

THE AMAZON BASIN

18.

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THE AMAZON BASIN

GENERAL CONSIDERATIONS

## GENERAL CONSIDERATIONS ON THE AMAZON BASIN

### I. General Characteristics

#### 1. Basic aspects

The Amazon Basin covers some 7 million squarekilometers. 1/ This includes 58% of the territory of Brazil, 60% of that of Bolivia, 60% of that of Peru, 32% of that of Colombia, 45% of that of Ecuador, 30% of that of Venezuela, and the entire territories of Guyana and Surinam. 2/

The surface of the Amazon Basin covers approximately one third of South America; it is the world's largest hydrographic system, and also forms the greatest extension of undisturbed forest ecosystems of the planet.

The Amazon Basin has a population of some 10 million inhabitants, concentrated for the most part in a small number of large cities. In general, the density of population is calculated to be little more than one inhabitant per square kilometer.

#### 2. Characteristics of the soils

One of the fundamental obstacles to the effective exploitation of the Amazon Basin on the part of the countries that compose it is the poverty of the soils, due to their low degree of natural fertility and the high degree of pluviometric precipitation. This has led these countries to undertake systematic studies of recognition and classification of Amazonian soils. In different projects it is considered that "soils whose fertility is acceptable for agriculture have been found. Preliminary estimates indicate 10% of fertile soils in the entire basin, making it even more important to carry soil studies of the region further". 3/

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1/ Preliminary figures. The various bibliographical references differ as to the figures on the extension of the Amazon Basin, and on the percentage of Amazon territory in each of the countries.

2/ These last two countries are not hydrographically Amazonian; however, they are considered to be situated in the Amazon basin's zone of influence, and therefore are considered as such.

3/ Medina, Ernesto. El Futuro de la Cuenca Amazónica. In Magazine Interciencia, Vol. 3, No. 4, July-August, 1978, page 196.

Of the action that has been taken in this sense we should underline the efforts of Brazil, Colombia, Peru and Venezuela. The information that is being obtained by the countries of the Amazon basin will permit a rational use of lands and of hydrological resources, and therefore, according to Dubois <sup>1/</sup> "the establishment of poles of development in cattle and agriculture, the exploitation of timber resources and the delimitation of forest reserves of exploitation, of areas of conservation and of protection".

### 3. Critical factors in the development of the Amazon region

The obstacles to a rational and effective use of Amazon lands can be classified in four major groups as follows: ecological, technical, social and economic.

- 3.1 Ecological obstacles. These can be reduced to two: the low degree of soil fertility, and drainage problems caused by the high degree of pluviometric precipitation.
- 3.2 Technical obstacles. Particularly the difficulty of developing production systems suitable to the region and the lack of efficient programmes to introduce these.
- 3.3 Social obstacles. Among others we should above all point to the lack of adequate services in the areas of health, education, housing, transport, technical assistance, commercialization and credit.
- 3.4 Economic obstacles. Related to the ecological obstacles is the problem of the use of fertilizers as the only means of developing a sustained agricultural production in the region. However, if this is to be achieved, the price of agricultural products must be greater than that of the fertilizers, or else agriculture will continue to be itinerant or migratory. <sup>2/</sup>

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<sup>1/</sup> Dubois, Jean. Los Sistemas de Producción más apropiados para el uso racional de las tierras de la Amazonía. In: Seminar on Renewable Natural Resources and Amazonian Regional Development. IICA, May 28 to 30, 1979, Bogotá, Colombia.

<sup>2/</sup> For more information on this aspect, see: Alvin P. de Tarso. Perspectivas de Producción Agrícola en la Región Amazónica. In: Magazine Interciencia, Vol. 3, No. 4, July-August, 1978.

McKenzie <sup>1/</sup>, studying the production of the Amazonian cattle and agriculture section in 1970, identified the limiting factors of each of the main products of this sector. This situation is illustrated in the following chart.

Chart 1-1

Characteristics of Main Cattle and Agriculture Products of the Amazon Basin. 1970

<u>Type of Crop or Product</u>	<u>Negative Factors that Limit the Exploitation of the Products</u>
Timber	- Minimum level of infrastructure
Cattle for beef	- Availability of animals
	- Minimum level of infrastructure
Cassava	- Adequate infrastructure for industrialization
Kingdom's Pepper	- Phyto-sanitary control
Rice	- Adequate infrastructure and personnel
	- Biological technique for mass cultivation
Maize	- Varieties suited to the conditions
Jute	- Adequate living conditions in the area
Para's Chestnut	- Economic transportation of the crop
	- Productive and pest-resistant varieties
Beans	- Varieties suited to the conditions
Rubber	- Phyto-sanitary control
Milk	- Productive breeds requiring little technology
	- General knowledge of available technology

## II. Migratory Agriculture in the Amazon Basin

Migratory or itinerant agriculture is the most common and generalized land use practice in the Amazon Region, thus playing the major role in the rural economy of the basin.

The land use system that characterizes traditional migratory agriculture is based on cutting and burning the virgin forest in order to cultivate different products for a number of years, generally three to four. This used land is then abandoned, and is generally left fallow for a long time. The practice is begun again on fresh ground.

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<sup>1/</sup> McKenzie, A. Thomas. Sistemas de Producción Agrícola en la Amazonia. In: International Meeting on Production Systems for the American Tropics (Land-use systems): IICA, Reports on Conferences, Courses and Meetings, No. 41, Lima, Peru, June 10-15, 1974.

According to the study undertaken by Sanchez 1/, the burning of virgin forest is the only preparation that the land receives for crop sewing. This author also considers that "the only fertilizer the land receives is provided by the mineral content of the ashes", and that "manual and occasionally chemical weed control is practiced (only) during the first months".

Over a considerable area of the Amazon basin, traditional migratory agriculture, which generally constitutes a subsistence production system, is beginning to be unbalanced. This process is described by Sanchez 2/, who points out that "the relation of crop years to fallow years diminishes, leaving the forest insufficient time to re-establish itself properly; yields then begin to decrease, and erosion takes place on an alarming scale". According to Dubois 3/, this degradation of traditional migratory agriculture is due to two fundamental causes, as follows: the intensification of demographic pressure, leading to a reduction in the fallow period which hinders the recuperation of soil fertility, and the large scale introduction of extensive cattle-raising, which leads to a reduction of the surfaces devoted to subsistence crops.

As a result of these two factors, which lead to the imbalance of itinerant agriculture, Dubois' study concludes that: "despite a considerable reduction in population, itinerant crops with a short fallow period are becoming generalized, provoking a progressive irreversible degradation of the soils. It is therefore advisable, when elaborating specific land-use policies and plans in the Amazon basin, to analyze the local status of migratory agriculture in terms of the combined effects of demographic and cattle pressures". 4/

This implies that the success of migratory agriculture and, thereby, the continued subsistence of the rural communities, depends to a large extent on the fallow period of the forest being longer, this being the only way the natural recuperation of soil fertility can be guaranteed.

Systems of continued agriculture are also being investigated as alternative forms to migratory agriculture. Such are the cases of Yurimaguas and Pucallpa, in Peru, and of the perennial and forest crop production systems, in Brazil. 5/ The justification for developing these experiments lies in the fact that, although the itinerant

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1/ Sánchez A., Pedro. Alternativas al Sistema de Agricultura Migratoria en América Latina. CIAT.

2/ Sánchez, A. Pedro. Op. Cit.

3/ Dubois, Jean. Op. Cit.

4/ Dubois, Jean. Op. Cit.

5/ These experimental works are mentioned in the chapters of analysis of the Amazonian territories of Peru and Brazil.

agriculture that has not become imbalanced constitutes a form of rational and stable subsistence production, it has the great disadvantage, as Sanchez points out <sup>1/</sup>, that it does not permit the agriculturalists to raise their standard of living nor does it permit them to obtain a significant increase in yields.

### III. Policies of Regional Development

#### 1. General considerations

The general criterion held by the various countries as regards the development of the Amazon basin is that of including these lands in their cattle and agricultural production so that they should contribute to the economies of the countries. These countries have, on the other hand, been undertaking policies of colonization aimed at these regions, to a greater or lesser extent. Brazil, in particular, has displaced considerable numbers from its North Eastern provinces to its Amazonian territories, mainly along the Trans-Amazon Highway. Not all the countries, incidentally, have shown the same concrete interest in the real development of the basin.

Brazil is the country that is most effectively carrying out concrete plans for the development of its Amazonian region. These actions are reflected in the policies of institutional organization, particularly of research, of regional infrastructure, of credit and of fiscal incentives. <sup>2/</sup>

Peru is also promoting the development of its jungle region, though to a lesser extent, and more recently than Brazil. The guidelines of its policy are based on promotion of rural settlements and agrarian exploitation. <sup>3/</sup>

Colombia has developed no planned policy in relation to its Amazonian territory. In 1974, the Amazonian Radargrametric project, PRORADAM, was launched with the aim of providing foundations for the future elaboration of an integrated development plan of the Amazon territory. The government, through institutes of colonization and land division, has promoted policies of colonization in this region, but in fact the majority of these have not had the expected results, owing mainly to the lack of experimental tests, ignorance of the vocation of the soils and absence of suitable infrastructures. Some of the cattle and agriculture research that has been undertaken is the result of isolated rather than globally coordinated action.

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<sup>1/</sup> Sánchez, A. Pedro, Op. Cit.

<sup>2/</sup> A more detailed description of each one of these aspects is to be found in the Chapter on the Brazilian Amazon territory.

<sup>3/</sup> The institutional structure, research activities and regional development policies are described in the Chapter on the Peruvian Amazon territory.



The Ecuadorian Amazon territory was, until late 1977, the area that received least attention from the State. Beginning in December 1977, the government passed the Law of Colonization for the Amazon Region and founded the National Institute for the Colonization of the Amazon Region, INCRAE, with the aim of planning, coordinating and fulfilling the action required by the integral development of the region. This new policy of attention to the Ecuadorian Amazon territory is related to the discovery of petroleum in this zone.

The Bolivian Amazon territory, representing approximately 60% of national territory, is the least developed area of the country, and has barely been touched.

The Venezuelan Amazon region is virtually uninhabited. In the Southern part of the Amazon Basin, corresponding to the part known as Venezuelan Guyana, the government has launched a considerable programme of industrial development.

Guyana and Surinam have made little investment in the way of resources and attention in their jungle regions. Brazil has a policy of close collaboration and technical assistance with regard to these countries.

## 2. The Amazon Pact

In July 1978, Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Surinam and Venezuela signed the treaty of Amazon Cooperation. <sup>1/</sup> The aim of this treaty is to make the cooperation of the countries binding in order to promote the development of their respective Amazon territories. The main aspects dealt with by the treaty are the following:

- a. To incorporate the respective Amazon regions into the economies of the countries.
- b. To procure a harmonious development of the Amazon basin in order to make a fair share of benefits among the countries.
- c. To promote policies establishing a balance between the economic development and the conservation of the region.

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<sup>1/</sup> The full text of the treaty can be seen in: INTAL. Revista de Integración Latinoamericana. August 1978, No. 3.

- d. To generate a system of information in order to facilitate the exchange of the experiences and results of the actions undertaken by each of the countries.
- e. Rational use of resources and creation of an adequate infrastructure.
- f. To promote scientific research in the following areas:
  - Flora
  - Fauna
  - Rational exploitation of hydric resources
  - Archeology and ethnic anthropology
  - Health: control of the epidemics and diseases specific to the zone.

With this aim, the treaty foresees the joint fulfillment and coordination of research programmes, the creation and operation of institutions of research or of centers of experimental production.

