as in the early 1970's, hovering at 25-28%, despite continual growth of 3%. This was due to the abundance of land, which meant that there was still plenty of leeway to increase the arable land area in addition to productivity.

3. The pivotal role of agriculture in economic growth

The contribution of each sector to GDP growth is calculated as follows:

$$\text{Sector contribution} = (GS \times Ys/Y)/(GY) \times 100$$

where,

GS = production growth rate for sector

Ys = GDP for sector

Y = Total GDP

GY = GDP growth rate

Figures from the above equation have been plotted in fig. 2.3.1.2. Secondary industry exceeded primary industry until 1983. In the years 1984 and 1988 it rose to 50% of GDP. A study of GDP growth rates by sector (fig. 2.3.1.3) clearly shows how the economic climate hinges on the fortunes of the agricultural industry, and hence the importance of this sector.

4. Slow investment activity and falling investment efficiency

Table 2.3.1.1 and fig. 2.3.1.4 show domestic GDP in terms of demand. Personal consumption is generally between 70 and 80% of GDP, while domestic investment remains at the 22-27% mark.

Fig. 2.3.1.5 shows capital efficiency, as calculated from the ICOR (Incremental Capital Output Ratio):

$$(I/Y)/(\Delta Y/Y) = \Delta K/\Delta Y = \text{Inversion} \quad \text{(Incremento del PIB)}$$

The construction boom up until 1981 saw high capital efficiency of 2-3 ICOR, after which the figure falls to 3-9. With the current economic structure it is highly unlikely that ICOR will fall and investment efficiency improve in the near future.

5. Economic growth not linked to living standards for the burgeoning population

For the past ten years the population has been rising at more than 3% per annum. Although this has been matched by economic growth of around 3%, there has been no corresponding increase in living standards for the general populace. The government is targeting 3% real economic growth in 1991, a figure it is likely to continue using for the foreseeable future. However if the population continues rising at the present rate, this will do no more than maintain GDP per head at the existing level. It will not contribute to better living standards for the people.

Tables 2.3.1.2 to 2.3.1.4 show GDP current prices for the decade 1982-1991, and growth in 1982 constant prices respectively. Table 2.3.1.5 shows the calculations of sector weight in GDP structure.

2.3.2 Trade

Paraguay exports primary produce such as cotton, soybeans, timber and meat, and imports mainly machinery, oil, automobiles and processed foodstuffs. Currently it has a trade deficit, due to a general deterioration in the global market for primary products.

Exports came to US$656 million in the 1992 fiscal year. In terms of the period 1960-1990 as a whole, livestock exports exceeded agricultural exports until 1973. The latter showed remarkable export growth after 1974, particularly in cotton and soybeans, which grew from 11,000 and 0 tons in 1970 to 232,000 and 1,640,000 tons respectively in 1990, some two-thirds of total exports. The fifteen-fold increase in total export volume over the last twenty years can be largely attributed to rising production levels in cotton and soybeans (see Tables 2.3.2.1-2.3.2.3).

Neither export share nor actual volume of timber, livestock produce, or manufactured goods has risen significantly over the same period, indicating that export share is on the decline. The statistics also indicate that agricultural produce other than cotton and soybeans is doing poorly.

Paraguay exports principally to Brazil, Argentina, Holland, Switzerland, Germany, Italy, and the USA. Being landlocked, it suffers a severe handicap in terms of overseas trade. The international market price for soybeans, for instance, was US$280/ton in 1989/90, while the FOB export price was US$206; in 1990/91 these figures were US$230 and US$163 respectively. Because of high transport costs Paraguay in effect receives only 70% of the international rate.

Imports in the 1992 fiscal year totaled US$12.37 million, creating a massive US$5.81 deficit. Principal imports were machines (21.7%), oil and oil derivatives (11.7%), transport machinery (14.2%), medical products (6.8%) and foodstuffs (3.7%), bought from Brazil, Argentina, Japan, and the USA.

2.3.3 Foreign debts

Due to the previous administration's lack of interest in large-scale industrialization and its restrictions on foreign obligations, Paraguay until recently had one of the lowest foreign debt levels of the South American countries. For the past few years, however, it has been facing spiraling debt problems.

During the early 1980s foreign debt rose from US$10 million to US$15 million, while repayments failed to get above the 20% mark. From 1985, with debt levels still rising, repayments began to climb upward also, reaching 27% in 1987. 1989 saw a sudden drop in the repayment rate due to rescheduling of loans with Brazil (see Table 2.3.2.4).

Source: APIC Country Information 92.2-3, Paraguay/No. 61

(1) At the end of 1991, foreign debt stood at US$1.716 billion, only 1.0% over the 1990

figure of US$1.699 billion, with funds coming from international agencies (US$632 million or 36.8%), foreign governments (US$864 million or 50.3%) and trading banks (US$221 million or 12.9%). Unpaid foreign debt in 1991 came to US$523 million (29.5% over US$44 million in 1990), of which US$400,000 (0.1%) belonged to international agencies, US$319 million (61.1%) to foreign governments, and US$200.9 million (38.8%) to trading banks.

(2) The Paris Club foreign debt talks, originally scheduled for February 1991, were repeatedly postponed for various reasons. An IMF group, visiting Paraguay in December 1991 to assess the economic situation, recommended a revision of the October 1990 Letter of Intent be revised but was not able to obtain the consent of the IMF Board of Directors. Although the talks were rescheduled for early 1992, there was no move on the letter of intent.

(3) The Paraguay government has earmarked approximately US$240 million in Gs currency for the timely repayment of loans expiring in 1992. Repayment of Japanese loans (OECF) due by the end of December 1991, although partly delayed after December 1990, was expedited between December 1991 and January 1992.

