

INTER-AMERICAN INSTITUTE FOR COOPERATION
ON AGRICULTURE (IICA)

COOPERATIVE PROGRAM ON TECHNOLOGY
GENERATION AND TRANSFER FOR THE
SOUTH AMERICAN TROPICS
(PROCITROPICOS)

November, 1990
San Jose, Costa Rica

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I. INTRODUCTION

The economic crisis presently facing the countries of Latin America and the Caribbean was unequivocally recognized by the Ministers of Agriculture who assembled in Ottawa (Canada) for the IXth InterAmerican Conference of Agriculture Ministers (CIMA) from August 31st to September 2nd 1987. They declared that "Most of our countries are currently facing a crisis whose proportions and scope are unparelled in the almost 90 years of this century that have elapsed... Given the present and foreseeable climate in which our economies are developing, the modernization and diversification of agriculture should play a central role in strategies for economic revival and development in our countries. The prospects of increased productivity that modernization holds out and the widespread distribution of its benefits represent the solid basis for an option of economic development that will have an inevitable multiplying effect on the rest of the economy and an immediately beneficial influence on the mass of the poor and neglected who live precisely in the rural area".

It is evident that technological modernization, with its vast potential for raising productivity as a means of improving the quality of life but also with its requirements for adjustments to the structure of society and production, is no longer a phenomenon exclusive to developed countries. It has already made its mark in our countries, especially in rural areas, creating new conditions and in a way significantly altering the problems, priorities and means at our disposal for harnessing our natural resources and promoting rural development.

The wealth of our countries in renewable natural resources that can be put to use in agriculture is undeniable. But it is likewise evident that these resources have been poorly mapped and little tapped, especially in regions with a tropical climate compared with those of a temperate climate.

On the other hand, the agricultural frontier in most of the countries in Latin America and the Caribbean has now been rolled back virtually to its maximum limits of physical productivity, despite diminishing economic yields caused by sudden changes in the production costs structure and technological problems that have a negative effect on their production systems.

Given present population growth and the need to seek alternative means of producing food, substituting imports and generating foreign exchange currency, it seems necessary to open up new frontiers for high technology production, so as to secure a more favourable economic outlook.

In this sense, the prospects for tropical regions are favourable on account of their great potential which resides in the feasibility of achieving extremely high primary yields, fundamentally because of the abundance of factors essential for photosynthesis and the consequent production of biomass. Nonetheless, the level of technology attained, especially for the humid tropics, is insufficient despite the technological advances and scientific knowledge already achieved in the countries of the region.

It is common knowledge now that the tropical ecosystem, with its diversity of flora, fauna and environmental resources, is exceedingly fragile. This discourages agricultural activities and tends to perpetuate shifting cultivation, the use of inadequate agricultural and livestock production systems and the predatory extraction of natural resources. Favourable changes in the cycle that characterizes this type of agriculture will depend largely on the extension of systematic, scientific knowledge in the tropics to make rational occupation possible, avert the destruction of untouched areas, and facilitate the recovery of those that have suffered degradation.

This need is particularly acute in the humid tropics of the Amazon, at a time when the governments and technical-scientific community of the countries, both inside and outside the region, are focusing their attention on the region's environmental and socio-economic problems. These problems highlight the need to establish technical-scientific cooperation and integration mechanisms at a regional level to achieve sustained, orderly development of agricultural, livestock and forestry activities without jeopardizing the local, regional and global ecological balance.

IICA is fully aware of the concern of the countries in the region to overcome the economic crisis and to provide their growing populations with better living conditions and an adequate food supply, through rational use of their renewable natural resources in areas of high potential like those in the tropical region of South America, and by using technological advances and their existing technical and scientific capacity to the full. Nevertheless, the isolated efforts of individual countries which on the whole correspond to the decisions of their own governments should be strengthened by means of integration and joint action (be it bilateral, multilateral or regional) so as to derive the maximum benefit from human and financial resources and from technical cooperation.

In view of this concern and with due regard for the mandate of the InterAmerican Agriculture Board (Jamaica 1983), a reformulation of the IICA-Tropicos Project has been undertaken for the purpose of redesigning and strengthening its operation so that it may serve as a broader instrument of technical cooperation for promoting balanced agricultural development in the region. The aim is to take in not only the

humid tropics of the Amazon but also complementary areas that are now and will continue to be a high priority, such as the tropical "llanos" (plains) and "cerrados" (savannah scrublands) and the Pié de Monte (Andean foothills).

In order to comply with this mandate, it is realized that a joint action between Member Countries and IICA, also respond to the outlines related to the maintenance of the productive capacity of renewable natural resources and the preservation of environmental quality as expressed by the Joint Action Plan for Agricultural Reactivation in Latin America and the Caribbean (PLANALC), approved by the JIA in October 1989, in San Jose, Costa Rica, through Resolution No 154.

In the initial phase, action will be concentrated in the countries already contemplated by the IICA-Tropics Project: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela.

II. BACKGROUND

Since it was created in 1942 as the InterAmerican Institute of Agricultural Science and its headquarters established in Turrialba in Costa Rica, the InterAmerican Institute for Cooperation on Agriculture (IICA) has been considered a pioneering institution in the field of research and formal training for the American tropics. Its undertakings and dedication have not been restricted to purely academic aspects; on the contrary, it has sought to break new ground for the development of the tropics in the member countries, conscious of the challenge that these regions represent, of the ecological characteristics that distinguish them from temperate zones for which greater know-how is available but much of which is not readily applicable in a tropical environment.

Following a resolution by its Board of Directors at the Seventh Annual Meeting held in Quito (Ecuador) in April 1969, IICA created the Cooperative Program for the development of the American Tropics (IICA-Tropics) which was designed to raise consciousness about the development of the American tropics. The ruling was formulated in Resolution IICA/JD-658-28, reflecting the desire of the Member States to set up a joint program which could provide support for their own efforts to develop their tropical zones.

The Program thus established would serve to promote and foster research, the development of human resources, the dissemination of methodologies and technologies suited to conditions in the tropics, and to provide support and strengthen the national bodies responsible for the development of the region and for the coordination and integration of undertakings at national and international level, with a view to achieving rational use of existing renewable natural resources.

Its objectives were:

- To raise consciousness and create a mystique concerning the development of the tropics and to encourage the search for solutions to their problems.

- To foster research and organized knowledge about the tropics and to elaborate a methodology for making efficient use of it.

- To promote the coordination and integration at national and international level of the action undertaken in individual countries so as to generate, disseminate and apply knowledge that contributes to the development of the tropics and the rational use of renewable natural resources.

The priority in the first stage of the Program was to promote, coordinate and implement multinational joint-actions designed to:

- identify the national bodies responsible for promoting agricultural development in the region;

- analyze the knowledge available and elaborate agricultural development methodologies;

- set up a Documentation and Information Center for Tropical Agriculture (UDIAT) at IICA's Information and Documentation Center (IICA-CIDIA) in Turrialba (Costa Rica);

- set up consultancy and technical cooperation services at national bodies in this sector;

- provide formal and informal courses for technicians, professors, research workers and documentalists in the region.

These actions essentially allowed to:

- develop consciousness in the individual countries about the characteristics and potential of the tropical Amazon region;

- initiate the revision of national legislation concerning the preservation and conservation of renewable natural resources;

- identify the absence of specific policies for utilizing and developing the tropics;

- encourage the design and establishment of experimental areas using a new research approach in integrated agriculture and livestock production systems;

- the need to establish coordination, information, documentation and horizontal technological exchange mechanisms at national and regional level.

Once this phase had been completed, the guidelines for the Program were reviewed by the Advisory Committee in April 1975 so as to switch the emphasis from actions at multinational level to actions in individual countries. This reformulation channelled more of the Institute's resources into operations at country level to be implemented by technicians in their National Offices in support of the Project's own National Coordination Committees.

Contrary to expectations and for reasons beyond the control of the Project, actions at the level of individual countries actually diminished significantly in intensity, except in Brazil. Moreover, they were limited to the areas of information and documentation, to the production of the Warning Service bulletins and inventory-reports on existing resources in the region, such as of research institutes and centres, as well as of individual researchers, by subject and location within the region.

In this new context, a significant offshoot of the IICA-Tropics Project was the establishment of institutional links with the Treaty for Amazonian Cooperation, drawn up in July 1978 as an important, historical instrument of regional cooperation designed to promote the integral development of the Amazon region and the preservation of its environment.

The establishment of institutional links between IICA and the Treaty for Amazonian Cooperation is also entirely in keeping with the aforementioned resolution of the Inter American Agriculture Board (Jamaica 1983) which elected the IICA-Tropics Project the most suitable cooperation instrument for accomplishing the objectives of the Treaty whilst also entreating the governments of the Amazon countries to continue and broaden the coordination of their undertakings within the framework of the Treaty, seeking cooperation with mechanisms already established, such as the IICA-Tropics Project.

The Treaty's first positive attitude towards IICA was forthcoming at the meeting held in Belém, in Pará State (Brazil) from 12th to 18th November 1984. The meeting's 6th Recommendation, item (1) states: "...That the national institutions of the Treaty's signatory countries, by means of a multilateral agreement between themselves and the InterAmerican Institute for Cooperation on Agriculture (IICA), designate IICA the coordination body and executive secretariat for the joint research programs they might establish for the Amazon region".

It would seem obvious that in a new phase of activities and a reformulated context, the IICA-Tropics Project should maintain and strengthen its cooperation links with the Treaty for Amazonian Cooperation, thus fulfilling the expectations raised by the Ministers of Agriculture of the countries in the region themselves.

At the same time, this initiative contributes to provide response to the Amazon Declaration issued at the Meeting of Presidents of member countries of the Amazon Cooperation Treaty, in Manaus/Brazil in march 1989, which calls for reciprocal cooperation towards a sustainable development of the Amazon Region.

Since the end of 1988, IICA's Program II - Technology Generation and Transfer, has begun to revise the IICA-Tropics Project so as to adjust it to the prevailing situation and make it more suited to the current needs of the participating countries, especially in view of the fact that the process of creating and/or reorganizing research systems, initiated in the 50's, has in many cases provided the countries with an adequate physical and human resources infrastructure whilst giving the region a rich choice of technologies and technical and scientific knowledge.

From the point of view of the tropical region, institutional development, though irregular, enables one to affirm that there are sound prospects for undertaking a drive for reciprocal cooperation between countries and their research, development and technology transfer systems to achieve sizeable medium-term technological development and, consequently, a viable alternative for economic recovery.

Given the prevailing economic climate in the countries of the region and current prospects, it is reckoned that only a concerted endeavour to strive for technological cooperation will enable them to attain greater development.

The final phase in the process of adjusting the IICA-Tropics Project was the creation of a technical Mission whose job it was to draft a revised Program taking due account of the countries' needs, priorities and demands, to be submitted, initially, to IICA.