The Amazon treaty is a relatively recent initiative, and has yet to be ratified by the contracting countries. For these reasons it is not yet possible to evaluate the actions aimed at fulfilling the agreements of the treaty. 1/

#### IV. Considerations on the Production Systems to be Developed in the Amazon Region 2/

##### 1. Guidelines and policies for the territorial treatment of the basin

Taking into account the considerations developed above as to the importance of migratory agriculture and the causes of its imbalance or degradation, this document proposes two major guidelines, within which various alternatives are recommended:

##### 1.1 Areas of low "demographic and cattle-raising" pressure

The following actions are recommended for the areas having this characteristic:

- a. Improvement of traditional migratory agriculture.

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1/ For a more detailed analysis of the background, the negotiations and the treaty itself, see: Landau, D. Georges. Tratado de Cooperación Amazónica: Nuevo Ensayo de Integración. In: Integración Latinoamericana, monthly magazine from INTAL, August, 1978, No. 3.

2/ The development of this part constitutes a work synthesis of J. Dubois. Op. Cit.

- b. Conservation of renewable natural resources.
- c. Selection and study of future poles of economic development.

## 1.2 Areas of increasing or of high "demographic and cattle-raising" pressure

The following actions are recommended for these areas:

- a. Reduction of credit to extensive cattle-raising <sup>1/</sup> and the generalization of the use of polystrata production systems.
- b. Promotion of the sustained yields forest economy in the zones of colonization.
- c. Conservation and preservation.

## 2. Production systems

Some of the production systems that we will take into consideration are barely at an experimental stage in some countries, but can provide a basis for launching and continuing investigation in others, as long as due attention is given to concrete and specific conditions.

### 2.1 Monoculture of short-cycle species and perennial species

Various species have been experimented in the state of Pará, Brazil, among others, black pepper.

### 2.2 Extensive cattle-raising

Research undertaken in Brazil, particularly in the state of Pará, has demonstrated the possibility of introducing cattle-raising projects by converting considerable area of forest into grazing land for cattle. The success of these projects depends to a large extent on the land treatment practices and on the types of soil chosen.

### 2.3 Multiple short-cycle crops

Multiple cultivation of short-cycle crops is being experimented in the Amazon region. Some of the combinations that are being used are:

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<sup>1/</sup> In various of the countries of the region, more than 80% of credit for the development of the Amazon areas is estimated to be absorbed by cattle-raising projects.

- a. Maize or cassava with grain leguminous plants.
- b. Rice-Maize
- c. Sugar Cane-Tropical Kudzu
- d. Cassava-Maize-Bean

#### 2.4 Combination of a perennial specie with short or medium-cycle species

These combinations almost always form a transition stage leading to polystrata perennial agricultural systems or to agro-forestry systems. The main combinations are:

- a. Coffee-banana (or plantain)
- b. Arnotto tree or cashew tree-papau, pineapple and cowpea. This type of combination is being experimented in the Peruvian region of Tingo María.
- c. Citrus-banana-annual species. Some experiments in this field are being carried out in the Padrón Experimental Station, in Venezuela.

#### 2.5 Integrated systems of stratified production

These systems are characterized by the fact that they are a deliberate copy of the "natural jungle" ecosystem. The principal ones are:

- a. Polystrata perennial agricultural systems. For example:
  - i. The association of coconut with other perennial crops. In tropical America there is no literature on coconut combinations; the only experience is the preliminary information provided by the Padrón experimental station in Venezuela, where cassava-cocoa-coconut combinations have been experimented.
  - ii. Rubber-coca. Though this combination has not so far shown much success, some experimental work is being carried out by EMBRAPA in Brazil.
  - iii. The association of oil palm and cocoa. This has not been attempted so far, but results obtained elsewhere - in Indonesia, particularly - are satisfactory and could serve as a basis for introducing this association in the Amazon basin.

b. Agro-forestry systems. Among the possible alternatives that are of particular interest in this field are the following:

i. The combination of agricultural crops and forest species. There are three alternatives in this field :

- The Taungya system <sup>1/</sup>. This system is being promoted by the Brazilian Institute of Forest Development.
- The silvo-banana system.
- Permanent combinations of agricultural and forest species. The combination of cocoa-erythrina-cordia goeldiana is being tried in some regions of Brazil, particularly in the State of Pará. Embrapa, with the Humid Tropics Cattle and Agricultural Research Centre, is also carrying out research on the combination of Bertholletia exelsa (Brazil nut) with cocoa, black pepper and guaraná.

ii. Silvo-pasturing systems. These, which are practiced in the Amazon region, have been insufficiently investigated. One alternative of forest-cattle production is being experimented in the Ecuadorian Amazon territory by the INIAP.

iii. Agro-silvo-pasturing systems.

### 3. Some final considerations

Owing to the incipient state of knowledge on the Amazon region, Dubois, in the above-mentioned document, lists a series of basic principles for the implementation of programmes for the exploitation of land and natural resources, as also for the various rural settlement programmes. These are as follows:

- 3.1 To maintain the main part of the Amazon territory in an untouched and conserved condition. Policies for the exploitation of these zones, considered as mobilization reserves, will crystallize in so far as the research that is being undertaken shows results that make it possible to take decisions concerning them.
- 3.2 To concentrate efforts on the consolidation and development of the areas already under colonization.
- 3.3. To situate new rural settlements in the more fertile lands, respecting at the same time the natural vocation of the soils.

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<sup>1/</sup> This system is characterized by the clearing of an area of jungle and then sowing of an agricultural crop and commercial trees.

- 3.4 To give priority, for the development of cattle and agricultural activities, to the use of production systems that successfully copy the natural ecosystems.
- 3.5 To take into consideration the basically forest aptitude of the Amazonian lands when defining policies for occupying them.

THE AMAZON BASIN

PERU

## THE PERUVIAN AMAZON TERRITORY

### 1. General characteristics of the Amazon Region

#### 1. Basic aspects

The surface of the territory of Peru is calculated at 1.285.215.6 square kilometers 1/, with a population estimated at 14 million. This implies that the surface is considerable in relation to a small population. However, the country is considered 2/ to have only 0.2 hectares of cultivated land per inhabitant.

Given the limited possibility of increasing the cultivated area, it is necessary to consider expanding the agricultural frontier by occupying forest and foot-hill jungle lands 3/. Dourojeanni's study calculates that, of the expansion of the agricultural frontier foreseen during the rest of the present century, 1.600.000 hectares will correspond to the Amazon Region. This implies that this region's potential is greater than those of the Mountain and Coastal Regions.

The great challenge, according to this document, is whether technology can procure the development of production systems that are profitable from the economic and social point of view, and that also counteract the negative effects of changes in the ecosystem.

There are various classifications of what constitutes the so-called Peruvian Jungle, or Amazon Region. One of these identifies three sub-regions within the region, as follows: Low Jungle, High Jungle, and the Foot-Hill Jungle or mountain.

From the administrative point of view the Peruvian Amazon Region, generically referred to as Jungle, includes four departments: Amazonas, Loreto

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1/ Equivalent to 128.521.560 hectares. Ministry of Agriculture figures put the extension of the country at 128.021.932 hectares.

2/ Dourojeanni, J. Marc. A new strategy for the development of the Peruvian Amazon territory. In: Revista Forestal del Perú, Nos. 1-2 Vol. 6, 1975-1976, Universidad Nacional Agraria La Molina, Lima, Perú.

3/ These lands include the Amazon Region.



San Martin and Madre de Dios. These departments cover a total surface of 76.424.747 hectares, corresponding to almost 60% of the total territory of the country.

Considering these three sub-regions, it is calculated that the Low Jungle and High Jungle comprise 88% of the Peruvian Amazon Territory, while the rest is composed of Foot-Hill Jungle.

## 2. Soil characteristics

According to a paper presented by José del C. Muro in the forum on the development of the Peruvian Jungle organized by the Universidad Nacional Agraria <sup>1/</sup>, the soils of the jungle region can be classified as: zonal, a-zonal and intra-zonal.

- a. Zonal soils. These have a low degree of fertility and productivity. In their natural state they are judged to be suitable for extensive and subsistence exploitations and, because of their low degree of productivity, unfit for annual crops. Sixty percent of the soils of the Amazon Region (the Jungle) are estimated to fall into this group.
- b. A-zonal soils. Composed of those soils that are in their initial stage of formation. They represent almost 8% of the region's soils, and are concentrated mainly in the High Jungle and Low Jungle sub-regions. They are considered to have a high productive capacity, and are in addition fit for intensive crops. However, it should be noted that a large proportion of these soils are flooded during certain periods of the year.
- c. Intra-zonal soils. These occupy almost 20% of the jungle area. Their exploitation in cattle or agriculture is considered to be almost impossible because they are submitted to a climate of permanent humidity.

## II. Human Resources

### 1. The region's population

The National Head Office for Statistics and Censuses calculated the population of the Peruvian Amazon Region, in 1970, at 1.386.000 inhab-

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<sup>1/</sup> Muro, José del C. Agricultural Potential of the Jungle Soils. In: "Forum on the Development of the Peruvian Jungle". Universidad Nacional Agraria, 24-28 Sept. 1973.

itants 1/, which gives a population density of 0.18 inhabitants per square kilometer 2/.

Figure II-1 shows the population of the country and its various regions, in 1960, 1970, 1976 and 1980. The data for the last three years are projections made by the above-mentioned body. The native population has been excluded from these figures 3/. As can be seen, the Jungle population reveals relatively small rates of participation. The region's participation in 1980 will be of 11.6%, as estimated by the above projections. If we consider this region's territorial extension, the population figures do not reveal the existence of a considerable demographic vacuum.

#### a. Density of population

Data concerning population density refer exclusively to the four departments that compose the region. These are 4/:

- Department of Loreto	1.1 inhabitants per km <sup>2</sup>
- Department of Amazonas	4.2 inhabitants per km <sup>2</sup>
- Department of San Martín	4.3 inhabitants per km <sup>2</sup>
- Department of Madre de Dios	0.3 inhabitants per km <sup>2</sup>

#### b. Urban and rural population

As can be observed in Figure II-2, the urban population of the Jungle has already increased its population. In 1960 this population represented 27.3%, and the estimations for 1970 and 1980 are 31.0% and 34.7% respectively.

These changes in the distribution of population are the result of a greater increase in the urban population rather than in the rural population. Rates of increase for the 1950-1960, 1960-1970 and 1970-1980 periods can be seen in Figure II-3.

1/ The number of natives was calculated at 230.000 in 1970. See: Banco de Crédito del Perú. Realidad, perspectivas y problemas de la Selva Peruana. Round Table Discussion, 6-8 Sept. 1971, p 56.

2/ Not counting the native population.

3/ Native population is estimated at 6.8% of the total population of the Amazon region. See the document of: Romero, Emilio. El Hombre en la Amazonia Peruana. In: Amazonia, conquista del presente. Forum, 6-9 Oct., Colegio de Arquitectos del Perú, Lima, 1978.

4/ Banco de Crédito del Perú. Op. Cit., p. 59.

### c. Distribution of the economically active population

Figure II-4 shows the distribution of the economically active population, according to sectors, for 1967, as regards the Jungle Region and the entire country. As can be seen, the outstanding activities are those related to cattle and agriculture, which absorb 65.6% and 49.8% of the economically active population, of the Jungle and the entire country, respectively.

## III. Characteristics of the Cattle and Agricultural Sector

### 1. Land use

According to the Ministry of Agriculture 1/ the lands of Peru can be classified into groups as follows:

Group I: Appropriate for intensive agriculture and other uses.

Group II: Appropriate for permanent agriculture, cattle-raising and silviculture.

Group III: Marginal lands relegated for extensive pasturage and silviculture.