2.3.4 Wages and commodity prices

Paraguay has one of the most stable inflation rates in South America, with prices rising at only 10-20% annually. For two years after the political change in 1989 the rate soared, but by 1991 it had settled once more at around 15-20%.

Minimum wages are fixed by the Ministry of Labour through negotiation with labour unions, and revised regularly in line with price rises. Wage revisions during the last decade have been conducted on average twice per year, excepting a period from December 1990 and July 1992 when they remained fixed (see Table 2.3.4.1). Many businesses however ignore the guidelines altogether.

2.3.5 National budget

Since it is unfeasible to impose personal income tax in a country such as Paraguay, the government relies on customs duty and indirect tax revenue. As the newly created common market among South American countries (the MERCOSUR: Mercado Comun del Cono Sur) is likely to reduce customs revenue, the government brought in a Value-Added Tax (Impuesto al Valor Agregado, or IVA) on 1st July 1992 in the form of a universal 10% consumption tax (primary produce excluded).

The national budget for 1992 was Gs 1423 billion, 14% more than the previous year. The Culture and Education Ministry was the biggest recipient, outstripping the Defence Ministry for the first time. The latter received only 11%, a considerable decline from 25% in 1960. The Public Works Ministry was generously funded during construction of the Itaipu Hydroelectric Project (1975-1982) but not afterward, despite its responsibility for social capital programs. Allocations to the Ministry of Agriculture and Livestock rose abruptly from the traditional 2-3% to 5.0% in 1990 and 6.7% in 1991.

(Fuente Boletin Estadis Tico. Mayo/1993/No 403, BCP)

2.4 INFRASTRUCTURE

For land-locked Paraguay, a transport network facilitating the movement of produce and materials is critical to production. The government is actively pursuing bilateral aid and funding from international agencies in order to develop and maintain the road, air, and river transport infrastructure.

National highways account for 39.9% (7700 km) of the total 22,700 km of principal roads, and farm roads the remaining 66.1% (15,000 km). Just 20% (1543 km) of highways are asphalt-paved, and only 4.4% (657 km) of farm roads. A properly-maintained road network exists only in the capital and the Asuncion-Encarnacion-Ciudad del Este triangle. Elsewhere are generally dirt tracks, often impassable when wet. There are 673 bridges in Paraguay, of which five are particularly important to goods transport: Ciudad del Este to Foz do Iguazu, Encarnacion to Posadas, Asuncion to Region Occidental, Concepcion to Pto. Militar, and Pto. Falcon to Clorinda.

The Rio Paraguay has nineteen port facilities and the Parana river seven. Both rivers are extremely shallow, at an average depth of three metres, falling to 1.5-2.0 metres in the dry season. The most important of the 26 facilities are those at Concepcion, Asuncion, Villeta and Encarnacion. Soybeans are shipped out at Concepcion (1940 km upstream of Buenos Aires), and cotton at Asuncion (1630 km), which is also the principal point of entry for imports. Villeta, only 37 km south of Asuncion, is used for exporting soybeans and cotton, and as a distribution base for cement materials from the port of Vallemi. Soybeans and tung-oil are shipped from Encarnacion, the largest facility on the Parana and 1583 km from Buenos Aires.

The first railway line in Paraguay, opened in 1861, was 370 km long, running from Asuncion to Encarnacion with a San Salvador-Abay branch line. It has since been linked with Argentina via a bridge between Encarnacion and Posadas. With the exception of rolling stock, upgraded in 1910, the original facilities are still being used. Deterioration is such that the average speed is only 20 km/h (and maximum speed 30 km/h), severely limiting passenger and cargo handling volume. The system runs at a loss.

Paraguay has one international and 47 domestic airports. Construction is underway on a second international airport near the town of Ciudad del Este. Another 1000 privately-owned airfields are scattered throughout the countryside. The main airports with concrete runways are at Asuncion (Aeropuerto Internacional Silvio Pettirossi; runway length 3,354 m), Itaipu (1,500 m), Concepcion (1850 m), Vallemi (1200 m), Pilar (1850 m), Ayolas (1850 m), and Mariscal Estigarribia (3600 m).

2.5 NATIONAL DEVELOPMENT PLANS

The 1985-1989 Five Year Plan was followed by a Short-term Social and Economic Development Scheme for 1989-1990, drawn up by the new government in 1989 to signal its approach to economic policy. The Scheme contained the traditional emphasis on road upgrading and infrastructure development.

In 1991 the Ministry of Agriculture and Livestock's 'Lineamientos de la Politica Agraria' divided the agricultural sector into three levels: organized, large-scale operations (major ranches and farms); small to medium-scale production centres; and small-scale farms. The first two received the same level of assistance as before, while top priority was given to the lowest level, the most disadvantaged in financial and technical terms, and to landless farmers, through land use policies favouring smaller operations, funding, the creation of small farming cooperatives, information sharing and technical training.

Specific policy developments at the Ministry include:

1) Land reform
   1. Allocation of land to 40,000 landless households by 1993. Agricultural Development Council (CDR: Consejo de Desarrollo Rural) to provide immediate assistance to newly landed farmers.
   2. Revision of governmental ordinances on agricultural reform, land use and the environment

2) Cultivated farming
   1. Self-sufficiency at the national level
   2. Wider range of products for export
   3. Greater productivity and efficiency from small farms
   4. Development of processing industry in order to boost agricultural output

3) Livestock farming
   1. Support for small livestock farming operations
   2. Research into productivity and animal hygiene

4) Forests and the environment
   1. Study of natural resources prior to formulation of land use policies; resources and environment conservation programs
   2. Revision of legislation geared towards conservation