III. CONSULTATION OF THE COUNTRIES INVOLVED

A) The Consultation Mission

The Mission consisted of the following officers: Dr. Jaime Navas, Director of the Agricultural Disciplines Division at the Colombian Agriculture & Livestock Institute (IICA); Dr. Benjamín Quijandría, Executive Director of the Peruvian Agricultural Studies and Development Center; Dr. Rufo Bazán and Dr. Jorge Ardila, technicians on IICA's Program II - Technology Generation and Transfer, based in Brasilia (Brazil) and Bogotá (Colombia) respectively. Dr. Jorge Ardila acted as the Mission Coordinator on behalf of Program II.

The Mission's work was divided into two phases:

i) Consultation Visit to the countries involved between April 12th and May 24th 1989. The countries visited were: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela;

ii) Preparation of the preliminary Draft Project in Bogota (Colombia) from May 22nd to June 20th 1989. The editing of the document and preparation of the final version were carried out in Brasilia (Brazil) between June 21st and July 31st 1989.

At the level of individual countries, the Mission interviewed directors and technical personnel in the institutions and bodies responsible for the most direct and immediate actions in the tropical region in the fields of research, transfer of technology, development and formal training, including international centers and, in some cases, representatives of private enterprise.

In all, 177 people from 47 national and international institutions were interviewed.

B) Results of the Consultation

The consultation carried out in the countries of the region was highly positive. The interview with directors and technical staff in the institutions visited helped pinpoint positive and negative aspects, the overall impression being clearly positive in terms of the prospects and appropriateness of commencing a joint undertaking to develop the South American tropics in three priority sub-regions: the Humid Tropics of the Amazon, the Llanos or Cerrados and the Pié de Monte.

Among the aspects raised and pinpointed in the countries, the following deserve special mention:

1. Installed capacity: It is obvious that, in varying degrees, the countries have already embarked on different kinds of action in the sub-regions mentioned, so there is now a significant physical and human infrastructure capable of acting as the springboard for a future drive for regional cooperation. (Annex 1).

Indeed, there are 123 institutions spread throughout the three sub-regions - but with actions concentrated mainly in the Llanos or Cerrados and in the Humid Tropics of the Amazon - responsible for research, training, extension, planning and development, most of which are stable. Most are likewise directly attached on their respective Agriculture, Planning and/or Education Ministries.

These institutions have an installed capacity in physical infrastructure in the region of approximately 103 Experimental Stations, Sub-stations and Experimental Farms, strategically located in areas whose potential has already been identified, with easy access, most of them near developed or developing centres. It is possible that their physical equipment - especially laboratories and research equipment - and other installations need up-dating, replacing and/or adding to.

As far as human resources are concerned, about 1,146 staff were identified in the different branches of agricultural sciences, with varying degrees of specialization and academic qualification. Together they constitute a remarkable body of critically-minded professionals.

2. Actions and Accomplishments: There is no doubt that the need to open up new geographical areas for development and to increase sources for the production of food, fibres, and products for industry and exports, has urged countries to roll back their agricultural frontiers in the tropical region by technical means.

The consultation identified about 24 large technical fields of action without taking into account the specific disciplines and products which are far more numerous. The scope and diversity of the know-how and/or technology already generated and available, concentrated in approximately 34 broad technical areas which could easily be multiplied if mention were to be made of specific disciplines and products (Annex 2), are proof of this.

Consequently, there is already a wealth of technical and technological know-how worth mentioning and a solid base of knowledge about the region which, though insufficient as the countries in the region themselves recognize, should be taken account of for the generation of future actions (Annex 3).

One aspect that should be borne in mind is the institutional, technological and socio-economic limitations and/or restrictions manifested (Annex 4).

The most noteworthy are: the lack or insuficiency of specific policies for the development of the region in matters such as science and technology, internal supply, markets, and integral development. The high turnover in technical personnel and their migration to the private sector or abroad in search of better career prospects and greater financial rewards is indicative of the powerful restrictions that hamper the development of national institutions in general. Other limitations include the lack of professional training with a clearly "tropicalized" outlook; the need to extend studies and research in various aspects

of technology and management of the production system, like soils, production systems suited to the environment, identification and management of natural resources in general; and finally issues such as intense rural migration to urban centres, adverse health conditions, badly organized human settlements, among others.

3. Agricultural development policies and strategies in the Tropics: It is clear that most of the basic foodstuffs in the countries of the region, such as grains and cereals, root crops, vegetables and fruits come from other geographic areas. In Bolivia, Ecuador and Peru, a high proportion comes from the Interandean Valleys, the Coastal Strip and the Andean Plateau, and is mostly supplied by small producers. In Colombia and Venezuela, the Llanos or Savannas must be added to the regions already mentioned, while in Brazil supplies come from the Cerrados and Southern, Centre-West and Northeast regions and from the Amazon itself. Finally, in Guyana and Suriname production is basically restricted to the coastal region.

Agricultural production in most of the countries in the region is insufficient to meet internal demand and the shortfall has to be made up by importing.

In actual fact, the agriculture sector's contribution to GDP in recent years has been unimpressive, largely due to the dependence on imports, small-scale production for exports, low yields and the persistence of poverty and unemployment in rural areas.

On the other hand, it is also evident that surging population growth is exerting increasing pressure on more developed industrial centres whose capacity for absorbing labour is nearing saturation point. Rural migration is on the rise and pockets of poverty are burgeoning in big cities.

Studies carried out in Brazil have depicted this problem in a palpable manner: from 1940-1980 the relative weight of the rural population fell from 68.8% to 32.3% of the country's total population (136 million in 1986), and current statistics indicate that the rural population will continue to dwindle, in relative terms at least. Thus, it is estimated that in 1990 about 26% of the total population will be living in the countryside and by the year 2000, a mere 18%.

The process of urbanization pushes agricultural activities, particularly the production of fruit and vegetables, further away from consumer centers, while land most suited to agriculture is swallowed up by the encroachment of urban centers.

Rising rural migration to urban centers, the shortage of farmland in more developed regions, and the search for new production areas or the expansion of those that already exist to cater for internal consumption or exports, are compelling countries to roll back their agricultural frontiers into regions with a potential for development, as is the case of the tropical regions.

The Mission found clear signs of this process. Thus, in Bolivia, for example, national agricultural development strategies place top priority on the utilization of the tropical plains ("llanos") in the northeast of the country, which encompass its Amazon region, where rubber extraction and nut gathering had hitherto been the main forms of exploitation.

In Ecuador, agricultural development policies are geared to integrating the East (Amazon region) into the national socio-economic system and measures have been introduced to encourage and support this integration, oil prospecting and production in the region, geopolitical occupation and control, and the displacement of groups of people by means of internal migration and settlement projects to create a live frontier. Moreover, the Ecuadorean Government has proposed the creation of and backing for integrated rural development projects.

Peru is striving to achieve a rational expansion of its frontier in the Selvas (jungle) region with a view to boosting the production of food for national and regional consumption, encouraging the cultivation of crops with agro-industrial potential, and expanding its local and exports markets.

In Guyana and Suriname the production of food and export crops is concentrated in the coastal strip, as is most of the population. Both countries are endeavouring to open up new production areas in the interior, in their Amazon regions which possess a potential for developing new alternatives in agriculture and livestock.

Colombia's agricultural development policies and strategies stress the importance of the agriculture and livestock sector as a key element in the country's economic and social development. The Eastern Plains (Llanos Orientales) and Amazonía regions (55% of the country) are ranked among the most important in the country, the Llanos being more readily and advantageously adapted to the production of commercial crops than is the Amazon region, which is essentially suitable for forestry activities and the development of agroforestry and agrosilvopastoral activities.

Venezuela shows a keen interest in its Amazon region, both as a frontier zone and as a reserve of renewable natural resources. It prefers to adopt a conservationist policy, delaying utilizing it until the country is equipped with sufficient technical baggage. The country also possesses great potential in the Llanos region which can be more readily used than that in the Amazon region.

As far as the rolling back of the agricultural frontier in Brazil is concerned, great importance has been attached to the development of technologies for underpinning the conquest of important regions of the country, including Amazônia, the Cerrados (plateau scrublands), the marshlands of the Pantanal in Mato Grosso state and the Southern Coast Lowlands.

Amazônia and the Cerrados deserve special mention. The former is the frontier of the future, the development of which requires the generation of adequate technologies based on wide-ranging knowledge already generated in various centres in the region and in observance of new policy guidelines being drafted by the Brazilian Government.

Due to their geographical location, climate, topography and extension, the Cerrados are a more immediate alternative for expanding Brazil's agricultural frontier. The region has a great potential for grain and livestock production, and forestry activities, and technological support, technical assistance and back-up services are readily available.

So, in most of these countries there is a political determination to use their tropical regions, despite the lack of specific policies for the utilization of existing natural resources in research or development projects, in infrastructure, transport and markets, and the lack of definition about priority production areas and so on.

All the aspects detected in the countries visited emphasize the need manifested and an interest in supporting IICA's initiative of reviving actions in the tropical region taking due account of support and technical cooperation needs (Annex 5), as well as the countries' own capacity to generate and supply the know-how and technology required.

IV. THE PROPOSAL FOR THE COOPERATIVE PROGRAM ON TECHNOLOGY GENERATION AND TRANSFER FOR THE SOUTH AMERICAN TROPICS - "PROCITRÓPICOS"

A. CONCEPTUAL BASES:

The Program proposed is essentially a reformulation of the IICA-Tropics Project and takes account of the knowledge and experience acquired during the implementation of its forerunner, adjusting them to a new dimension, based on the region's development needs and aspirations and its present reality. The aim of the Program is to generate an economic development strategy in which the agriculture sector plays a relevant role in the production of food, in the generation of foreign exchange currency through exports and substitution of imports, generating employment and labour, providing incentives that will fix labourers on the land and give farmers stability in geographic areas that are currently subject to national and international pressures, and so foster rational use of renewable resources and the conservation of the environment.

The Program intends to establish a milestone of inter-institutional and inter-regional cooperation in the South American tropics and more specifically in the Humid Amazon Tropics, the Tropical Llanos and Cerrados and the Pié de Monte sub-regions. It is to provide direct support for national undertakings to define and carry out plans of action geared to developing sustainable, lasting agriculture from an ecological, agronomic, economic and social point of view.

To this end, it recognizes and takes due account of the fact that the participating countries are sufficiently capable of identifying priorities and have enough political determination to undertake joint actions, make full use of their institutional capacity, and of the infrastructure and human resources available in each country.

Likewise, and especially with regard to the humid Amazon tropics, due account is taken of the concern expressed in the "Amazonia Declaration" (Manaus, Brazil - May 1989), which states: "We hope conditions may be created which will allow free access to harmless scientific knowledge and technologies or those designed to preserve the environment, and we reject attempts to obtain commercial gain by invoking legitimate ecological preoccupations". In this sense, the Program will promote actions designed to develop the region whilst conserving its renewable natural resources and ensuring that the production systems to be developed and implemented are sustainable.