Group IV: Lands unsuited for cattle-raising, agriculture and silviculture.

Based on this classification, the land distribution of the Jungle region is presented in Figure III-1 2/.

### 2. Cattle and agricultural activities

According to Dourojeanni 3/, the cattle and agricultural activities in the Peruvian Amazon territory are mainly of a spontaneous nature, and of low rentability. They are basically activities of auto-sustenance. He also

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1/ Quoted in: Banco de Crédito del Perú, Op. Cit., p 38.

2/ Another classification of Amazonian land use is considered in the Dourojeanni document, Op. Cit., based on calculations made by C. Zamora, as follows: 25 million hectares suitable only for conservation as forests of protection; 45 million hectares suitable only for forest exploitation; 6 million hectares suited to cattle-raising and 2 million hectares devoted to agricultural production.

3/ Dourojeanni, Marc. Op. Cit.

considers, quoting Malleaux, J., that migratory agriculture has destroyed 7.5% of the Amazon region.

#### a. Agriculture

Figures III-2 and III-3 present information on the main perennial and annual crops in the Peruvian Amazon Region.

Among the perennial crops, and according to their order of importance in terms of cultivated surface, the most outstanding are: coffee, plantain, citric fruit, cocoa, tea, oil palm and Kingdom's Pepper. Peru's report to the international meeting on production systems for the American tropics <sup>1/</sup> mentions the following as perennial crops with considerable potential: india-rubber, bread-tree, mango, guava, coconut tree, arnotto tree, barbasco, cinnamon, nutmeg, vanilla and ipecacuanha. It also estimates that almost all the perennial crops are destined for export markets.

Of the annual crops, the most important in the order of their cultivated area are: cassava, rice, kidney beans, corn, jute and tobacco. These annual crops form the basis of the subsistence agriculture. The report mentioned above also considers other annual crops as having considerable possibilities of development in the Peruvian Jungle, as follows: soya, sesame, sorghum, sugar cane and cotton.

#### b. Cattle-raising

The number of head of bovine cattle in the Jungle Region is calculated <sup>2/</sup> at 200.000. Cattle exporting farms in the area are characterized as being of medium and small size, and mainly meat producing.

The technological level of this production is low, and it is calculated that: "annual birth rates are approximately 50-60% and the growth rate reduced to the point that the slaughtering age is prolonged to 4-5 years of age. All this is due to the deficient nourishment which is partly the result of the poor quality of the pastures (graminaceous

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<sup>1/</sup> Dourojeanni, Marc et al. Informe de Perú. In: "International Meeting on Production Systems for the Amazon Tropics (land use system)". IICA, Reports on conferences, courses and meetings, No. 41, Lima, Perú, June 10-15, 1974.

<sup>2/</sup> Dourojeanni, Marc et al. Op. Cit.

plants) and partly to deficient management". 1/

### 3. Forest activities

According to the Peru Report to the international meeting on production systems 2/, the extension of Peruvian natural humid tropical forest is of approximately 77.5 million hectares, 70% of which is judged to be production forests, 20% to be protection forests, 4% to be swamps and areas without use and 6% to be forest areas destroyed by agriculture. Of the 77.5 million hectares, 4% is considered to be suitable for intensive agriculture. This means that more than 90% must be dedicated to forest exploitation as the main activity.

On the basis of the study on "A new strategy for the development of the Peruvian Amazon territory" 3/, one can say that this region contains 2.500 species that can be exploited as timber, of which only 658 are known botanically. Of these, only the use of about 100 has been studied experimentally.

It is also estimated that in the High Jungle and Low Jungle regions only 25 species are exploited commercially, whereas in the Foot-Hill Jungle more than 60 species are used owing to the fact that extraction is more or less mechanized and that there are markets close-by. One can, however, on the basis of this situation, state that the volume of timber extracted in Peruvian Amazon territory is really small. This same document calculates that the annual production of tree trunks amounts to less than 1% of the annual growth of the forest, and only to 0.006% of the total volume of wood standing.

### 4. Hunting and fishing activities

According to the above-mentioned Peru Report, fishing and forest fauna contributed around 20% of the total production of the Peruvian Amazon territory between 1960 and 1970.

The importance of these activities is due to their contribution to the nourishment of the population of the region. Fishing and hunting are esti-

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1/ Dourojeanni, Marc et al. Op. cit.

2/ Ibidem

3/ Ibidem

mated to have provided more than 85% of the protein consumed in the rural area and about 25% of that consumed in the urban areas.

Although these resources are considerable they have been ill-managed and, what is more, over-exploited.

As for the conservation of the fishing resources and the development of pisciculture we should point out that only extraction techniques have been used so far, with no attention paid to actual management of the resource.

#### IV. Policies and Strategy of Regional Development

The development strategy defined for the Peruvian Jungle aims at respecting the natural aptitude of the soils, dedicating them to the multiple use of the renewable natural resources they contain. This strategy is based on the integration of agricultural, cattle-raising, forestry, fishing and forest fauna activities. The need to apply new technologies adapted to the reality of the region and to establish agro-forestry-cattle-raising rotations are basic mechanisms for the implementation of this policy.

In June 1974 the government passed Law No. 20653 <sup>1/</sup> which refers to the native communities and to the promotion of cattle and agriculture in the Jungle Regions (High and Low) and in the Foot-Hill Jungle.

In May 1975 the government's Decree No. 21147 passed the Law of the Forest and of forest fauna.

The agrarian development of the Amazon Region is intended to be obtained with the application of these two instruments.

In the Peru Report to the international meeting on guidelines for research <sup>2/</sup> the outlines of the policy of development for the Peruvian Jungle are laid out. What follows is a synthesis of this policy.

The guidelines of this policy are based on criteria on rural settlements and on agrarian exploitation.

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<sup>1/</sup> This Law was enforced by Decree No. 22175 of May 1978.

<sup>2/</sup> Castagniño R. Dante and Roberto Hooker Leguía. Informe del Perú. In: IICA-EMBRAPA-INPA. "International Meeting of the Work Group on Research Guidelines on Production Systems for the American Tropics". Reports on conferences, courses and meetings, No. 90, Manaus, Brasil, Nov. 24-28, 1975.

## 1. Rural settlements

These are conceived in the two laws mentioned above. The rural development of the Amazon territory should be based on the integral rural settlements.

The rural settlement is defined as: "The organized establishment of qualified peasants, with the aim of integral exploitation of renewable resources and the provision for them of technical and credit assistance during the period required before they can cope with their private resources". <sup>1/</sup>

According to the Law, the rural settlements should undertake the exploitation of the following resources:

- a. Soils suitable for cattle-raising and agriculture. Annual and perennial crops and agriculture.
- b. Soils suitable for forest exploitation. Re-forestation.
- c. Forest. Timber and forest resources other than timber.
- d. Forest fauna. Hunting and tourism.
- e. Hydro-biological resources. Fishing and pisciculture.
- f. Natural landscapes. Tourism.

The requirements demanded by the law for the establishment of these settlements are basically two, as follows: that soil classification studies and forest evaluation studies be carried out previously.

It is considered that property in these settlements should be of an associate and not a private nature.

## V. Structure and Development of Cattle and Agricultural Research

### 1. Institutional structure

The agencies that may be partners in the humid tropics of Peru can be classified as:

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<sup>1/</sup> Decree Law No. 22175 of 1978, Article 3.

a. Agencies of the agricultural sector. These include:

i. The Ministry of Agriculture and Fisheries. This acts through the:

- General Head Office for Agrarian Reform and Rural Settlement.
- General Head Office of Cattle and Agricultural Research.
- General Head Office of Forests, Hunting and Lands.
- General Head Office of Cattle and Agricultural Promotion.
- General Head Office of Fisheries.
- General Head Office of Commercialization.

ii. Decentralized public bodies. In particular:

- The Agro-Industrial Research Institute - IIA.
- The Public Company of Services to Cattle-Raising, Agriculture and Fisheries - E.P.S.A.P.
- The Bank of Cattle and Agricultural Promotion.

b. Agencies of the educational sector. These include:

i. The Ministry of Education. Which acts through:

- The General Head Office for Common Education.
- The General Head Office for Technical Education.

iii. Decentralized bodies. In particular:

- The Universidad Nacional Agraria.
- The Universidad Nacional Mayor de San Marcos.
- The Universidad de la Amazonia Peruana.
- The Universidad Agraria de la Selva.

c. Multi-sector bodies. Composed of:

- The National Office of Evaluation of Natural Resources-ONERN.
- The National Research Council.
- The Meteorology and Hydrology Service.

2. Considerations regarding fields to be developed in the cattle and agricultural sector.

The following synthesis of the new parameters to be developed in the various activities of the Peruvian Jungle is based on the report presented at the international meeting on research guidelines <sup>1/</sup> and on Douro-

<sup>1/</sup> Castagnino R. Dante and Roberto Hooker Leguín. Op. Cit.



jeanni's study 1/.

a. Recommendations for the development of agriculture and cattle-raising

The following production systems are considered to be applicable to the Peruvian Amazon territory:

- The Taungya and silvo-banana system. This implies cleaning the jungle, exploiting the timber and planting agricultural crops and forest trees simultaneously.
- Agro-forest systems. Based on perennial crops and forest plantations.
- Use of alternate belts of agriculture and forest.
- Maintaining seed-trees in the areas that have been cleaned in order to encourage natural regeneration and colonization of the soil with valuable timber species.
- Cattle and forest rotations. The establishment of plantations and forest curtains in pasture lands.
- Agro-cattle-forest rotations.
- Bovine cattle raising should be intensive and not extensive.
- The practice of bovine cattle raising should maintain silvo-pastoral equilibrium.
- Promotion of water buffalo raising.
- Raising of pig varieties based on non-traditional forages such as cassava 2/.
- Development of family-scale horticultural production.

b. Recommendations for the use of the Flora and Fauna

The main recommendations in this field are:

- The rationalization of forest exploitation. This rationalization includes: the application of the principles of forest management and ordering; the gradual simplification of the ecosystem by means of the elimination of the less important species; the enriching or capitalizing of the forest and the extraction of the maximum volume per hectare.
- Development of forest industries. It is considered that the industrial processes that are implanted should, on the one hand, permit an integral use of the existing timbers and, on the other, that they should be efficient.

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1/ Dourojeanni, Marc. Op. Cit.

2/ Experiments have already been undertaken in the Institute for Veterinary Research of the Tropics and Altitude. IVITA.

- Lands devastated by migratory agriculture, particularly in the Foot-Hill Jungle, should be recuperated by means of soil conservation projects, massive reforestation and correction of water-ways. This implies a correct management of the affected basins.
- Promotion of the use of forest products other than wood, that are suitable for the development of small and medium industries.
- Forest fauna should be managed in: areas as yet not subject to forest or cattle and agricultural exploitation; protection forest; lands of forest management and cattle-raising areas.
- Ichthyological resources should be managed in: rivers and streams; lakes and ponds and artificial conditions. The latter implies the development of pisciculture.

### 3. Research activities 1/

The institutions mentioned initially carry out different activities of research. The main ones, according to the various institutions, are:

- a. The Head Office of Agrarian Research. Responsible for the main research activities of the Ministry of Agriculture, through: 2/
  - i. The North East Regional Center for Agrarian Research. The main station is in Tarapoto and it covers the departments of San Martin, Loreto, and the province of Leoncio Prado in the department of Huanaco. Work is being carried out with relation to the African Palm, in order to obtain hybrid seeds and to develop local seed production.
  - ii. The Northern Regional Center for Agrarian Research. This center is responsible for a great deal of the research work in the Jungle. The main center is in Chiclayo, and it covers the department of Amazonia and the province of Jaen.

A tropical soils management project was started in Yurimaguas in 1972. This project is carried out jointly as an agreement of the Ministry of Agriculture and Food and the Universidad Nacional de Carolina del Norte. Its objective is to develop a system of continuous production,

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1/ Based on the document: "Programa cooperativo para el desarrollo del trópico Peruano." IV meeting of the Advisory Commission. National Coordinating Committee, Lima, Peru, May 21-26, 1973.

2/ Only those stations are mentioned that are concerned with research being undertaken in the Peruvian Amazon Region.

as an alternative to migratory agriculture that has started to become imbalanced. <sup>1/</sup>

- b. General Head Office of Forestry and Hunting. This has worked on projects of:
  - i. Forest exploitation in Iparfa.
  - ii. Development of the Alexander Von Humboldt national forest.
  - iii. Development of the Iparfa national forest (Ioreto-Huánuco).
  - iv. Bank of forest seeds.
- c. General Head Office of Agricultural Production. This works on promotion in the tropical region, mainly through agrarian zones VIII and IX. These are mainly devoted to:
  - i. Food crops: rice, corn, kidney bean, cassava.
  - ii. Fruit: mango, pineapple, citric fruits.
  - iii. Forage: graminaceous and leguminous plants.
- d. The Universidad Nacional Agraria La Molina. The National Agrarian University investigates the Peruvian Amazon Region through its various academic programmes.
  - i. The Programme of Forest Sciences. This carries out research in the following fields:

Dendrology. Three experimental studies were projected for 1973 and 1974, as follows: a technical study of the timbers of Peru; a study of the industrial possibilities of national timbers for making paper pulp; and a study of the exploitation of jungle in order to obtain edible oil.

Silviculture. To experiment the behaviour of the forest species of the country. Sixty-four experiments had been carried out by 1973.

Dasometry and Photo-interpretation. Work has been going ahead on the mapping of the Peruvian Jungle. Studies have also been made on: the establishment and control of growth plots in natural forests and plantations in the area of Huanuco, Tingo Maria, Iquitos; forest dispersion in Jenaro Herrera, Iquitos.

<sup>1/</sup> For a more detailed account of this research see: Sanchez A. Pedro. "Alternativas al Sistema de Agricultura Migratoria en América Latina". CIAT.

Forest Fauna and National Parks. This field includes making studies on the management of forest fauna in the region of Jenaro Herrera.

#### Exploitation of timber

Technology of timber. This field includes studies on the physico-mechanical properties and uses of the timbers of Iparia-Pucallpa; the anatomic structure of the timbers of Tingo Maria; and the physico-mechanical properties and uses of the timber of 60 species from the Alexander Von Humbolt national forest in Pucallpa.

#### Preservation and drying of the timber

#### Forest industries

- ii. Programme of native fruit species. Studies have been made of papau, guava and maracuyá. Likewise of fruit species native to the Jungle such as camu-camu, important on account of its citric content.
  - iii. Programme of horticulture. This programme has carried out experiments on the adaptation of vegetables in the regions of Pucallpa, Iquitos, Satipo and La Merced.
  - iv. Programme of Phyto-technique. This programme has worked basically on research on coffee.
  - v. Programme of research on cattle-raising improvement. This programme, on agreement with the Ministry of Agriculture, has developed research on milk production, in the Tarapoto area.
- e. The Universidad Nacional Mayor de San Marcos. The university works on research through its Institute for Veterinary Research of the Tropics and Altitude, IVITA. The Ministry of Agriculture finances research work by means of agreements with the Institute.

The main studies undertaken by IVITA over the 1973-1974 period were:

- i. Research into meat and milk production in the Peruvian tropics, in the zone of Pucallpa, covering the fields of: pasture and forage, meat production, animal health, milk production and nourishment of cattle.
- ii. Research on poultry production in the jungle, in the Iquitos zone.

The most complete research work undertaken on cattle production systems is considered to be that of the IVITA in the Pucallpa zone. <sup>1/</sup>

- f. The Universidad Nacional Agraria de la Selva. This institution works on cattle and agricultural research in the Tingo María region. It coordinates its activities with the North East Regional Center of Agrarian Research, with the experimental station of Tulumayo.
- g. The Universidad Nacional de la Amazonia Peruana. Carries out agricultural, cattle and forest research. In the agricultural field, experimental work is going ahead, mainly on food crops (rice, cassava, plantain, pituca, tomato, corn, forage and others). Activities in the field of cattle are concentrated on pig varieties, water buffalo and bovine cattle. It also works in the field of forestry, on soils and fertilization and in pisciculture. The University's center of activities is in the Iquitos region.
- h. The Universidad Nacional del Centro. Though its main field of action is in the central mountain region, it has an experimental cattle and agricultural station in the Satipo zone. There, research is carried out on tropical crops such as: tobacco, palto, citric varieties, plantain, papau, maracuyá and others.
- i. The Universidad Nacional San Cristobal de Huamanga. Its main field of action is in the mountain region, but it carries out research in tropical forage in the Apurimac area, in the High Jungle region.
- j. The Institute of Agro-Industrial Research. The Institute works on investigation of an industrial nature as regards various agricultural products. Of particular interest are the projects on various palm trees native to the Peruvian tropics.

<sup>1/</sup> An analysis and synthesis of the main achievements can be found in Sanchez A. Pedro. Op. Cit.

Chart 11-1

Perú: Population According to Regions and Percentage Distribution  
- in thousands of inhabitants -

REGION	1950		1960		1965		1970*		1975*		1980*	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Coast	2.685	33.7	3.950	39.4	4.928	42.3	6.127	45.1	7.617	48.0	9.430	50.9
Mountain	4.694	58.9	5.193	51.8	5.615	48.2	6.073	44.7	6.522	41.1	6.498	37.5
Jungle	590	7.4	882	8.8	1.107	9.5	1.386	10.2	1.730	10.9	2.149	11.6
Total for the Country	7.969	100.0	10.025	100.0	11.650	100.0	13.586	100.0	15.869	100.0	18.527	100.0

\* Projection

Source: Banco de Crédito del Perú. "Realidad, perspectivas y problemas de la Selva Peruana". Round table discussion, 6-8 of September, 1971. Lima, 1972. Taken from the National Head Office for Statistics and Censuses.

## Chart II-2

## The Jungle: Urban and Rural Population

- in thousands -

Years	URBAN		RURAL	
	Number	%	Number	%
1950	140	27.0	450	73.0
1960	241	30.3	641	69.7
1965	323	31.9	784	68.1
1970	430	33.6	956	66.4
1975	567	35.2	1.163	64.8
1980	746	36.8	1.403	63.2

Source: Banco de Crédito del Peru, Op. Cit., Chart No. 9,  
page

Chart II-3

Percentage Growth rates of the Urban, Rural and  
Total Populations of the Junble

Population	P e r i o d s		
	1950-1960	1960-1970	1970-1980
Urban	5.6	6.0	5.7
Rural	3.6	4.1	3.9
Total	4.1	4.6	4.5

Note: The calculation of the geometrical growth rates was made with the following formula:

$$i = \sqrt[n]{\frac{P_f}{P_o}}$$

where: i = geometrical average rate  
n = relevant period  
P<sub>f</sub> = end period population  
P<sub>o</sub> = beginning period population

Source: Calculations based on data from Tables II-1 and II-2.



Chart II-4

1967. Percentage Distribution of the Economically Active  
Population (PEA) According to Economic Sectors

Sectorial Activities	Jungle	Country
Agriculture, Silviculture and Fishing	65.6	49.8
Mining and Quarries	0.7	2.1
Manufactures	7.0	13.2
Construction	1.5	3.4
Electricity, Water, Gas, and Health Services	0.1	0.3
Commerces	5.8	9.0
Transportation, Food and Communications	1.8	3.0
Other Services	14.3	15.2
Not Specified	3.2	4.0
Total	100.0	100.0

Source: Banco de Crédito del Perú, Op. Cit., Chart No. 10,  
page

Chart III-1

## Classification of Jungle Lands

Groups	Surface -in hectares-	Percentage Distribution
1	5.534.648	7.3
2	30.864.453	40.4
3	22.124.767	29.0
4	17.900.879	23.4
Total	76.424.747	100.0

Source: Banco de Crédito del Perú, Op. Cit., Chart No. 6,  
page

## Chart III-2

Area, Yield and Production of the Main  
Perennial Crops of the Peruvian Humid Tropical Territories  
1974 <sup>1/</sup>

Crop	Cultivated Area -in hectares-	Yield -in Kg/Ha-	Production in Metric Tons
Coffee	138.000	554	75.000
Tea	2.500	800	2.000
Cocoa	4.000	500	2.000
Oil Palm*	2.300	6.950	16.000
Pepper	179	1.120	200
Fruits Citric	8.000	13.750	110.000
Plantain	56.000	12.200	685.000

\* The cultivated area will be completed in 1977. The indicated production will be obtained in 1982.

Note: <sup>1/</sup> Estimates

Source: Dourojeanni, J. Marc, et al. Informe de Perú. In: International Meeting on production systems for the American Tropics (land use systems). IICA, Reports of conferences, courses and meetings No. 41, Lima, Perú, June 10-15, 1974.

Chart III-3

Area, Yield and Production of the Main Annual Crops of  
the Peruvian Tropical Territories  
1974 <sup>1/</sup>

Crop	Cultivated Area -in Hectares-	Yield -in Kg/Ha-	Production in Metric Tons
Maize	8.300	1.900	15.000
Beans	15.000	1.300	9.000
Rice	17.300	2.000	28.500
Cassava	38.000	13.000	482.000
Jute	3.500	1.000	3.500
Tobacco	2.800	1.000	2.800

Note: <sup>1/</sup> Estimates

Source: Dourojeanni, J. Marc, et al., Op. Cit.

THE AMAZON BASIN

BRASIL

## THE BRAZILIAN AMAZON TERRITORY

### I. General Characteristics of the Amazon Region

#### 1. Basic aspects

For reasons of the planning, execution and coordination of federal action, the Brazilian Amazon territory was defined by Law 5,173 of October 1966, which thus constituted the so-called legal Amazon territory. This covers an area of 4.897.645 square kilometers 1/, and therefore occupies about 58% of the total area of the country.

Administratively, this vast region includes:

- a. The states of Pará, Amazonas and Acre.
- b. The federal territories of Amapá, Roraima and Rondonia.
- c. The western part of the state of Maranhão.
- d. Part of the states of Goiás and Mato Grosso, to the North.

Of the 15.719 kilometers that constitute the total frontier of the country, 77.1% correspond to the Amazon region. 2/

The two factors that identify the region are the Tropical Forest and the Amazon Basin. The first of these - the Forest - constitutes the main characteristic of the region, covering continuously or discontinuously more than 53% of the area. The second factor of identity is the Amazon Basin. It is calculated that besides the 3.300 kilometers of the course of the Amazon river in Brazilian territory, this basin also includes a considerable network of tributary rivers. 3/

#### 2. Characteristics of the soils

Most of the Amazonian lands are of low fertility. According to the geological nature of the land, Amazonian soils can be classified in two major categories: a) "terra firme" soils, located in the highlands out of reach of river flooding. About 70% of these lands are calculated to be of low

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1/ Equivalent to 489.764.500 hectares.

2/ This 77.1% includes the frontier with Bolivia, part of which lies outside of the Amazon territory.

3/ Gelio Manuel Emilio. Brasil Experiencia Amazónica. In: *Amazonia, conquista del presente*. Forum, 6 to 9 October. Colegio de Arquitectos del Perú, Lima, 1978.

fertility, and b) the "varzeas" that comprise the flood lowland itself. <sup>1/</sup> These soils are considered fertile, have flat areas and an extension of 60.000 square kilometers.