At the same time, the governmental and non-governmental bodies participating in the Program should

make the most of opportunities for cooperation with private enterprise, International Agricultural Research Centers, national, regional and international technical and financial cooperation agencies, that may facilitate the implementation of programs and specific projects in priority areas and under conditions stipulated by the countries involved.

The Program covers a vast geographic area which contains three ecosystems of high potential for agricultural and livestock activities. All three have different ecophysiological characteristics which call for differing treatment from a technical and scientific point of view.

The humid Amazon tropics zone alone has continental dimensions and is undoubtedly the sub-region that requires the most urgent basic and applied research as it is subject to the pressure of unbridled expansion of the agricultural frontier in most of the countries in the region and of equally disorderly human settlement.

The issue of the preservation of the environment and of renewable natural resources is the linchpin of a strong internal and external pressure being brought to bear on countries. This undertaking may possibly contribute to reducing the practice of straightforward exploitation of forestry resources and to curtailing the opening up of new areas, as is frequently the case, especially in the humid tropics of the Amazon. It may likewise foster resorting to new strategies and alternative uses, such as the priority utilization of areas that have already suffered intervention and/or are undergoing a process of degradation within the region, for instance. On the other hand, more intensive utilization of neighbouring areas, like the Upland Plains and Plateau Scrublands (Cerrados) and the Foothills, could be encouraged to enable them to act as buffer zones.

It is common knowledge that both the Upland Plains and Plateau Scrublands and the Foothills have less drastic ecological features and that greater technological know-how is available for developing these zones than for the Amazon sub-region. They thus hold out more favourable prospects for immediate utilization for agricultural and livestock activities, as well as better opportunities for intensifying the process of technology transfer between countries.

B. OBJECTIVES

1. General Objective

The general objective is to promote and contribute to the sustained development of agricultural and livestock activities in the sub-regions of the South American Tropics: Upland Plains and Plateau Scrublands, Foothills and Humid Tropics of the Amazon. The aim is to foster the

rational use of renewable natural resources while offering the countries participating in the Program a real alternative for economic recovery in the prevailing crisis.

To this end, the Program will seek the active participation of national institutions devoted to research, technology transfer and training, and of other bodies concerned with the promotion of development in the sug-regions mentioned above.

The Program is confident that the results of its undertakings will lead to the long-term development of technology that will achieve sustainable production in addition to improving and strengthening the technical capacity of the participating national institutions.

2. Specific Objectives

The Program has the following specific objectives:

- Activating processes for generating, transferring and developing agricultural technology, training and sustainable production in the tropical region with a view to achieving economic growth combined with the conservation of the environment;

- Institutionalizing reciprocal technical cooperation mechanisms between the participating countries so that mutual benefit can be derived from available technology and resources for promoting the development of the tropical region;

- Boosting the efforts currently being made by the countries in the region to further the development and exchange of technologies and experience in the field of agricultural production and environmental conservation so as to facilitate the selection of technologies deemed valid and suitable from a biological and economic standpoint that can successfully be transferred to farmers in the region;

- Raising scientific and technological capacity and the transfer of technology by means of programs for training the human resources responsible for technological development in the region;

- Boosting the efforts currently being made by the countries in the region to further the development and exchange of technologies and experience so as to facilitate the selection of valid and suitable technologies that can be successfully be transferred to farmers;

- Propitiating endogenous development in the region so that the necessary conditions can be created for agricultural inputs and support goods industries to spring up around agricultural development projects thus reducing dependence on imports as well as generating foreign exchange and savings as national and regional level;

- Uniting the common interests and objectives of the countries through joint and coordinated infrastructure actions designed to facilitate subsequent actions that may be proposed;

- Assisting relatively less developed countries to attain the objectives of sustained food production and environmental conservation as the basic ingredients for achieving greater economic and social progress;

- Furthering the process of regional integration in the fields of research and technological development, product markets, raw materials and inputs and capital goods;

- Propitiating greater coordination and utilization of the results of research between the National Research Systems and International or Regional Research Centers acting in the tropical region.

C. GENERAL STRATEGY

Since one the purposes of the Program is to upgrade the technical capacity of national institutions so as to overcome the factors that limit the national utilization of the tropical region, in the context of an agricultural revival and the recovery from economic crisis, it seems obvious that the Program's operational strategy should include actions in areas covering both technological and strictly interrelated administrative aspects.

These actions may thus include the following areas:

1. Cooperative Research, based on a review of the schemes of priorities and the allocation of resources, for the purpose of concentrating and pooling efforts within and between countries, thus maximizing the utilization of existing capacities and resources.

The actions to be undertaken should take as their starting point the conditioning aspects which channel research towards the kind of agricultural technology the region is striving to master in order to bring into being an internally profitable and internationally competitive agriculture sector.

The utilization and/or considerations of technological advances and existing know-how for carrying out an ecological, agronomic, economic and social characterization of the region in particular; of the production systems, predominant and priority crops and products, as well as the technological implications of the present and future state of agriculture and the possibility of adapting technological innovations for use in the region, are also aspects that deserve consideration.

2. Technical-Scientific and Technological Exchange, interrelated with research so as to create efficient institutional mechanisms for overcoming technological limiting factors in areas pertinent to the Program, be they ecological, factors affecting the rational utilization of renewable natural resources, productive management aspects. The consideration of cooperation networks and programs, whether they be exclusively national or extend to include the regional and international centers in the region, is of fundamental importance in these mechanisms.

3. The Training of Human Resources in the participating institutions and those otherwise linked to the Program, through adequate schemes suited to the region, as a fundamental measure for alleviating and staunching the net loss of qualified personnel, a fact that has seriously hampered the development and implementation of programs and projects at national and regional level.

The holding of short courses, seminars, in-service training, technical exchange visits, logistic and financial support for the elaboration of undergraduate and postgraduate theses, as well as the granting of sabbaticals, are all forms of action that should be pondered.

The strengthening of formal and informal training centres in the tropical region, especially where the reformulation, up-dating and planning of teaching and training programs with a tropicalized approach is concerned, is another line of action to be pursued.

4. Information and Documentation as an essential means of supporting the actions mentioned above. They include the preparation of specialized texts, leaflets and technical bulletins, reports and technical notes.

The creation of data banks and a regional information and documentation network for the tropical region, in addition to the improvement of existing information and documentation centers will also be considered.

At the same time the Program will propitiate the development and application of leading edge technology in the field of Informatics, with the dual purpose of integrating the information resulting from technical activities in the various Subprograms and their specific projects and of contributing to an understanding of the environmental complex of the South American Tropics.

5. Technical Assistance, in the form of Consultancy services, priority being given to the employment of the installed professional capacity in the countries covered by the Program, bearing in mind the technical and economic benefits to be derived from hiring top-class professionals with first-hand knowledge and experience of the tropical region in Latin America and the Caribbean.

6. The carrying out of Special Studies as and when required, to provide back-up and guidance for specific projects, and also to serve as a source of information on aspects reckoned to restrict or limit the normal development of the projects to be undertaken, for instance in the fields of Technological Policies, Technological Inputs Markets, Agroindustrial development and Economic Integration.

. The study of technological policies is basically to concentrate on surveying existing guidelines on this issue in each country in order to ensure that the activities undertaken in the projects are compatible with the long-term interests of the countries in each field of study.

. The study of technological inputs markets is to focus on assessing the economic potential of the tropical region (based on a detailed analysis in each country) for utilizing technological inputs and, eventually, improved machinery and implements, as a by-product of the activities being undertaken in each of the Subprograms initially proposed.

As far as agroindustrial development is concerned, the aim of the study is to survey the agroindustrial capacity installed in the region as well as the feasibility of producing the technological inputs, raw materials, and the machinery and implements to be utilized in activities related to the projects proposed, instead of importing them wholesale. In this sense, the basic criterion is to be that of endogenous development.

Economic integration. This study will lay the foundations for bilateral or multilateral economic cooperation with a view to propitiating the signing of agreements between participating countries in relation to technological inputs markets and the utilization of existing agroindustrial capacities.

7. Coordination and Cooperation with other national, regional and international bodies related to the Sector, an action in which the Program can play an important liaison role in facilitating and systematizing activities such as the technical and scientific exchange of personnel, know-how and experience, of technologies and bi and multilateral actions between the countries in the region.

The importance of this action resides in the fact that, at country level, there are many governmental and non-governmental institutions that play a part in regional development, including: Ministries, companies and regional development corporations or agencies, universities, and so on. Very often, planning and implementation actions are dispersed and isolated, which indicates the need for an unequivocal determination to support and coordinate the bodies and institutions mentioned so as guide their activities in the area.

Likewise, there are a number of international institutions and governments at country and regional level carrying out or interested in carrying out technical cooperation activities in Amazonia and equivalent areas of the South American humid tropics: FAO - UNDP, IICA, CIAT (International Tropical Agriculture Center, based in Colombia), IITA (The International Institute of Tropical Agriculture, whose headquarters are in Nigeria), ORSTOM (France), the Max Planck Institute (West Germany), USAID, several universities in the United States, the Ford Foundation, the International Development Research Centre (IDRC, Canada), ICRAF (the International Council for Research in Agroforestry-Kenya), Banks like IRDB, IDB, etc.

Firstly, it is obvious that aid and support from these institutions can only be obtained once the Governments themselves have reached a definite position, based on their national policies, interests and priorities. Secondly,

once the interest of an individual Government or of the region as a whole in a particular technical cooperation for specific projects has been stated, it is essential that adequate mechanisms be established for procuring agile international cooperation through channels that suit the interest of the national institutions involved.

From the point of view of multinational cooperation, it is easier to obtain aid for areas in which the countries have a shared interest, since one can rely on an existing mechanism and program, recognized by the local Governments and which have already acquired a certain amount of experience in the region and degree of technical cooperation capacity.

8. External technical cooperation: there are agricultural research centers in tropical areas around the world, like IITA, ILCA and ICRAF in Africa whose knowledge and experience and the technologies they have generated could constitute a rational basis for the generation of technologies in the countries of the Amazon. The Program can play an important role here in transferring such know-how and by acting as a scientific and technical intermediary.

9. Creation of Services on which production depends:

All strategies will fall short of the mark if additional services can provide farmers with certain facilities for attaining full production capacity cannot be supplied. These include:

- education and health, the distribution of inputs, technical assistance, credit lines, marketing and so forth;

- the organization of producers, especially where production depends on small-scale farmers, in which case the creation of associative companies and production and marketing cooperatives could be encouraged, etc.;

- processing farm produce, creating or strengthening the agroindustrial sector geared mainly to the exports market, producing foreign exchange earnings, substituting imports;

- an attempt should be made to industrialize products in the production areas themselves so that the location of processing plants may contribute to the creation and growth of development poles, thus furthering economic and social progress in the region.