One diagnostic provided by the Banco de la Amazonia refers to the difference of these two types of soils as follows: "The fundamental difference between "varzea" soils and those of "terra firme" is the fact of the periodic enrichment of the former, due to the sedimentation of particles suspended in the flood waters". Despite the periodic natural manuring of the "varzea" soils, technicians consider that they would lead to low levels of rentability if continuous crops were used without fertilizers. <sup>2/</sup> Falesi et al <sup>3/</sup> consider that the "terra firme" soils should be used with long-cycle perennial crops or in grazing pasture-lands; and that the "varzea" have a high potential for cultivation of annual plants, mainly rice and jute, as also for rational raising of buffalos. In addition to this consideration, the above-mentioned diagnostic explains that a more intensive use of "varzea" soils requires more detailed studies relating to drainage, in the rain season, and irrigation in the dry season. <sup>4/</sup>

### 3. The regional model of cattle and agricultural organization and its situation

The following are the principal patterns of cattle and agriculture activities in the Brazilian Amazon territory:

- a. Extraction agriculture. Main products are rubber, Pará's chestnut, piacaba, rose wood and timber.
- b. Subsistence agriculture. It consists of activities with regard to which the production decision obeys the subsistence needs of the producer and his family. Market forces are a very secondary consideration. This agricultural model consists mainly of the production of corn, kidney beans and cassava.

<sup>1/</sup> The term "varzea" is used to identify lowlands on either side of the rivers, which are periodically flooded.

<sup>2/</sup> Banco da Amazonia S.A. - BASA. Uma Filosofia de Ação. Rio de Janeiro, Brasil.

<sup>3/</sup> Falesi, Claudio, et al. Informe Brasil. In: "International Meeting on Production Systems for the American Tropics (land use systems)". IICA, Reports on Conferences, Courses and Meetings No. 41, Lima, Perú, June 10-15, 1974.

<sup>4/</sup> Reference is made later on to the main research recommendations for the various types of soils.

- c. Commercial agriculture. The main crops that come under this heading are: Kingdom's pepper, husk rice and jute.
- d. Small-scale extensive cattle-raising. Undertaken mainly on the basis of bovine cattle. Reveals low reproduction indexes, high percentages of mortality and, as a result, low rentability.
- e. Large cattle-raising projects. Large cattle farms are the main form under this heading, generally organized as stock companies. They have rich and abundant pastures.

A description of the situation of these various cattle and agricultural production models is to be found in the Banco de la Amazonia study <sup>1/</sup>. This diagnostic points out that the extraction activities are situated in the Northern extremity of the country, mainly in the states of Acre and Amazonas. The subsistence crops are common to all the states that compose the Amazon region. The main crop is cassava. Of the commercial crops, the Kingdom's pepper is concentrated in the state of Pará, in the Tomé-Açu and Bragantina regions and in the state of Amazonas, in the central Amazonas region. Jute production is also concentrated in the first two states mentioned above. Rice production is concentrated in the states of Goiás and Mato Grosso, particularly in the Alto Tocantins, baja Cuibana, médio Tocantins Araguaia and Alto Guaporé-Jauru regions. Also in the state of Pará, in the médio Amazonas Paraense, Guajarina and Xingu regions. In the state of Maranhao, the main volumes of rice production are to be found in the Itapecuru, Altos Mearim and Grajaú regions. Small-scale extensive cattle-raising is to be found in the low Amazonas, Isla de Marajó and bajo Maranhense regions. The large cattle farms are situated mainly in the South of Pará, North of Mato Grosso and in the state of Goiás.

## II. Human Resources

### 1. Population of the region

In 1978, the population of the Brazilian Amazon region was calculated at 9.670.000 inhabitants, giving a density of 1.97 inhabitants per square kilometer.

The Amazon region, with 58% of the territory of the country, absorbs 8.3% of the total population calculated at 116.393.000 inhabitants in

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<sup>1/</sup> Banco da Amazonia S.A., Op. Cit.



that same year.

Chart II-1 shows the region's situation in 1970, with regard to surface, population and demographic density. For the states of Maranhao, Mato Grosso and Goiás, only the territories belonging to the Amazon region were taken into account. 1/

In 1970 - Chart II-3 -, the Northern Region 2/ concentrated 73.1% of the Amazon territory and 49.2% of its population, the states of Pará and Amazonas being outstanding. The state of Maranhao, which belongs to the North Eastern region of the country, absorbed the main percentage of Amazonian population (33.9%), though it represents only 5.5% of the Amazonian territory.

#### a. Density of population

As was pointed out previously, the density of the Amazon region is of 1.97 inhabitants per square kilometer. This density can be considered somewhat deceptive owing to the concentration of population in the large cities, and in certain states and federal territories. Three cities alone, Belém, Manaus and San Luis, were calculated in 1975 to account for 20% of the regional population. 3/

In 1970 the demographic density of the Amazon region was 1.49 inhabitants per square kilometer. However, this density varies in the different regions, as is shown in Chart II-1. The region of highest density is the state of Maranhao and that of lowest density the state of Roraima.

In general we can consider that most of the Brazilian Amazon territory has densities of less than 0.5 inhabitants per square kilometer.

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1/ The Amazon characteristics of these states are as follows:

Maranhao: composed of 15 micro-regions. 81.5% of the territorial extension is considered Amazonian; the Amazonian area absorbs only 8.8% of the total population.

Mato Grosso: composed of 5 micro-regions. 63.1% of the territorial extension is considered Amazonian; this area absorbs 32.3% of the total population of the state.

Goiás: composed of 7 micro-regions. 42.3% of the territorial extension is considered to form part of the Amazonian territory, and absorbs 24.4% of the total population of the state.

2/ The Northern Region is composed of the states of Rondonia, Acre, Amazonas, Roraima, Pará and Amapá.

3/ Gelio, Manuel Emilio. Op. Cit.

b. Urban and rural population

The process of urbanization of the Amazon territory has become more accentuated. This is revealed by the existing figures on the Northern Region 1/. Chart II-4 shows that 580.867 inhabitants lived in urban nuclei in 1950. In 1970 this population is of 1.626.000 inhabitants, and it is calculated to stand at 2.457.400 inhabitants in 1980.

Chart II-5 shows the percentage composition and evolution of both rural and urban populations in the Northern Region and the various states that compose it. These figures reveal the changes that have occurred, as we have mentioned already. They are confirmed by the calculation of growth rates over the 1950-1960, 1960-1970 and 1970-1980 periods - Chart II-6 -. The average annual growth of urban population is greater than that of the rural population.

c. Sectorial distribution of employment - Northern Region

As can be observed in Chart II-7, industrial activities and others (services) absorb most of the employed labour force (61% in 1960 and 70% in 1970) in the micro-regions 2/ where the capital cities are located.

In the inland 3/, cattle and agricultural activities continued, in 1970, to concentrate 77.2% of the labour force employed in these regions. The situation is similar for the entire Northern Region. We should nevertheless underline a change that occurred between 1960 and 1970, in so far as employment in cattle and agriculture activities diminished and the industrial and service sectors increased. Growth of non-agricultural employment is based more on the industrial activities than on the so-called "others". As can be seen in this Chart, the growth rate of the so-called "other activities" is of 3.7%, whereas that of the industrial activities is of 5.3% for the Northern Region. Precisely the same situation occurs in the micro-regions of the inland.

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1/ Information is not available for the Amazon region of the states of Maranhao, Goiás and Mato Grosso.

2/ The states are composed of various micro-regions.

3/ This refers to micro-regions that do not include the capital cities.

### III. Regional Infrastructure

The absence of roads and communications in the Amazon territory was one of the factors of the region's isolation. When the Brazilian government decided to develop this territory it concentrated a considerable part of its investment on the construction and on establishing efficient tele-communications systems. The various public sectors likewise directed the assignment of resources to establishing and generating projects of electricity, public works, sanitation, education, and health. Governmental action increased noticeably from 1970 on. With the National Integration Programme, aimed basically at creating the physical structure for, and promoting, colonization. The National Integration Programme - PIN - made provision for the construction of two major roads to complement those already in existence 1/. These two highways are:

1. The so-called Trans-Amazonic Highway, which was to connect the city of Estreito with Humaitá, along a distance of 2.322 kilometers, and then to continue on into Perú. The first stretch was completed in 1974, and its continuation was inaugurated recently.
2. The Cuiba-Santarém road, stretching along 2.618 kilometers, which was completed in 1977.

A number of other roads, in addition to these, were begun and completed in the seventies. 2/

This regional infrastructure, particularly the network of roads that were built, have fulfilled a major role in the occupation of the Amazon region.

### IV. Evolution of the Cattle and Agricultural Sector

#### 1. Structure of property

According to the diagnostic of the Banco de la Amazonia 3/ the land structure in this region does not constitute a factor that limits agricul-

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1/ The first two connections between the Amazon territory and the rest of the country had already been completed by 1970. Both were begun in 1950. These were: 1) the Brasília-Belém road, covering 2.123 kilometers, and 2) the Brasília-Acre (Peruvian frontier) road. Gelio, M. E., Op. Cit.

2/ A description of these is to be found in Gelio, Manuel Emilio's documents. Op. Cit. p 19, and SUDAM, BASA, SUFRAMA. Isto é a Amazônia. November 1972, pp 6-9.

3/ Banco da Amazonia. Op. Cit.

tural development, if one considers its geographical extension and demographic density. However, the structure of landed property in the already exploited areas is more imbalanced than in the country as a whole. According to the 1960 census of cattle and agriculture, in the Northern Region 136.382 farms of less than a thousand hectares occupied 12.5% of the exploited lands, whereas 1.979 farms of over one thousand hectares concentrated 87.5% of exploited lands. Chart IV-1 shows the degree of concentration of landed property for each of the territories that compose the Northern Region.

## 2. Use of the land

The data that appears in Chart IV-2 shows the use of the land in the Northern Region of the country. 1/ Above all, the considerable percentage of unexploited lands, which correspond to 65.9%. Pará is the state with the highest proportion of unexploited lands; it is followed, in order, by the federal territory of Amapá, the state of Amazonas, the territories of Rondonia and Roraima, and finally the state of Acre, with the highest percentage (57.3%) of exploited lands.

Of lands exploited in the Northern Region, 13.444.950 hectares, that is 65.7%, are dedicated to the extraction of vegetation 2/. The territory of Rondonia and the states of Acre and Amazonas concentrate, respectively, 91.4%, 93.4% and 81.7% of exploited lands in activities of vegetation extraction.

In the state of Pará, cattle-raising and vegetation extraction activities represent, respectively, 44.9% and 45.7% of total exploited area. In the federal territory of Amapá the majority (54.1%) of the exploited lands are devoted to cattle-raising; extraction activities are nonetheless of some importance, representing 38.9% of exploited lands. Cattle-raising is predominant in the territory of Roraima. It concentrates 91.1% of total exploited lands.

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1/ Taken from the study by Cardoso H. Fernando and G. Muller, Op. Cit. p. 78

2/ According to Cardoso and Muller, the activities of extracting rubber, chestnut, rose wood and timbers are outstanding among those of vegetation extraction.

### 3. Cultivated area according to selected products - Northern Region 1/

Chart IV-3 presents cultivated area according to selected products, in the Northern Region, and the states and territories that compose it. Temporary crops can be said to be more important, in terms of cultivated area, than permanent crops. The information provided reveals the predominance of food crops. In the Northern Region, rice, cassava and corn comprise 73.4% of total cultivated area. In the units that compose the region we are referring to, the same occurs with regard to these products. The territory of Rondonia is the only exception, since Jute accounts for 62.4% of its exploited area.

The state of Pará totals 70% of total exploited area in the Northern Region. It is followed, in order, by the territory of Rondonia, the states of Acre and Amazonas, and lastly, the territories of Roraima and Amapá.

## V. Regional Development Policies

### 1. Historical development 2/

There follows an historical synthesis of the main measures that reveal the policy of the Brazilian government as regards the occupation and profitable use of the Amazon Region.

YEAR	MAIN MEASURES
1946	The first major step is taken to implement a policy of regional development of the Amazon territory with the provision that not less than 3% of the tax returns of the unions, states and municipalities of the zone be invested in a plan for the economically profitable use of the territory. Though this provision was not fulfilled, it already expressed the government's commitment to the development of this important area.
1950	The federal government created the Banco de Crédito de la Amazonia. Its functions were aimed mainly at supporting the rubber economy.

1/ Reference is made exclusively to the Northern Region, since information is not available on the Amazonian parts of the states of Maranhao, Goiás and Mato Grosso.

2/ This historical synthesis is based on Gelio M. Emilio. Op. Cit. and Cardoso H. Fernando and G. Muller. Op. Cit.

YEAR	MAIN MEASURES
1953	<p>The Superintendency of the Economic Valorization Plan SPVEA - was created. This superintendency became the first institution of regional development. Its functions were to elaborate the five year development plans and to coordinate, at a national level, all the activities of all the bodies acting in this region. The first and only five year plan elaborated by the SPVEA was not approved by congress. The functions of the superintendency were reduced to those of passing on public resources to the state bodies in the region.</p>
1957	<p>The free zone of Manaus was created as an area of both free exportation and importation of merchandise. The aim was to stimulate the commercial and industrial activities of the city of Manaus. The law that established the free zone opened it to use by the countries of the Amazon basin.</p>
1966	<p>Law No. 5173 of November 1966 created the Superintendency of Amazonian Development - SUDAM - to replace the SPVEA. The main functions attributed to the SUDAM were:</p> <ul style="list-style-type: none"> <li>a. To stimulate investigation of the natural resources and economic potential of the region.</li> <li>b. To select economic areas suitable to a planned development and to the definition of poles of development.</li> <li>c. To define policies of migration and create urban nuclei.</li> <li>d. To stimulate cattle-raising, agricultural and piscicultural activities.</li> <li>e. To apply fiscal, credit and other incentives, with the aim of attracting national and international capital for the region's development.</li> <li>f. To adopt programmes for the formation of human resources.</li> </ul> <p>The government, in the complementary legislation, defined the incentives to private capital, the criteria for their application and the creation of the Banco de la Amazonia, BASA, to replace the Banco de Crédito de la Amazonia. The BASA became the SUDAM's financial agent.</p> <p>This Law also created the Fund for Private Investment in Amazonian Development - FIDAM. This is administered by the Banco de la Amazonia, under SUDAM supervision.</p>
1967	<p>Decree Law No. 288 of February 1967 created the Superintendency of the Free Zone of Manaus - SUFRAMA. It is the body entrusted with the administration of the zone.</p>

YEAR	MAIN MEASURES
	<p>This Law complemented that of 1957, and favoured the free zone with fiscal incentives specifically aimed towards the establishment of commercial, industrial and cattle and agricultural centers.</p> <p>The recently created superintendency was entrusted with the elaboration of a plan to direct the development of the region and with the establishment of an industrial and an agricultural district. An area of 16 square kilometers was chosen for the establishment of the first of these. The infrastructure has already been completed. In 1977, 16 industries were functioning and 25 were being installed. The cattle and agricultural district is being established on a surface of 569.000 hectares along the Manaus-Caracarl road. It is hoped that this district, besides being a supply source for the city of Manaus and for exportation, will become an advanced experimental center with various research institutions working on it together.</p>
1968	<p>The fiscal concessions of the free zone are extended to the entire Western Amazonian Region <u>1/</u>, as regards products received or elaborated in it, and that are to be used or consumed in the territorial units that compose this region.</p> <p>Decree No. 63.952 of December 1968 created the coordinating committee for energy studies of the Amazon territory. This committee is dependent on the Ministry of Mining and Energy, and has the representation of the Ministries of the Interior and of Planning.</p>
1969	Decree Law No. 764 of August 1969 created the Mineral Resources Research Company - CPRM.
1970	Decree Law No. 1.110 of June 1970 created the National Institute of Colonization and Agrarian Reform - INCRA. It was born of the need to simplify the previous administrative structure and to reformulate the colonization policy.
1975	SUDAM elaborated the II Amazon Development Plan, 1975-1979 <u>2/</u>
<u>1/</u>	Composed of the states of Amazonas and Acre, and the federal territories of Roraima and Rondonia.
<u>2/</u>	The elements composing these development plans will be mentioned further on.

## 2. Consideration of the policies of regional development

In the above historical synthesis, mention is made of some of the main policies of development established by the government. It is necessary to refer to some of these. 1/

### a. Policy of incentives. Two categories of incentives are applied:

#### i. The fiscal incentives include:

- Exoneration of up to 50% of the income tax on persons registered in the country who guarantee to invest resources in projects of agriculture, cattle-raising, industry of basic services of interest to the development of the Amazon territory. These projects must have SUDAM approval.
- Exoneration from income tax on 42% of the value of the obligations acquired with the FIDAM.
- At SUDAM's decision, reduction of or exoneration from income tax generated in the Amazon territory, for persons exercising any economic activity in the region.
- Reduction, at SUDAM's decision, of 50% of the import tax and the tax on industrialized products - machinery, equipment, etc. - not produced in the country, and that are necessary for the implementation of industrial projects of interest to the Amazon region.

#### ii. Credit incentives: Through the FIDAM-BASA financial system the SUDAM can provide up to 75% of the capital for projects that it approves.

#### iii. The main criteria for the application of these incentives are: the nature of the project, the use of raw materials from the region, the aggregate value in the region, the level of employment that is foreseen, the contribution to imports substitution, the generation of exports capacity and regional decentralization.

#### iv. Main results of the policy of incentives. Since this policy of fiscal incentives was begun, and up till April 1978, 1.169 new and reformulated projects had been approved through the SUDAM, amounting to a total value of 2.462 million dollars. 50.7% of this figure corresponded to the policy of incentives.

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1/ The description of the policies of regional development is based on the documents used in the elaboration of the historical synthesis.



Of the 1.169 projects approved by the SUDAM, 43.3% were cattle and agriculture projects, 49.3% were industrial, and 7.4% corresponded to basic services.

- b. Actions of the Banco de la Amazonia - BASA. The Bank established special credit programmes along three lines:
  - i. The specialized credit programme that includes rural, industrial and infrastructural credit.
  - ii. The programme of economic maintenance.
  - iii. The assistencial programme, covering the fields of research, technical assistance and development of human resources.
- c. The National Integration Plan - PIN. The PIN, established in 1970, was fundamentally aimed at creating a physical infrastructure and at colonization. One of the ideas that inspired the programme was that of the need to channel the surplus population of the North East towards the empty spaces of the Amazon territory and the Central Plateau.

The elements of the programme were:

- i. Construction of works of infrastructure. 1/
- ii. The RADAM project. The PIN foresaw an investigation of the characteristics and natural resources of an area of 44.000 square kilometers stretching along the Trans-Amazon Highway, in order to facilitate human settlements.
- iii. Colonization. Colonization was initially concentrated along the axis of the Trans-Amazon Highway. Later along the Cuibá-Santarém road. The planning of this colonization was undertaken by the INCRA, which carried it out according to a hierarchy of priorities, establishing the so-called "agrovillas", "agrolis" and "agropolis". Twenty-eight agrovillas and 8 agropolis were established in the zones of Altamira, Marabá and Itaituba - all of them along the axis of the Trans-Amazon Highway.

In addition to the projects of directed colonization, a spontaneous colonization has developed along the newly constructed roads. 2/

1/ Already described.

2/ For a more detailed account of the policy of colonization see Cardoso H.F. and G. Muller. Op. Cit. Ch. VII: Governmental Action; Colonization.

iv. The plan includes other elements, particularly: tele-communications, energy, social development and scientific research. The latter through the Humid Tropics Programme, incorporated in 1971.

d. The II Amazon Territory Development Plan, elaborated by the SUDAM to cover the 1975-1979 period. This new plan establishes the following lines of action:

- a greater concentration of effort on increasing and distributing regional revenue.
- a reduction of inter-regional inequalities.
- preservation of the ecology.
- rational occupation of the territory.
- definition of priorities for the use of the resources of the various official programmes.
- establishment of a selective colonization process.
- exploitation of the comparative advantages of some regional sectors and products.

As a result of the new orientation defined in this development plan, a programme of Cattle and Agriculture and Agro-Mineral Poles for the Amazon Territory - POLOAMAZONIA- was established. This programme selected 15 poles with regard to the spacial distribution of identified cattle and agriculture and mineral resources and with regard also to the existing structure of human resources. Ten of these poles are situated in the SUDAM's area of influence, and 5 in the area of influence of the superintendency for the development of the mid-western region - SUDECO.

## VI. Structure and Development of Research in Cattle and Agriculture

### 1. Institutional structure

Research into the Brazilian humid tropics is being carried out by the following institutions:

#### a. The Brazilian Cattle and Agriculture Research Company - EMBRAPA

Its actions in the tropical areas of Brazil are developed by:

- The Humid Tropic Cattle and Agricultural Research Center - CPATU, in Belém, in the state of Pará.
- The National Center of Rubber Research, in Manaus, in the state of Amazonas.

- The state-level research execution units - UEPAES, situated in Altamira, in the state of Pará, in Manaus, in the state of Amazonas, in Rio Branco, in the state of Acre, and in Puerto Velho, in the federal territory of Rondonia.
- b. The Amazon Territory Research Institute - INPA. This center is related to the National Council for Scientific and Technological Development - CNPq, which is the body responsible for implementing the national policy of scientific and technological development. The INPA is situated in Manaus, in the state of Amazonas.
- c. The Cocoa Research Center - CEPEC-CEPLAC. It belongs to the Ministry of Agriculture. It carries out research through experimental centers in the states of Pará, Acre and Amazonas, and in the federal territory of Rondonia.
- d. The Amazon Territory Forestry Research Center. A forestry development and research project - PRODEPEF, was created by agreement between the PNUD and the Brazilian government, through the Ministry of Agriculture, represented by the Brazilian Institute of Forestry Development - IBDF. Work began in 1973, with regional research centers being established in the Northern, Central and Southern regions.

The Amazon Territory Forestry Research Center, related to PRODEPEF, was created on the basis of the criterion of integration with the problems and with the other institutions of the region. This center began its activities in 1977.

## 2. Considerations on the priorities and fields for development in cattle and agricultural research

Based on Brazil's Report to the reunion on production systems <sup>1/</sup> we offer here a synthesis of the priorities and recommendations concerning the various considerations that should be kept in mind in cattle and agricultural research. These considerations are a result of the systematic ordering of some existing achievements and of the study of preliminary diagnostics, dealing with the Amazon region.