D. CONCEPTUAL FRAMEWORK

The Program's conceptual framework consists of the various operational phases or stages as well as its means of action, starting from the definition of its geographical coverage, the main criteria governing its action and its operational structure. Finally, the participating institutions are listed according to kind and their field of activity.

The diagram 1 on the following page clearly presents all these components, duly grouped into sequential levels, which are described below.

E. COVERAGE

1. Geographical and Ecological Coverage

The Program's coverage will consist of the following components:

a) Geographical coverage including the following countries: Bolivia, Brasil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela.

b) Ecological coverage including the following ecosystems or sub-regions: the Humid Tropics or Amazon Basin, the Llanos or Cerrados (plateau lands) and the Pié de Monte (foothills).

The distribution of these sub-regions in the participating countries is given in the following table:

Table 1. Distribution of sub-regions by countries (km²)

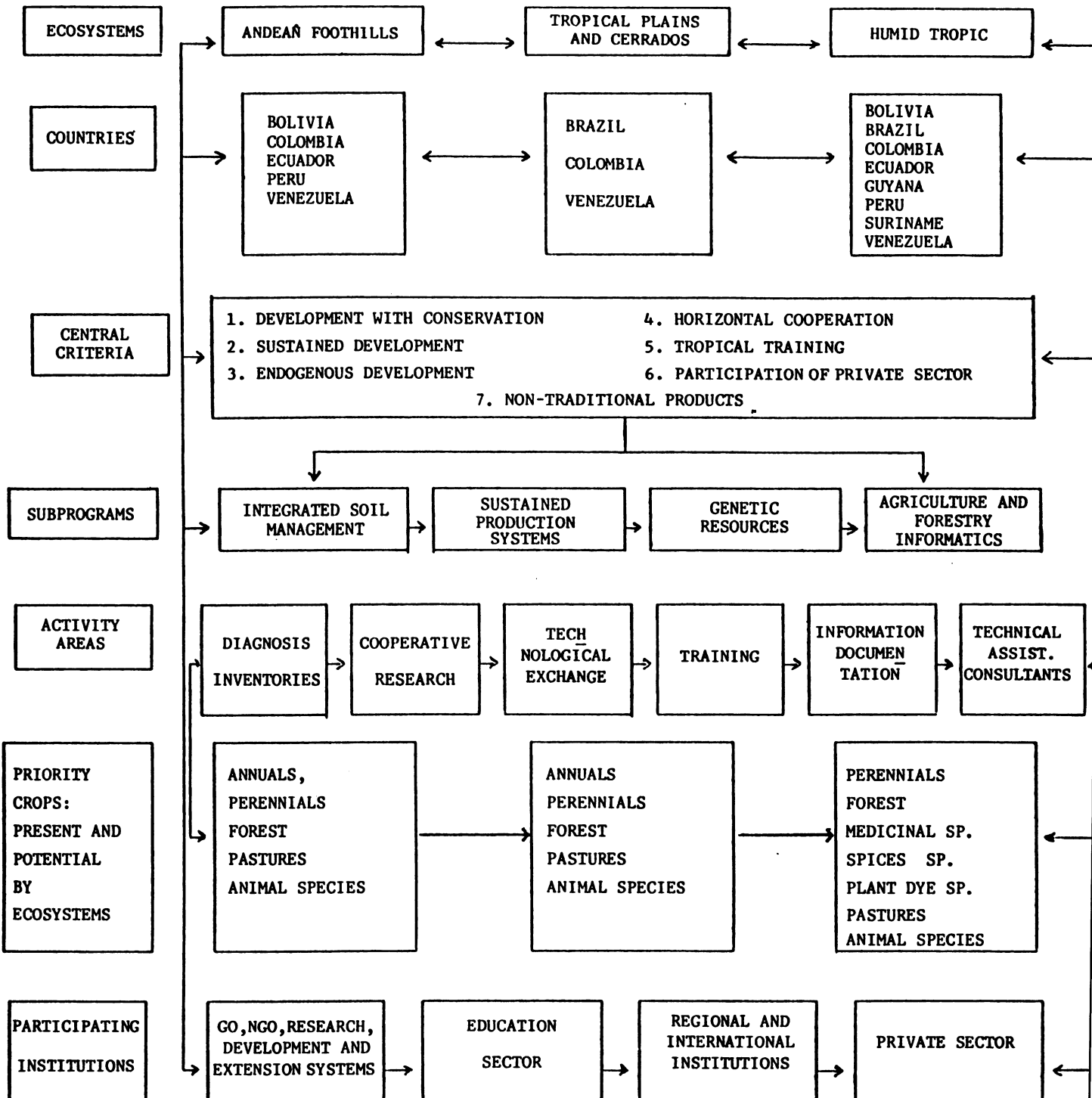
COUNTRIES	HUMID TROPICS	PLAINS AND CERRADOS	FOOTHILLS	TOTAL	%
Bolivia	345,920	-	14,080	360,000	3.6
Brasil	5,144,300	2,037,600	-	7,181,900	71.8
Colombia	398,750	230,960	9,250	638,960	6.4
Ecuador	103,220	-	150	103,370	1.0
Guyana	195,380	-	-	195,380	1.9
Peru	552,513	-	204,353	756,866	7.6
Suriname	127,780	-	-	127,780	1.3
Venezuela	382,280	244,420	10,420	637,120	6.4
TOTAL	7,250,143	2,512,980	238,253	10,001,376	
%	72.5	25.1	2.4	100.0	

Source: IICA - Country Reports. PROCITRÓPICOS Mission. July 1989.

Program 1.

PROCITROPICOS

CONCEPTUAL FRAMEWORK



One observes that the total territorial extension of the three sub-regions is approximately 10,001,376km² of which about 7,250,143km² (72.5%) are occupied by the Humid Amazon Tropics, about 2,512,980km² (25%) by the Llanos or Cerrados and only about 238,253km² (2.4%) by the Pié de Monte.

The whole tropical region represents about 73.7% of the total territorial extension of the eight participating countries, which is approximately 13,571,199km², as can be seen from the attached provisional Map.

In the individual countries, the coverage of the tropical region is as follows: in Bolivia it is about 360,000km² or 33% of the country's entire territory; in Brazil, approximately 7,181,900km² or 84.5%; in Colombia, about 638,960km² or 56%; in Ecuador, 103,370km² or 40% of its territory; in Guyana, 195,380km² or 91.3% of its territory; in Peru, 756,866km² or 56.6%; in Suriname, 127,780km² or 78% of its territory and in Venezuela, 637,120km² or 59.5% of its total territory.

The Table also shows that Brazil has the largest portion of the tropical region, about 7,181,910km² (71.8% of the region), followed by Peru with about 756,866km² (7.6%), Colombia and Venezuela with 6.4% and finally Bolivia, Ecuador, Guyana and Suriname with 3.6%, 1.0%, 1.9% and 1.3% respectively.

The Humid Amazon Tropics sub-region is present in all eight countries, mostly in Brazil (71.2%); the Llanos and Cerrados are characteristic in Brazil (81.1%), Colombia (9.2%) and Venezuela (9.7%); while the Pié de Monte is restricted to the Andean countries, since it corresponds, in physiographic terms, to the foothills of the Andes Mountain Range which assume greatest importance in Peru (86%), then Bolivia (5.9%), Venezuela (4.4%), Colombia (3.9%) and Ecuador, where they represent a mere 0.06%.

2. The Sub-Regions and their Importance

From an ecological point of view, the three sub-regions play an important role in the economy of these countries. The Pié de Monte, principally in Bolivia and Peru, is intensively used for agriculture and livestock projects and especially for the development of settlement projects, on account of its climate, temperature and rainfall which favour this kind of activity despite the disadvantage of being located on hillsides and thus being prone to deterioration by soil erosion. Easy access to this sub-region is another advantage from the point of view of marketing its produce.

The Llanos and Cerrados account for about 25% of the surface area of the South American Tropics, totalling

about 250 million hectares. The largest part is in the Brazilian Cerrados, which cover 200 million hectares, followed by the Llanos of Colombia and Venezuela.

Large urban areas have sprung up in both the Brazilian Cerrados and the Llanos of Colombia and Venezuela, generating a strong demand for agricultural products. The productive capacity of these regions has been put to the test in the last two decades and there is still great potential for expanding the agricultural frontier in these tropical areas to meet growing regional demands and produce exportable surpluses. Brazil's experience is exemplary. The Country's Cerrados cover approximately 204 million hectares, about 170 million of which are suitable for agriculture and about 100 million have arable soils. It is estimated that in 1988 the Cerrados produced approximately 41% of Brazil's total soybean production. If they were wholly occupied in an intensive and rational manner, the Cerrados could produce approximately 200 million tons of grain, eight million tons of meat and 600 million cubic metres of timber over a period of 50 years; all told, this is three times Brazil's current production figures.