### a. Recommendations for the use of soils

At the beginning of the present study we presented a brief characterization of the soils of the Brazilian Amazon region, classifying them in two major categories: the so-called "terra firme" and "varzea"

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<sup>1/</sup> Falesi I. Claudio, et. al. Op. Cit.

soils. The above-mentioned report presented by Brazil makes the following recommendations for developing research with relation to these types of soils:

- Determination of soil management and conservation systems for regional crops in low fertility areas.
- Implementation of research projects aimed at rational exploitation of "varzea" soils in order to obtain not only the production of rice for exploitation but also the production of annual crops.
- Intensification of research on "varzea" soils for buffalo-raising.
- Solution of the problem of the high cost of fertilizers and correcting agents in the Amazon territory <sup>1/</sup>.
- Intensification of studies on the effects of burning in relation to the alterations that have occurred, mainly, in the soils used for grazing.

b. Research priorities in perennial agriculture

The initial consideration is that the results of research into this type of crops are incipient. According to this report, research programmes, when defining priorities, consider the following criteria: the economic potential of the product; the ecological requirements of the species; the availability of agronomic knowledge; and the socio-economic and cultural factors of the crop's production.

With relation to these criteria, the following priorities and fields of research were established for each of the chosen products:

Rubber:

- Control of leaf burn and secondary diseases.
- Management of native rubber trees.

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<sup>1/</sup> "In order for it to be possible to obtain reasonable harvests for a number of consecutive years in relatively poor soil the use of fertilizers is indispensable. If the price of the fertilizers is too high with relation to the production cost of the product, there will be no alternative solution other than that of reverting to the system of itinerant agriculture... This situation may be modified in any region at any moment, in so far as there is a modification in the relation between the price of the fertilizers and the price of the agricultural products". Alvim P. de Tarso. Perspectivas de Producción Agrícola en la Región Amazónica. In: Revista Inter-ciencia, Vol. 3, No. 4, July-August 1978, p 246. In order to demonstrate the economic viability of intensive agriculture using modern input, Alvim quotes in this article the examples provided in the Brazilian Amazon territory by Kingdom's Pepper and horticultural crops. These products have a high commercial value.

- Reduction of the period leading to maturity.
- Genetic improvement.

#### Cocoa:

- Phyto-sanitary control
- Selection, introduction and formation of hybrids.
- Planting and management methods.
- Treatment of the product.

#### African Palm:

- Production of hybrid seeds.
- Phyto-sanitary control.
- Management and cultivation.
- Introduction of native germplasm in the production of hybrids.

#### Guaraná:

- Broadening of the external market.
- Experiments with the production of native guaraná.
- Vegetative multiplication.
- Determination of a better architecture for the plant.
- Determination of nutritional requirements.
- Phyto-sanitary control.

#### Kingdom's Pepper:

- Broadening the internal and external markets.
- Introduction and selection of clones.
- Phyto-sanitary control.
- Determination of a better architecture for the plant, for purposes of productivity.

#### Sugar Cane:

- Introduction and creation of varieties.
- Phyto-sanitary control.
- Management of the crop.

#### c. Research priorities in the annual crops

The main annual crops are:

Corn, rice, cassava and peanut

- Studies on the rentability of the crops, sown each in isolation or in association with other crops, by the method of migratory agriculture.
- Obtaining new varieties and multiplying the better varieties of seeds.
- Studies on crop practices.

Jute and mallow:

- Genetic improvement.
- Studies of mechanical extraction.
- Seed production.

d. Integrated production systems for the exploitation of the natural resources

Owing to the importance of the forest industry in the economy of the region, the integration of the forest and agronomic activities is considered a major priority.

The promotion of integrated production systems has two main aims:

- i. To adjust the forest silvo-agricultural-plantation in association with temporal agricultural crops.
- ii. To promote the exploitation of cut timber varieties having potential, due to the colonization programmes and cattle-raising projects.

Six production systems are proposed <sup>1/</sup>, in consideration of these aims and in order to obtain forest development:

- The "agro-cattle conversion" system.
- The "silvo-cattle complex" system.
- The "silvo-agricultural" systems.
- The "natural regeneration" system.
- The "artificial regeneration" system.
- The "forest life" system.

e. Investigation priorities for forest products

The above-mentioned report specifies the following types of products,

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<sup>1/</sup> A more detailed description of these production systems is to be found in Brazil's Report, mentioned above.

and establishment of priorities for the guidelines to be followed in the forest investigation programmes.

i. Products of first class priority

- Mechanically convertible timbers.
- Forest animals.

ii. Products of second class priority

- Chemically convertible timbers.
- Secondary forest products.

Chart VI-1 shows the priorities for the Amazonian forest according to lines and systems of research.

f. Research priorities in bovine cattle and pastures

Owing to the importance of cattle-raising in the Amazon Region <sup>1/</sup> and its backwardness in comparison to other areas of Brazil, the following priorities and fields of action in future research are considered:

Meat and milk varieties of bovine cattle:

- Nutrition of the herd.
- Animal management.
- Genetic improvement
- Animal sanitation.

Meat and milk buffalos: the same areas of research are considered as for bovine cattle.

3. Some investigation results

Falesi et al. <sup>2/</sup> offer the following qualitative appreciation of research carried out in Brazil: "The results generated by the research which has been undertaken so far are sufficient for the formulation, with a satisfactory degree of precision and security, of simple technology packages for economic activities such as: buffalo-raising on "varzea" soils and bovine

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<sup>1/</sup> As a result of the policy of incentives, important cattle-raising companies have been attracted to the region.

<sup>2/</sup> Falesi, I. Claudio et al. Op. Cit.

cattle-raising on "terra firme" soils, both with cultivated pastures; the introduction of perennial crops such as Kingdom's Pepper, cocoa, oil palm, rubber, sugar cane and guaraná, and the establishment of preliminary rules of forest management".

Some of the investigation results relating to various of the crops mentioned in this quotation, and to others not mentioned, are presented by Paulo de Tarso Alvim. <sup>1/</sup>

- a. Cocoa: Soil test work and experimental crops have established the existence of considerable areas within the Brazilian Amazon region which are suited to the successful cultivation of this product. Of the regions that have already been studied, the territory of Rondonia and the region near Altamira, along the Trans-Amazon Highway, are particularly well adapted and situated for cocoa cultivation. Considerable annual production with good yields per hectare have been obtained here, and cocoa has been cultivated in the shade without the use of fertilizers.
- b. Rice: Irrigated rice production is considered to have good possibilities in the "varzea" soils of the Amazon Valley. This has been demonstrated with experiments in commercial plantations in the states of Pará and Amapá. On the basis of soil tests it is possible to calculate at more than 1.5 million hectares the "varzea" areas suited for this product.
- c. African Palm or Dendé: This is considered to be one of the main crops for the development of commercial agriculture in the Amazon region. The areas where it is being produced are those surrounding the Amazon Delta. These soils have the characteristic of being poor. Plantations established in the state of Pará, in the city of Belém, have given considerable yields. Within the programmes of the state of Pará, small producers are promoting cultivation of this product. The SUDAM is also offering financial assistance in order to establish 100.000 hectares of cultivation.
- d. Silviculture: In the state of Amapá, a private company has promoted the establishment of certain tree species (the Gmelina arborea and Pinum caribea). Certain forest plantations in "terra firme" soils and with no fertilization, are producing with high yield indexes. Experimental plots of various native and foreign species have been established near Manaus, in the state of Amazonas, and results have been highly positive.

<sup>1/</sup> Alvim, P.de T. El equilibrio entre la conservación y la utilización de los trópicos húmedos. Paper presented in 1976 at the New York Symposium on "Species in danger of extermination", published by the Magazine "Desarrollo Rural de las Américas", Vol. VIII, No. 3, Sept.-Dec. 1976. IICA.



- e. Brazil nut: Though this is considered to be one of the major productive species of the region, little research has been undertaken with this product.

Certain plantations have failed to give the expected results. Experimentation carried out near the city of Manaus has established that the use of this tree to give shade to cocoa has had good economic results.

- f. Rubber: A lot of research has been devoted to controlling the disease known as "The South American Leaf Stain", that had prevented the establishment of commercial plantations in the Amazon region.
- g. Pastures: In the Southern Pará and Northern Mato Grosso regions, a lot of research has been carried out that has shown that some species of tropical pastures are as efficient as leguminous plants in the process of nitrogen fixation.

Alvim, quoting a paper written by Falesi on the soils of the Amazon territory and their importance in the definition of the agricultural production system, points out that: "It has been demonstrated in Brazil that when pastures are suitably managed, they not only afford good protection against soil erosion but that they apparently improve soil fertility in certain regions. The critical problem with tropical pastures is the need to develop good management techniques". <sup>1/</sup>

As far as research in production systems is concerned, the following projects should be pointed out:

- Production systems of rubber with complementary crops. This research project has been carried out since 1975 by the National Rubber Research Center. Its aim is to introduce new forms of technology in native rubber in order to obtain increased productivity, thereby making it possible to free labour for the development of the complementary crops required to feed the rubber collectors' families.
- Crop rotation. This project has been carried out since 1971, in the territory of Amapá, mainly with crops of corn, rice, kidney bean and cassava.

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<sup>1/</sup> Alvim, Paulo de T. Op. Cit., p 192.

- Productivity of Amazonian soils and ecological changes under different systems on management <sup>1/</sup>. The bodies responsible for carrying out this project are: The Cocoa Research Center - CEPEC-CEPLAC, the Brazilian Cattle and Agriculture Research Company - EMBRAPA, and the Amazon Territory Research Institute - INPA. Research aims can be reduced to three headings:

- i. To analyse the ecological changes produced by the effects of the different forms of management.
- ii. To establish the cost-profit relation of the various types of management.
- iii. To design a system of agriculture that makes profitable and permanent exploitation of the tropical region.

In Manaus, the project's experimental area, there are 12 treatment plots of one hectare each. These plots include: annual crops, perennial crops, pastures, forest species and regeneration of primary forest. Each of these plots is in turn divided into sub-plots.

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<sup>1/</sup> For a more detailed description, see: Alvim, P. de T. and Antonio Carlos de Costa P. Productividade De Solos Amazônicos e Mudanças Ecológicas sob Diferentes Sistemas de Manejo. In: "International meeting of the work-group on Guidelines for research in production systems for the American Tropics". Reports on conferences, meetings and courses No. 90, Manaus, Brazil, Nov. 24-28, 1975.

Chart II-1

## Amazon Territory: Extension - Population and Demographic Density

Amazon Region	Extension Km <sup>2</sup>	1 9 7 0			Demogra. Density Inhab/Km <sup>2</sup>
		P O P U L A T I O N			
		Urban	Rural	Total	
Rondonia	243.044	59.564	51.500	111.064	0.46
Acre	152.589	59.307	155.992	215.299	1.41
Amazons	1.564.445	405.831	549.404	955.235	0.61
Roraima	230.104	17.481	23.404	40.885	0.18
Pará	1.248.042	1.021.966	1.145.052	2.167.018	1.74
Amapa	140.276	62.451	51.908	114.359	0.82
Disputed Zone AM/PA	2 680				
Sub-Total Northern Region	3.581.180	1.626.600	1.977.260	3.603.860	1.01
Maranhao	267.751	--	--	2.484.484	9.28
Mato Grosso	776.921	--	--	516.437	0.66
Goiás	271.793	--	--	715.823	2.63
Total Amazon Territory	4.897.645	--	--	7.320.604	1.49
Total Brazil	8.511.965	52.084.984	41.054.053	93.139.037	10.94

Source: For the Northern Region: IBGE. Anuario Estadístico Do Brasil 1975. Rio de Janeiro, 1975.

For other States: Banco da Amazonia S.A. Indicadores Socio-Econômicos Básicos das Areas Amazonicas do Maranhao, Goiás e Mato Grosso. In: Revista Econômica Do Basa. Vol. 2, No. 1, January-Abril, 1972, Belém.

Chart II-2

Amazon Territory: Percentage Distribution of Extension and Population,  
in Relation to the Total for the Country

Region	Extension	1970 Total Population
Rondonia	2.86	0.01
Acre	1.79	0.23
Amazons	18.38	1.03
Roraima	2.70	0.04
Pará	14.66	2.33
Amapá	1.65	0.12
Disputed Zone AM/PA	0.03	
Sub-Total Northern Region	<u>42.07</u>	<u>3.87</u>
Maranhao	3.15	2.67
Mato Grosso	9.13	0.55
Goiás	3.19	0.77
Total Amazon Territory	<u>57.54</u>	<u>7.86</u>
Total Brazil	100.00	100.00

Source: Calculations based on the data of Chart II-1.

Chart II-3

Amazon Territory: Percentage Distribution of Extension and Population,  
in Relation to the Total for the Amazon Territory

Region	Extension	1970 Total Population
Rondonia	4.96	1.52
Acre	3.12	2.94
Amazons	31.94	13.05
Roraima	4.70	0.56
Pará	25.48	29.60
Amapá	2.86	1.56
Disputed Zone AM/PA	0.05	
Sub-Total Northern Region	<u>73.12</u>	<u>49.23</u>
Maranhao	5.47	33.94
Mato Grosso	15.86	7.05
Goiás	5.55	9.78
Total Amazon Territory	100.00	100.00

Source: Calculations based on the data of Chart II-1.

Chart II-4

Northern Region: Urban and Rural Population <sup>1/</sup>

Region	1950		1960		1970		1980	
	Urban .	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Rondonia	13.816	23.119	30.842	39.941	59.564	51.500	96.600	75.600
Acre	21.272	93.483	33.998	126.210	59.307	155.992	92.800	195.300
Amazonas	137.736	376.363	239.659	481.556	405.831	549.404	615.000	636.700
Roraima	5.132	12.984	12.717	16.772	17.481	23.404	24.200	32.200
Pará	389.011	734.262	630.672	920.263	1.021.966	1.145.052	1.350.600	1.450.200
Amapá	13.900	23.577	35.390	33.499	62.451	51.908	98.200	76.000
Northern Reg.	580.867	1.263.788	983.278	1.618.241	1.626.600	1.977.260	2.457.400	2.466.000

Note: <sup>1/</sup> For 1950-1960 and 1970 according to the censuses.  
For 1980: As estimated by IBGE.

Source: IBGE. Anuario Estadístico do Brasil. 1975. Rio de Janeiro, 1975.

Chart 11-5

Northern Region: Percentage Distribution of Urban and Rural Population

Region	1950		1960		1970		1980	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Rondonia	37.4	62.6	43.6	56.4	53.6	46.4	56.1	43.9
Acre	18.5	81.5	21.2	78.8	27.6	72.5	32.2	67.8
Amazonas	26.8	73.2	33.2	66.7	42.5	57.5	49.1	50.9
Roraima	28.3	71.7	43.1	56.9	42.8	57.2	42.9	57.1
Pará	34.6	65.4	40.7	59.3	47.2	52.8	48.2	51.8
Amapá	37.1	62.9	51.4	48.6	54.6	45.4	56.4	43.6
Northern Region	31.5	68.5	37.8	62.2	45.1	54.9	49.9	50.1

Source: Calculations based on the data of Chart 11-4.

Chart II-6

Northern Region: Annual Growth Rates of the Urban and Rural  
Population  
(Increase for Every 100 Inhabitants)

Region	1950-1960		1960-1970		1970-1980	
	Urban	Rural	Urban	Rural	Urban	Rural
Rondonia	8.4	5.6	6.8	2.6	5.0	3.9
Acre	4.8	3.0	5.7	2.1	4.6	2.3
Amazonas	5.7	2.5	5.4	1.3	4.2	1.5
Roraima	9.5	2.6	3.2	3.4	3.3	3.2
Pará	5.0	2.3	4.9	2.2	2.8	2.4
Amapá	9.8	3.6	5.8	4.5	4.6	3.9
Northern Region	5.4	2.5	5.2	2.0	4.2	2.1

Note: The calculation of the geometrical growth rates was made with the following formula:

$$i = \sqrt[n]{\frac{P_f}{P_o}} - 1 \quad \text{where: } i = \text{geometrical average rate}$$

$n$  = relevant period  
 $P_f$  = end period population  
 $P_o$  = beginning period population

Source: Calculations based on data from Chart II-4.



Chart 11-7

Sectorial Distribution of Employment, Capital Cities and Inland <sup>1/</sup>

## Northern Region

Year	Capitals Inland Micro-regions	Total	Cattle and Agricultural Activities	Industrial Activities	Other Activities
1960	Capitals	100.0	39.0	11.4	49.6
	Inland	100.0	82.0	3.0	15.0
	Northern Region	100.0	65.9	6.1	28.0
1970	Capitals	100.0	29.7	17.6	52.4
	Inland	100.0	77.2	6.6	16.2
	Northern Region	100.0	56.9	11.4	31.7

Note: <sup>1/</sup> Capitals: Micro-regions in which the capital cities are located.

Inland: Remaining micro-regions

Source: Taken from: Cardoso, H. Fernando and G. Muller. Amazonia: Expansão do Capitalismo. Editora Brasiliense, 1977. According to the demographic censuses of 1960 and 1970.

Chart IV-1

Northern Region: Structure of Possession of Land <sup>1/</sup>

	Farms with more than 1,000 Has.		Farms with more than 1,000 Has.	
	Number	% of Land	Number	% of Land
Acre	481	99.13	3,160	0.87
Amapá	114	91.72	999	8.28
Amazonas	539	87.53	47,932	12.47
Pará	574	51.75	82,667	48.25
Rondonia	18	78.25	995	21.75
Roraima	263	81.22	620	18.78
Total Northern Region	<u>1,979</u>	<u>87.50</u>	<u>136,382</u>	<u>12.50</u>
Total Brazil	32,885	47.29	3,309,212	52.71

Source: IBGE Agricultural Census, 1960. Taken from: Banco da Amazonia,  
Op. Cit.

Note <sup>1/</sup> Does not include states that are partly located in the legal Amazon  
territory owing to lack of statistical information.

Chart IV-2

Percentage Distribution of the Use of the Areas of Brazil and the Units of the  
Northern Region Federation

1972

	Brazil	Northern Region	Rondonia	Acre	Amazonas	Roraima	Pará	Amapá
I. Exploited Areas	<u>58.5</u>	<u>34.1</u>	<u>43.0</u>	<u>57.3</u>	<u>38.7</u>	<u>46.0</u>	<u>24.5</u>	<u>31.6</u>
a. Crops	<u>10.0</u>	<u>2.2</u>	<u>1.0</u>	<u>1.7</u>	<u>2.9</u>	<u>1.1</u>	<u>2.3</u>	<u>2.2</u>
- Horticulture	<u>0.1</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
- Permanent	2.5	1.0	0.2	0.4	1.3	0.6	1.2	0.6
- Temporal	7.4	1.2	0.8	1.3	1.6	0.5	1.1	1.6
b. Cattle	<u>42.0</u>	<u>9.5</u>	<u>2.7</u>	<u>2.1</u>	<u>4.2</u>	<u>41.9</u>	<u>11.0</u>	<u>17.1</u>
- Pastures	<u>30.0</u>	<u>7.5</u>	<u>1.7</u>	<u>1.6</u>	<u>2.6</u>	<u>36.1</u>	<u>8.8</u>	<u>12.5</u>
- Temporal grazing	12.0	2.0	1.0	0.5	1.6	5.8	2.2	4.6
II. Vegetation Extraction	<u>6.5</u>	<u>22.4</u>	<u>39.3</u>	<u>53.5</u>	<u>31.6</u>	<u>3.0</u>	<u>11.2</u>	<u>12.3</u>
III. Unexploited Areas	<u>41.5</u>	<u>65.9</u>	<u>57.0</u>	<u>42.7</u>	<u>61.3</u>	<u>54.0</u>	<u>75.4</u>	<u>68.4</u>
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. (thousands hectares)	370.275	39.428	2.137	5.538	7.863	1.737	20.910	1.242

Source: Cardoso H. Fernando, and G. Muller. Amazonia: Expansao do Capitalismo. Editora Brasiliense, 1977,  
page 73. Taken from INCRA, 1972.

## Chart IV-3

## Area Cultivated with Selected Products. Northern Region, 1973

- in hectares -

Crops	Northern Region	Rondonia	Acre	Amazonas	Roraima	Pará	Amapá
<u>Temporary Crops:</u>	<u>393.159</u>	<u>71.808</u>	<u>22.632</u>	<u>18.803</u>	<u>4.523</u>	<u>273.154</u>	<u>2.239</u>
Jute	58.306	45.002	-	-	-	13.304	-
Herbaceous Cotton	926	800	-	-	-	126	-
Peanut	280	230	10	-	-	40	-
Rice	107.967	20.300	4.930	1.579	1.527	79.170	461
Sugar Cane	17.748	156	1.580	2.191	584	13.143	94
Beans	16.386	2.640	2.570	903	82	10.142	49
Tobacco	2.931	-	372	621	27	1.911	-
Cassava	123.397	815	8.660	12.146	649	99.744	1.383
Maize	64.574	1.840	4.500	1.206	1.651	55.131	246
Tomato	644	25	10	157	3	443	6
<u>Permanent Crops:</u>	<u>21.481</u>	<u>277</u>	<u>850</u>	<u>3.045</u>	<u>255</u>	<u>16.756</u>	<u>298</u>
Banana	4.343	194	412	1.267	170	2.250	50
Cocoa	7.571	-	-	1.365	-	6.199	7
Coffee	890	-	116	11	-	713	50
Bahia Coconut	1.545	28	175	68	32	1.121	121
Orange	1.410	29	144	289	51	830	67
Kingdom's Pepper	5.722	26	3	45	2	5.643	3
TOTAL	414.640	72.085	23.482	21.848	4.778	289.910	2.537

Note: - No data available

Source: IBGE. Anuario Estadístico do Brasil. 1975. Rio de Janeiro, 1975.

Chart VI-1

## Forestry Research in the Amazon Territory: Priorities According to Lines of Research and Production Systems

Lines of Research	Products	P r o d u c t i o n   S y s t e m s					
		Agro-pasturage conversion	Silvo-pastur. complex	Silvo-agricult. systems	Artificial regeneration	Natural regeneration	Forest Life
A. Forestry Research							
Timber technology	M, Q	1T, 2V				1T, 1V	-
Marketing study	M, A, Q, S	1T, 3V				1T, 3V	1
Exploration and transport	M	3T, 1V	Further Stage		1T, 3V	1T, 1V	-
Seed production	M, Q, S	-	1T, 2V	1T, 1V	1T, 1V	-	-
Species tests	M, Q, S	-	-	-	2T, 1V	-	-
Origin tests	M, Q, S	-	-	-	2T, 2V	-	-
Artificial regeneration	M, Q, S	-	1T, 3V	1T, 3V	1T, 1V	-	-
Enriching	M, S	-				1T, 1V	-
Diagnostics	M, A	-				2T, 1V	-
Experimental nurseries	A	-				-	1
Forest life management	A	-				-	1
Forest economy	M, A, Q, S	Cost data related with each research project					
B. Support Research							
Synecology	A	-	2	-	2	2	1
Soils	M, Q	1T, 2V	-	2T, 3V	2T, 3V	2T, 3V	-
Production economy	M, Q, A, S	1	1	1	1	1	1
C. Support Activities							
Forestry inventories	M	2	2	2	1	1	-

Notes: M = Mechanical conversion timbers  
 Q = Chemical conversion timbers  
 S = Secondary forest products  
 A = Forest animals

1 = First class priority  
 2 = Second class priority  
 3 = Accessory priority

T = "Terra Firme"  
 V = "Varzeas"