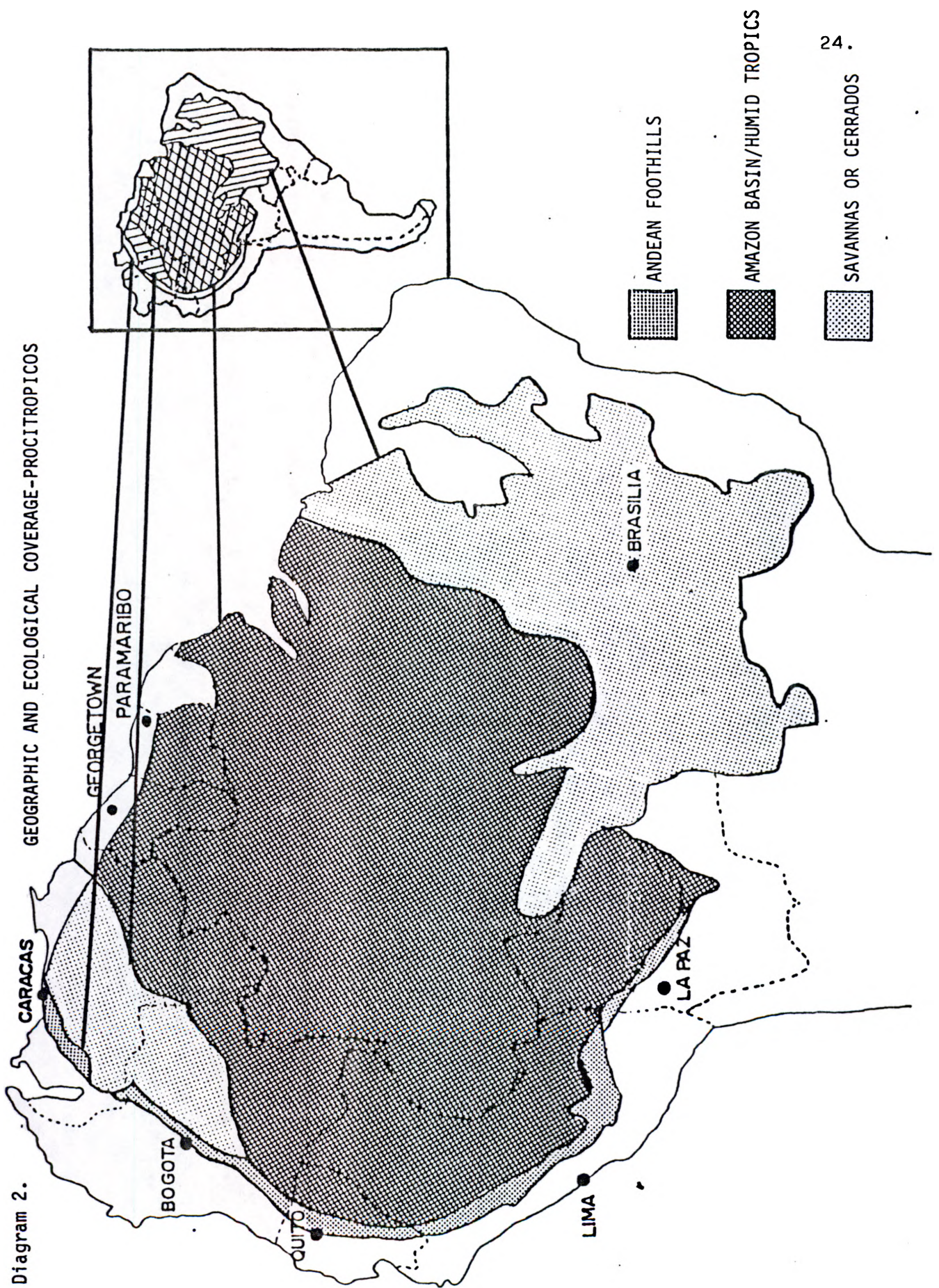
One can thus state that the Llanos and Cerrados represent the most immediate alternative for expanding the agricultural frontier in the three countries mentioned, due to their geographical location, territorial extension, their ecological characteristics that are highly favorable for agricultural development and to their easy access to markets and urban centres.

Moreover, both sub-regions (Pié de Monte and the Llanos or Cerrados) can play a strategic role in preserving Amazonia since the intensification of productive agricultural activity in both regions could significantly alleviate the pressure to occupy the Humid Amazon Tropics.

Finally, the Humid Amazon Tropics is the most extense tropical sub-region. To a greater or lesser extent, its occupation has been marked by disorderly extraction activities in all the countries of the region. Nowadays, though, it is witnessing the beginning of a new phase in which the interest in extracting its greatest riches, its hardwoods, is allied to the quest for a new frontier for the production of food and raw materials.

In most of the countries, this sub-region lacks the minimum infrastructure for better utilization, so one can readily anticipate that its occupation will depend principally on its existing infrastructure, especially on the roads and tracks penetrating into its interior. On the other hand, there is an evident lack of technological know-how for the sub-region, without which it is impossible to draft concrete and specific policies for its occupation and rational utilization, and this makes it necessary to broaden

Diagram 2.



the scope of an extend knowledge about the environment and about the principal land-use systems, striving to generate technology that will make the preservation of its natural resources possible in the future.

Research, especially research on soil and crop management, in Amazonia is inevitably very restricted to specific locations and crops. Information about soils in the region, on the other hand, has advanced constantly in terms of geographic distribution, classification and morphology, so that all together the information available demonstrates that most of the limitations or restrictions regarding soils in the region do not rule out their utilization. It is, however, clear that without adequate management technology, any new alternative production systems are doomed to failure. This concept emphasizes the need for developing adequate technologies for the region.

3. Special Characteristics of the Sub-Regions

It is important to bear in mind certain special characteristics of a socio-economic, technological and institutional order which distinguish the three sub-regions of the South American tropics from the point of view of restrictions or advantages for their utilization and development. On the other hand, they provide answers to questions about the present stage of development or the intensity of actions being carried out in each sub-region.

These characteristics, displayed in the Table below, clearly show that there are restrictions which argue against the intensive and immediate utilization of the great majority of the Humid Tropic. Indeed, the sole, if very important, favourable characteristic is its biological productivity. Harnessing it to obtain high economic yields will depend on the degree of control that can be exerted on such restrictive factors or elements through adequate management.

The Llanos or Cerrados and the Pié de Monte possess a series of advantages, including greater availability of technological information and/or technologies for immediate utilization; accessible domestic markets, greater communications and services infrastructure for supporting production; less drastic climatic conditions which, added together, secure greater economic productivity, with limiting factors that can be controlled at a lower cost than in the humid tropics.

An important limiting factor which stands out in the Pié de Monte region today is the presence of serious social conflicts sparked off by the unbridled spread of so-called prohibited crops (coca) or imposed by guerrilla warfare.

An aspect which is common to all three sub-regions is their highly fragile ecosystem which indicates the lack of correspondence between the vegetation component and the soil component, as well as the persistence of erosion and high temperatures which contribute strongly to the deterioration of the productive system, especially with regard to the soil.

All in all, it is easy to understand the intensification and promotion of actions associated with agricultural production in the Llanos or Cerrados and Pié de Monte regions, rolling back the agricultural frontier in some of the countries that possess these sub-regions. On the other hand, preserving the Amazon region, maintaining it as the agricultural frontier for the future until rational alternatives for developing it without neglecting conservation can be generated, is a valid strategy.

Table 2. Special characteristics of sub-regions

CHARACTERISTICS	HUMID TROPICS	PLAINS/CERRADOS	FOOTHILLS
1. Fragility of the ecosystem: - Erosive rains - Fragile soils	Predominant	Predominant	Predominant
2. Territorial extension	Large	Large	Smaller
3. Technologies and technological know-how	Insufficient	Readily Available	Readily Available
4. Infrastructure: communications, roads and support services, access to markets	Inssufficient	Adequate	Adequate
5. Population density and labour-force	Low	Low	Higher
6. Capital and Investments	Low availability	Low availability	Readily available
7. Living conditions: health, education	Difficult	Adequate	Adequate
8. Biological productivity	High	Low	Low
9. Economic productivity	Low	High	High
10. Turnover at work	Low	Average	Average
11. Social conflicts	Increasing	Increasing	High
12. Natural resources Renewable Potential	High	Average	Average

F. MAIN CRITERIA

Developing agriculture in the South American tropics is more complicated than in other ecological regions because of the region's characteristically fragile ecosystem which is prone to rapid deterioration if its natural renewable resources are not managed in strict accord with the ecological conditions that are peculiar to it: high rainfall, high temperature and solar radiation; slight seasonal variation and generally low natural soil fertility.

This situation is even more critical in the Humid Tropics of the Amazon Basin where national interests of a geopolitical order are at stake. These interests should be considered from the standpoint of the orderly and systematic process of the utilization of the Amazon at national and regional level.

The Llanos or Cerrados, by way of contrast, have a number of important comparative advantages in relation to other regions. The most important are the availability of surface water for irrigation, topography and soil structure well suited to mechanized farming, excellent quantity of sunlight hours, low incidence of economically significant plagues and diseases, and excellent availability of genetic resources.

The Main Criteria that underpin the formulation of principles and strategies for the Program include:

1. Development with Conservation

The search for a balance between the need to expand the agricultural frontier of the participating countries and the need for rational use and conservation of natural resources naturally makes "agricultural development allied to conservation" the Program's prime precept and its most important criterion. In this sense, the aspects on which technologically-based agricultural development are grounded should give equal weight to boosting production and productivity and to conserving the resources that generate the production process.

This implies striving for a balance between production efficiency and productivity, allied to the conservation of natural resources (soil, water and climate). In consonance with this principle, a balance must be achieved between technological aspects which raise production and productivity (seeds and varieties, fertilizers, plant protection, farming practices, etc.) and those which tend to preserve or promote rational use of the soil, climatic and water resources.

In other words, what is required is a balance between efficiency and conservation. In two of the geographic

areas to be covered by the Program (the Foothills and the Plains or Cerrados) sufficiently adequate technological know-how is available for promoting such a balance, whereas in the Humid Tropics region the project should place an emphasis on research in basic aspects of the ecosystem and its potential for agricultural development so that the generation of technologies may maintain the balance between production and conservation.

2. Sustained Development

In the tropical region, the concept of sustainability in agricultural activities assumes particular relevance in view of the nature of the soil which rapidly deteriorates in physical and chemical terms. This means that technological alternatives must be found that may provide a long-term productive view of improved production systems by means of national management of the region's renewable natural resources on which production depends. This concept combines conservation aspects, appropriate technology and a policy of selecting products that match the region's vocation and the demands of the market.

3. Endogenous Development

The tropical regions of Latin American are the regions that on average have progressed the least in social, economic and production terms. The tropical ecosystem provides relative climatic and ecological advantages which, if properly handled, could become the driving force and stimulus for regional development in the Amazonian countries.

The development of agriculture and livestock activities in the Cerrados or Llanos and the Foothills' regions (which together total about 250 million hectares) constitutes the most immediate alternative for expanding the agricultural frontier, given their climatic conditions, geographical location, extension and the morphological characteristics of their soils. Moreover, these areas have a high potential for producing a series of products of which there is a shortage in the region. Examples of this sort of development are prevalent mostly in Brazil and Colombia. There are still doubts, however, about the long-term sustainability and stability of monoculture cash crops.

Endogenous development in the Llanos or Cerrados, as well as in the Foothills regions, will also help to expand local labour markets and provide opportunities for agriculture and livestock production and services which will delay or curb migration into the more fragile humid tropics regions whose potential for agricultural production is less immediate.

Lastly, one should consider that opportunities for industries providing goods and services for the sector

are likely to spring up in the wake of development in agriculture and livestock activities. These include the production and distribution of fertilizers, pesticides, improved seeds, riding gear, tools and mechanized farm equipment. Efforts should be made to provide the necessary conditions for associated support industries to flourish around agricultural development, not only at national level but also by expanding regional markets for goods and services that fuel economic development in the region.

4. Horizontal Cooperation

The survey carried out in the countries and institutions in the region shows that there is very limited cooperation, liaison or horizontal communication between the institutions responsible for agricultural development. It has been noted that links with extra-continental organizations are probably stronger than those with organizations in the region itself.

Promoting, supporting and strengthening the horizontal cooperation mechanisms between institutions within the same country or across national borders rank high among the Program's main criteria. The experience of the PROCISUR and PROCIANDINO Programs clearly indicates that there is ample scope for cooperation and liaison between institutions involved in the generation and transference of technology.

The advantages already established include: a) rationalization of research and technology transfer resources; b) optimization of extension plans and programs; c) ability to capitalize on previous experience in countries at different relative stages of development; d) training of technical personnel through exchange experiences; e) formation of communication and information networks for sharing knowledge and technologies; f) better coordination and utilization of the results of work carried out at Regional and International Research Centers.

Finally, it is expected that the knowledge generated may strengthen the region's capacity for taking decisions about the use and the future of the tropical regions.

5. Training for the Tropics

Traditionally, training of agricultural sciences personnel in Latin America has been undertaken in countries with a temperate climate. The knowledge thus acquired has had to be adapted to the agro-ecological conditions of the Latin American tropics in order to be of any use. The fact is that this has often not occurred and the tropical agro-ecological system has been put at considerable risk when technologies or agricultural techniques suited to other environments have been introduced here without the necessary adjustments.

In the light of this, the Program has included "tropicalized training" of local technical personnel as another of its Main Criteria. The aim is to build up a stock of knowledge and concepts to orient the training of a new generation of technicians for the tropical region. The Program aims to support and strengthen existing professional training schemes, making use of facilities and experience accumulated in the region, providing support for postgraduate programs in local universities, and also by organizing an in-service training system that will make it possible for research workers to acquire a "tropical approach", first-hand knowledge of available technologies and, finally, the capacity to generate technologies specifically designed to cater for the region's problems.

6. Private Sector Participation

On the whole, government agencies tend to have a limited approach to the generation and transference of technology. So, at some point, know-how and technologies should be handed on to private enterprise so that they can become commercial processes and be used for production. The Program will thus seek to involve private sector concerns in the agricultural goods and services field in the process of developing the tropics.

This implies making an inventory of private sector participation in the process of developing the tropics. At a later stage, it will mean setting up horizontal cooperation mechanisms for exchanging experiences and information. Finally, this association should help define the horizons and limits of common markets, at both national and regional level, in which the private sector can operate. The feasibility of undertaking joint actions in mixed (public and private sector or regional transnational) companies in the region should be examined.

7. Non-traditional Products

One of the relative advantages of the tropics is the great diversity and wealth of native edible, medicinal and/or industrial species. The quest for new horizons and products that contribute to the sustained development of the region should derive the maximum benefit from this advantage.

The Program intends to study aspects related to the production, marketing and processing of those crops and breeds that present comparative advantages and can raise the profitability of local agriculture.

G. PROPOSED SUBPROGRAMS

1. Lines of Action

Recently, environmental issues and, more precisely, the detrimental effect of the intensification of the process of agricultural development on the deterioration of the quality of the tropical environment, specially the air, water and soil, have generated great national and worldwide concern. This obliges programs of technical, economic and social importance, like PROCITROPICOS, to take due account of them.

Of the three sub-regions contemplated in the Program, the Humid Tropics of the Amazon has received most critics and adverse comment in technical and academic circles concerning the present and potential implications of the degradation of the sub-region's renewable natural resources and its effect on the quality of the environment.

In this context, mention is made (i) of the rapid encroaching of areas deforested by modern systems of exploitation and the disorderly establishment of pastures and agricultural activities, (ii) of the emergence of critical areas susceptible to flooding, landslides and erosion, (iii) of climatic and ecological modifications, such as the increase in the temperature of the environment and the degradation of the soil's physical, chemical and biological components, (iv) of the effect of widespread burning and its contribution to the pollution of the environment, increased CO² concentrations, thinning of the ozone layer and the "greenhouse effect".

On the other hand, the process of generating technology for the rational use of the tropical region's renewable natural resources should not merely follow traditional guidelines but should rather take up the challenges of world progress in new fields of advanced technology (such as agrobiotechnologies) so as to achieve internally profitable and internationally competitive agriculture in the region.

The region's complexity, reflex of the fragility of its ecosystem, its rich biological diversity and the scarce availability of basic knowledge and of production and conservation technologies, hinder the process of defining and selecting the actions to be undertaken in the Program. With regard to its overall strategy, the Program should work with a limited number of lines of action whose impact may be generally relevant for sustained development of the tropics. This has proved workable in the case of the PROCISUR and PROCIANDINO Programs that were organized around groups of products held to be the top priority of the participant countries and the sponsoring agencies, the number of products being kept small enough to be manageable.

In view of the foregoing, the initial proposal is that PROCITROPICOS should encompass a limited number of Subprograms that reflect the reedback of wide-ranging consultations with the participating countries concerning their own priorities and interests regarding the cooperative development of the tropical region.

The point of departure for the Program is thus the participating countries' needs:

- To develop activities related to sustained production and environmental conservation;
- To identify and make rational use of the renewable natural resources of the South American tropics from the point of view of production with minimum negative impact on the environment;
- To consider and take full account of the potential provided by the genetic diversity in the different subregions and ecosystems of each country;
- To extend and develop new mechanisms for gathering, processing and disseminating information and knowledge, experience and technological advances in the region.

In line with this position expressed by the participating countries, the Program proposes to focus its research activities on four Subprograms, the selection of which is based on the priority attached to integral subject areas most closely related to the problems of production and conservation in the region.

The selection of these Subprograms is the first stage of the Program, though it should be clearly stated that, as agricultural development is a dynamic process, at a later stage, the countries themselves may well consider it necessary to open up new lines of action in the light of subsequent priorities established for the Program.

The four Subprograms now being proposed by PROCITROPICOS are the following:

- Integrated management of soils;
- Sustained production systems;
- Management and conservation of genetic resources;
- Tropical agriculture and forestry in formatics.

The reasoning behind the selection of these particular Subprograms is that the first two are a direct response to the region's most glaring problem: the fragility of the ecosystem, in which soil and vegetation are the most significant elements - the former on account of its susceptibility to degradation, given its physical and chemical characteristics; the latter because it is a means of responding to this degradation. By this criterion, these Subprograms are designed to seek solutions through specific projects that will promote rational use of the region's renewable natural resources by means of alternative management techniques that ensure productiveness and prolonged stability of both components.

The third Subprogram, on genetic resources, is a response to the fact that the tropical region is a vast and diversified gene bank. The actions proposed will seek to organize and increase knowledge of these resources, while also identifying their potential application, as the basis for increasing the chances of producing traditional species as well as new species with potential on the local and export markets, such as spices, medicinal plants and native fruits, among other.

The fourth Subprogram, on tropical agriculture, and forestry Informatics will place an emphasis on the development and application of modern information technology while also seeking to integrate the information generated by the projects in the other Subprograms, by developing specific applications, so as to make a generalizing contribution to the global interpretation of the ecosystems covered by the Program.

The Subprograms, the initial stage of which is planned to last six years, will be elaborated on the basis of the findings of technical missions coordinated by IICA that are to be manned by specialist representatives of the national research, technology transfer and training institutions.

Similarly, in drawing up detailed proposals, the technical missions will make due account of the priorities established by each country. In this sense, the definition of certain products or crops within the general framework of the Program is only a preliminary measure and it should be made clear that the specific consideration of these items will be decided upon by the participant countries on the grounds of their priorities and reciprocal cooperation interests.

It is likewise worth mentioning that the specific projects being prepared for each of these Subprograms will have national, multinational or regional cover according to the kind of problem being treated.

2. The Subprograms

What follows is a general outline of the contents of each of the proposed Subprograms.

INTEGRATED MANAGEMENT OF SOILS SUBPROGRAM

a. Introduction

Tropical soils in the South American region cover about one billion hectares, approximately 700 million hectares of this total corresponding to the tropical ecosystems (Amazon basin) and 300 million hectares to the so-called acid savannahs.

The majority of these soils have been classified as oxisoils and ultisoils which have the following important restrictive characteristics: high acidity, aluminium toxicity, low availability of major, secondary and minor nutrients, low organic matter content, high susceptibility to erosion and degradation of their physical characteristics.

The eight countries participating in the Program and that to a greater or lesser extent possess territory in the tropical ecosystems, have needed to use these areas and will need to resort to them in the future for their agricultural development. In most of these countries their tropical regions are the most important alternative for expanding their productive capacity, either by horizontal expansion of their agricultural frontier or by raising productivity in the areas presently being utilized.

From the foregoing, one can deduce that the tropics of Latin America are subject to two major pressures: (1) the vertical or horizontal expansion of the agricultural frontier for the purpose of boosting agricultural production; (2) the preservation of a fragile ecosystem of great diversity. In this context, the soil is recognized as an element of crucial importance for attaining a harmonious and balanced solution.

Sustained development of these regions can only be achieved by a complete understanding of the soil, by an analysis of its special characteristics, appropriate zoning and the definition of adequate management systems suited to the agricultural system to be implemented. Otherwise any attempt to link them to the production system on a stable basis will run aground.

The preceding considerations underscore the importance of developing a Subprogram on Integrated Management of Soils, integrated management meaning the use of the distinct elements of the science of soils in an integrated fashion and in interaction, in time and space, with the surrounding biological and physical environment so as to make sustained use of them in agricultural production.

b. Objective

The general objective of this Subprogram is to promote the development of knowledge and technologies regarding the characterization, zoning, use, management and conservation of soils required for adequate protection of the region's natural resources and for the productive and sustained use of the soils in the different sub-regions of the South American Tropics.

c. Principal Activities

1. Diagnosis

Diagnoses and inventories of the Subprogram's various activities will be carried out with a view to making full use of existing knowledge and technologies in the region. These will include diagnoses of:

- Soil classification and characterization techniques, in order to foster the standardization of methodologies for soil surveys, the identification of homogenous areas and potential use. These actions are to be undertaken in the first year for the purpose of defining the methodologies, scope, detailing and characteristics of the unified maps of the region and sub-regions (soil surveys and potential use, homogenous agro-ecological areas, etc.) to be drawn up in subsequent years.
- Methodological and technological results generated by the research institutions in the region in the different branches of soil science, that should be used in research and technology transfer projects.
- Human resources and physical infrastructure regarding soils in the countries, that may be used in the Subprogram.
- Quantification of raw materials for the development and production of inputs, machinery and implements for the region.

2. Development and Production of Inputs, Machinery and Implements for the Region

This activity is associated with the convenience of endogenous development in the region, in other words, the development of technological-industrial capacity in the field of agricultural inputs, specially fertilizers, and agricultural machinery, mainly tilling implements.

The region possesses important reserves of raw materials for fertilizers and products for correcting the soil that need to be properly quantified. The technologies required for using these materials to overcome the limitations that the region's soils impose on productive capacity also need to be developed. This is the case of the phosphoric, feldspathic and calcareous rocks for the production of phosphate and potassium fertilizers and soil amendments.

3. Research

Research in specific projects will include both basic research - for providing better knowledge of the characteristics and their dynamics in physical, chemical and biological aspects - and applied research for generating technologies on the use and sustained, conservationist management of the soils under different production systems.

The research activities will be undertaken through the installation of research modules in each sub-region (ecosystem) and in countries selected on the basis of their problems and logistic capacity. The research will analyze soils under the following systems: a) pastures (degraded and undergraded); b) annual, perennial and mixed crops; c) woodlands; d) mixed production systems.

Research will focus on the following aspects: a) soils management (appropriate tilling, physical characteristics and their management, structure, compaction, water erosion, soil mechanics); b) nutritional aspects (fertilizers management and efficiency on major, secondary and minor elements; fertilizer application techniques, nutrient's cycle; c) soil biology (soil microbiology: micorrhiza and biological N fixation, organic matter cycle and management).

4. Technology Transfer

Coordination mechanisms and the exchange of experience and knowledge; observation visits by researchers and farmers; seminars, workshops and other technical events will ensue.

The publication of texts, books, specialized bulletins, a bi-annual technical-scientific journal and reports of workshops, courses, seminars and technical events will also be promoted and financed.

5. Support on Laboratory Equipment and Infrastructure

It is important to recognize that several of the participating countries need to expand and upgrade their installed capacity in research laboratories and other physical infrastructure, especially in the field, so as to attain a rough levelling of conditions within the region.

6. Training

Through short courses, on-the-job training, apprenticeships, support for the elaboration of postgraduate theses, sabbaticals and special work on the actions of the Subprogram.

7. Subprogram Coordination

The Subprogram will be coordinated by an international coordinator and national coordinators in each country, with the respective budgetary and logistic support.

SUSTAINED PRODUCTION SYSTEMS SUBPROGRAM

a. Introduction

The South American tropical region, covering approximately one billion hectares, is an area of great potential for agriculture, livestock and forestry activities. The lack of sufficient technical-scientific knowledge and the use of unsuitable technologies in the region have led to a breakdown of the ecological balance in highly fragile zones, with the consequent degradation of their renewable natural resources, expansion and acceleration of the shifting cultivation cycle, loss of productivity and a strongly detrimental effect on the environment and the quality of life of the populations in the region. One can thus not ignore the importance of intensifying the research programs in the region, designed to generate knowledge and technologies that will allow for adequate management and preservation of areas that have not suffered human intervention.

The Subprogram will give pride of place to research on production systems that provide agricultural production with varying degrees of agronomic and economic sustainability in the long term and variable impact on the environment according to the components and the management and application characteristics involved.

In view of this, the production systems to be researched are:

a. Systems for Preserving Environmental Conditions (SPCA): these are native production systems in which the forestry component is strongly predominant and that have a high degree of economic sustainability depending on the predominant economic species. The management of these systems is basically geared to the preservation and maintenance of the area's natural resources.

b. Systems of Minimum Negative Impact on Environmental Conditions (SMIA): these are characteristic of ecosystems that have undergone human intervention on their management is designed to provoke minimal alterations in the environment by means of low intensity tilling. Under such conditions, the degree of agronomic and economic sustainability is similar to that achieved in systems for preserving environmental conditions.

In both these systems, perennial and forestry species are predominant.

c. Systems for Improving Environmental Conditions (SMCA): these are characteristic of ecosystems that have suffered human intervention, management techniques being designed to prevent their degradation and even to improve certain conditions that hamper the recuperation of effected natural resources - the improvement of physical conditions (structure) or chemical conditions (fertility) of the soil - by the inclusion of suitable components or species in the production system.

The degree of agronomic and economic sustainability of these systems varies according to the characteristics of their components: the greater the predominance of perennial components or species over annual ones the more sustainable the system. In terms of their make-up, these systems range from monocultures (agriculture, livestock or forestry) to the most complex systems (agro-silvo-pastoral systems), including intermediary systems (agro-forestry, agro-pastoral and silvo-pastoral).

d. Systems for Recuperating Environmental Conditions (SRCA): these are typical of ecosystems where intervention has brought degradation through inadequate management conditions over a period of time, provoking a low degree of agronomic and economic sustainability. This occurs in areas abandoned by itinerant farming (agriculture or livestock) which is prevalent in the humid tropics of the Amazon.

The recuperation of these systems and the degree of sustainability will depend on the components involved, basically combinations of annual and perennial species and the employment of rational management techniques.

The technologies to be generated within the framework of the four systems proposed must fulfill the requirement of ecological and economic sustainability in time so as to ensure the adequate use of the South American tropical region's resources with the consequent benefits for the countries in the region.

b. Objectives

The Subprogram's basic objective is to generate technologies for rational use of tropical ecosystems so as to achieve sustained development of agriculture, livestock and forestry activities by means of the economic exploitation of existing renewable natural resources, and conservation of the environment by means of production systems that are recognized alternatives for adequate management.

c. Principal Activities

1. Diagnosis

The first activity to be undertaken in the Subprogram will be a regional diagnosis that will make it possible:

- i) to identify and classify the agriculture, livestock and forestry production systems, as well as the predominant native systems in the major agro-ecological zones of the three sub-regions - this activity should be carried out in conjunction with the soils subprogram for the purpose of identifying appropriate agro-ecological zones;
- ii) to identify the state of technologies available in production systems, both inside and outside the region, that can be transferred for recuperating degraded areas, improving the management of areas where intervention has caused a process of degradation and of areas that have not suffered intervention;
- iii) to identify the human resources and infrastructure available in the participating countries in the field of production systems.

2. Research

Research activities will be undertaken through specific projects, in the form of pilot modules that represent the predominant ecosystems and the subregions of economic interest to the participant countries.

The systems to be researched will have differing characteristics, according to the conditions of these predominant ecosystems. These systems may be:

- Perennial crop systems
- Annual crop systems
- Livestock systems
- Forestry systems
- Agro-forestry systems
- Agriculture/Livestock systems and
- Agro-silvo-pastoral systems .
- Native systems.

All these systems may be submitted to management with low or high intensity use of inputs according to the characteristics and conditions of the environment.

The fundamental aspect to be researched in all the different systems is the dynamics of the population of the most economically important species which are, in turn, the basis of each system from the point view of agronomic and economic sustainability.

Finally, the product of the research to be undertaken should generate, as far as possible, technological packages that will ensure its dissemination and application among the farming community.

The research systems detailed above will make it possible to generate production or environmental preservation alternatives in the three subregions for the purpose of transferring technology in order to achieve the dissemination and adoption of systems for preserving environmental ecosystems (SPEA) in areas with no intervention, minimum negative impact systems (SMIN) and systems for improving environmental conditions (SMCA) in areas where there has been intervention and/or new areas, and systems for recuperating environmental conditions (SRCA) for degraded areas.

The elaboration of the research projects should take into consideration medium and long-term aspects of the sustainability and management of the systems and their socio-economic viability in terms of agro-industry and marketing, and their effect on the environment.

3. Technology Transfer

Technology transfer will be carried out on two levels. The first will involve the exchange of knowledge, experience. Information and documents with support from the Informatics for Agriculture, Livestock and Forestry Activities Subprogram.

The second level will involve visits to the research modules by technicians and farmers, technical-scientific exchange between countries operating the same module and technical events such as seminars, workshops, courses, etc. Technology transfer should be marked by agility and high frequency.

4. Training

Training will be carried out mainly in the form of seminars, workshops and short courses on specific topics. Training of technicians at undergraduate and postgraduate level will be promoted and fostered by means of the preparation of postgraduate theses, apprenticeships and sabbaticals. The reformulation of syllabuses in existing academic centres in the region, designed to achieve tropicalized training of future professionals in the field, is also receiving support.

5. Publications

The publication of a bi-annual journal containing up-to-date information, technical bulletins, reports and documents of technical events is proposed and is to receive direct support from the Subprogram on Informatics for Agriculture, Livestock and Forestry Activities.

6. Subprogram Coordination

The Subprogram will be coordinated by an international coordinator who will receive budgetary support, and by national coordinators who will be responsible for liaising with other national institutions capable of carrying out the projects.

SUBPROGRAM FOR THE MANAGEMENT AND CONSERVATION OF GENETIC RESOURCES

a. Introduction

The ecological subregions of the South American tropics possess an abundant and still little-known wealth of genetic resources in flora and fauna. Numerous species used for food and industrial purpose have originated in the region and it is still an abundant source of genetic variability which could provide continuous and broad-ranging work in genetic improvement and production.

The search for, identification and domestication of new species hold out ample alternatives for multiplying the supply of food (regional self-sufficiency in foodstuffs), besides providing new and potential products for the exports market. On the foreign trade front, there are countless opportunities for food crops and breeds, industrial crops, medicinal plants, and exotic tropical species and fruits.

The survey and subsequent knowledge of tropical genetic resources - in the case of both presently disseminated crops and breeds and of new species with future potential - will facilitate the development of technologies and sustained production systems that have minimum impact on the environment, on the basis of native resources adapted to the region's ecological conditions, their characteristics being resistance to the environment, diseases and plagues. The emergence and use of new technologies (the case of agrobiotechnologies) in identify, separating and forming clones, tissue cultures and methods for the biological control of plagues and diseases likewise open up a new and broad technological horizon for available genetic resources and the potential of the tropical region.

Another aspect to be considered is the management and quarantine of genetic material brought to the region from other environments, for the purpose of genetic improvement of species presently being exploited or in the search for new production alternatives. In this present, the actions involved in the Subprogram should subscribe to the norms and international agreements established by the countries themselves to achieve the biological and sanitary protection required.

Finally, an aspect of particular importance is the need to preserve the biological wealth and genetic diversity of the South American tropics which are subject to a constant and intense process of erosion as a result of the gradual disappearance of natural genetic resources brought about by the encroachment of the agricultural frontier. The progressive adoption of new plant varieties and animal breeds, scientifically developed in crecent decades, and farmers' consequent abandoning of traditional crops, added to the lack of adequate legislation for regulating the extraction of these resources in the region, has further aggravated the situation. The strengthening of the national genetic resources systems will thus enable the countries to develop joint policies and strategies for action geared to preserving the region's biological resources.

It is obvious that such a broad and complec Subprogram as this will need to be planned and programmed in stages or phases so that the results it generates can be assessed on a partial and global basis in varying periods of time.

b. Objectives

The fundamental objective of this Subprogram is to generate methodologies, coordinate and step up regional activities geared to identify, gathering, assessing and systematizing the use and commercialization of the genetic resources of the South American tropics, making them available to be national agricultural research systems in the region so as to contribute to the development of sustained agriculture that does not harm the environment and to technological innovation in agricultural production.

c. Principal Activities

1. Diagnosis

This is the point of departure for the Subprogram, the purpose being to identify and assess the national genetic resources systems, in order to obtain up-to-date information on the pace and extent of growth in the region, to be used in planning training and technical-scientific exchange strategies. A survey will also be made of the institutions and specialists in the region with a view to forming a cooperation network and establishing horizontal communication and information mechanisms. In addition, specialized units or centers of excellence will be established, by mutual agreement, for sets or groups of species on the basis of comparative physical and human advantages.

The diagnosis will consist of:

a) Description of infrastructure, human resources, areas and capacity for action, as well as limiting factors.

b) Inventory of new species and others available under conservation, conservation technologies, in and ex situ management of germplasm resources and the present state of knowledge about conservation techniques and germplasm banks.

c) Identification of methods for managing genetic resources and fostering of unified identification, description, conservation and management systems.

d) Extent of utilization and application of genetic resources in technological innovation in agricultural and livestock activities by means of biotechnologies and the practical utilization of these resources by the national agricultural research systems.

2. Research

Research will be carried out in specific projects in areas or niches of genetic diversity on concentration that the participating countries consider critical from the point of view of their importance and immediate economic utility or of their preservation as potential future resources.

These resources may include industrial species, medicinal plants, native fruits, spices, promising crops, imported species, as well as forestry species and domestic and wild animals.

For each of the economic and environmental interest groups, the following research actions will be undertaken, the intensity of activities depending on the prevailing conditions at national level:

a) Expeditions for renewed collection and assessment of the natural habitat of plant and animal species aimed at furthering knowledge of the existing genetic resources, their use by native populations, their insertion in the natural systems that exist in the region and their potential use in new production alternatives with a high degree of sustainability and conservation of the environment.

b) Dynamics of the population of native species of economic importance in situ.

c) Botanical, biochemical and agronomic (or zootechnical) classification and assessment methodologies.

d) In and ex-situ and in-vitro genetic resources conservation systems.

e) Assessment of agro-biotechnology techniques for multiplying and improving species of economic interest and of genetic breeding techniques for preserving semem, ovules and for embryos of species of domestic and wild animals.

f) Techniques for introducing genetic materials derived from new technologies and for putting them to use in the national research systems.

g) Cooperative development of germplasm banks and handling techniques.

h) Design and creation of national and regional financing strategy mechanisms, considering genetic resources as a source of wealth with high bargaining power and of technological independence which should be protected and utilized on a joint basis.

i) Studies on regulations, patent laws and biological protection of genetic resources.

3. Technology Transfer

To be undertaken by means of:

a) Existing horizontal regional cooperation, coordination and net-work type mechanisms, with effective participation of regional and international research centers and of specialized centers like the Latin American Center for Cooperation and Concerted Action on Vegetal Germplasm (CARFIT) of the Latin American Economic System (SELA).

b) The establishment of information systems that facilitate the dissemination of inventories, diagnoses, methodologies and advances in the field of genetic resources.

c) The holding of technical events at national, regional and international level to foster the exchange of experience, know-how and technological advances, as well as the promotion of exchange and observation visits by professionals and farmers.

d) The utilization of new technologies in the field of informatics for regional and extra-regional technical-scientific intercommunication.

e) The publication of texts, specialized technical bulletins, a bi-annual technical-scientific journal, in addition to reports and documents presented at technical events.

f) Direct exchange between countries on the issue of pertinent international agreements on germplasm, inventories, norms and technologies for its immediate utilization in the national research systems or in enlarging national germplasm banks.

4. Training

The Subprogram makes allowance for the need to develop and train the human and specific resources in the national genetic resources systems with a "tropicalized" approach, as PROCITROPICOS proposes, under the aegis of a national Program tailored to the countries' needs and priorities.

Besides formal and informal training on the issue of genetic resources, it will also be necessary to include new fields of technological innovation, such as biotechnology and also new technological dissemination techniques which will provide a more dynamic response to the demands imposed by the technification and sustained growth of agricultural production.

5. Support in Equipment

The Subprogram contemplates the need for supporting countries participating in PROCITROPICOS that are less technologically developed in the field of genetic resources in order to promote a greater degree of equality of conditions in all the countries in the region. This support will consist of a boosting of the physical capacity of biotechnology laboratories and germplasm banks in the national research systems, in line with each country's requirements.

6. Coordination

An international coordinator, provided with adequate operational and logistic resources, will be responsible for coordinating the Subprogram.

SUBPROGRAM: TROPICAL AGRICULTURE AND FORESTRY INFORMATICS

a. Introduction

Greater knowledge of the various basic elements of tropical ecosystems - soils, climate, flora and fauna - implies handling a vast quantity of data which require processing with modern computer systems and data bases. Moreover, these various subsets of items of information, their inter-relations and correlations, their utilization in models and simulations can only be made scientifically viable with the support of the modern science of informatics.

On the other hand, the use of the knowledge generated by PROCITROPICOS in its Subprograms will be made feasible by an efficient system for gathering, processing and disseminating information, the INFOTROP System. This system, which is linked to national data bases and can access regional and international data bases, will provide for modern handling of the information generated. The information will be rapidly handed on to the member countries by means of computerized transmission using telephone "modems" with satellite communication of the Telemet-Carinet type.

As the development of informatics for agriculture, livestock and forestry activities is still relatively new, the Subprogram will make a significant contribution to generating technology in this field of science. It will strive to achieve modern processing of the information on tropical soils, climate, flora and fauna and will include an important analytical undertaking employing models and simulations of systems with long-term sustainability. This Subprogram will provide the remainder with the necessary technical back-up, for instance by organizing their data

bases, processing the thousands of bits of information they generate, facilitating the development of their models with systems of minimum environmental impact (SMIA), improved environmental conditions (SMCA), recuperation of environmental conditions (SRCA) and preservation of environmental conditions (SPCA). It will thus ensure a high level of integration between the Subprograms, propitiating adequate knowledge of the various tropical ecosystems by means of a complete analysis of their different elements (soil, climate, flora and fauna) which can be undertaken on a separate and/or interrelated basis.

It should be emphasized that the technology generated by this Subprogram may contribute to scientific development in several other fields (including environmental and agro-silvo-pastoral studies) besides benefiting informatics itself, by developing programs, processes, methods and even equipment designed for environmental preservation and the national utilization of tropical agricultural resources, securing its sustainability in time.

b. Objectives

The general objectives of the Subprogram are: a) generating technology in informatics for agriculture, livestock and forestry activities in order to achieve efficient handling of large quantities of data, thus ensuring sufficient analytical capacity for furthering scientific knowledge of the tropics, and b) developing a computerized system for gathering, processing and disseminating integrated information about soils, climate, flora and fauna, interconnected with regional and international data bases, thus fostering the publicity and utilization of the knowledge generated by PROCITROPICOS.

c. Principal Activities

1. Diagnosis

It is proposed that the first step be the elaboration of an inventory to be carried out in the member countries for the purpose of assessing their capacity in human resources, financing, equipment and informatics programs for the handling of data on tropical soils, climate, flora and fauna. This regional inventory should be supplemented by an international assessment of the state of the art in informatics for agriculture, livestock and forestry activities geared to gathering, processing (analysis, creation of models, simulation) and dissemination of information within the scope of interest of PROCITROPICOS.

2. Research

In order to outline the actions for the Subprogram with an appropriate scientific approach, it is proposed that an international seminar be held for the presentation, adjustment and validation of these actions, an endeavour being made to attain technical excellence, and possible sponsoring countries, finance and technical cooperation agencies being invited.

The proposal is that two lines of action be adopted: one generating agro-silvo-pastoral technology for the handling and analysis of information in the tropics; the other enabling the Program to undertake modern processing and dissemination among the member countries of all the information generated by the other Subprograms in PROCITROPICOS.

In the field of technology generation, it is proposed that a factory be set up for designing and producing computer programs suited to the varied demands of informatics for soils, climate, flora and fauna and similar production systems. It will contemplate the organization of computer stations, generators for processing large volumes of data and analyzing their interrelations.

An important research and development drive will be undertaken to model systems of minimum environmental negative impact (SMIA), recuperation of environmental conditions (SRCA), improved environmental conditions (SMCA) and preservation of environmental conditions (SPCA). The modelling of these systems will allow for consequent development of simulation which will in turn make it possible to study the conditions that determine sustainability in the different tropical ecosystems.

The System for Gathering, Processing and Disseminating Data on Tropical Agriculture, Livestock and Forestry Activities (INFOTROP) will also be established with a central nucleus regionally connected to the member states of PROCITROPICOS and will be able to access international data bases. This electronic gathering, processing and dissemination system, which will possess an important tropical data base on agro-silvo-pastoral activities, will be in a position to provide important services for a variety of users interested in the ecology of the Amazon, savannahs and foothills.

3. Technology Transfer

The Subprogram will make use of mechanisms for coordination and exchange of experience and knowledge; observation visits by researchers and farmers, seminars, workshops and other technical events that will facilitate

the technology transfer of the results obtained by this and the other Subprograms. The system for gathering, processing and disseminating data on tropical agriculture, livestock and forestry activities (INFOTROP) will, moreover, play an important role in the transference of technology by disseminating the technologies and data generated by PROCITROPICOS among the member countries in a swift and sufficient manner.

The Subprogram will promote a strong drive to achieve reciprocal technical cooperation among the member countries, fostering the transference of its technological results, as well as training in human resources services, thus facilitating the exchange of knowledge about successful experience in the management of the tropics in its different thematic areas.

4. Training

It is proposed that an international seminar for up-dating, follow-up, adjustments, validation and dissemination of INFOTROP's technologies and services be held with the participation of renowned international and national specialists.

Training will also be carried out through short courses, on-the-job training, apprenticeships and practical field work, support for the qualification of specialists and through special work on the project's actions.

5. Publications

The publication of bulletins, manuals, specific documents, ecological zoning maps, and zoning maps of soils, sustained production systems with minimum negative environmental impact, etc. will be promoted and financed. Moreover, the Subprogram will produce an important series of information which will not necessarily be presented in the form of traditional publications, but rather as computer and information handling programs package in modern electronic formats like floppy disks, magnetic tapes, etc.

6. Coordination

The Subprogram will be coordinated by an International Coordinator provided with the necessary budgetary and logistic support.

H. PARTICIPATING INSTITUTIONS

The setting up of a Cooperative Program for the Tropics is based on the shared interest of the countries in the region in participating in a coordinated manner in a joint effort which lead to the efficient generation of agricultural knowledge and technologies for this important region of Latin America.

Developing the tropical region should be a multi-institutional, interdisciplinary undertaking within and between the countries involved, since the establishment and implementation of policies and Programs for rural development, management and conservation of natural resources and the environment demands the involvement of a large number of public and private institutions. Within this cooperation and coordination framework, the participating institutions would be grouped into 4 categories:

- Full Member National Institutions
- Other National Institutions participating at local level
- The InterAmerican Institute for Cooperation on Agriculture - IICA
- Other international and regional research, technical and financial assistance centres and agencies

1. Full Member National Institutions

The institutions to comprise the Programs main governing body are:

BOLIVIA	The Bolivian Institute for Agricultural Research - IBTA.
BRAZIL	The Brazilian Agricultural Research Enterprise, EMBRAPA
COLOMBIA	The Colombian Agriculture and Livestock Institute - ICA.
ECUADOR	The National Agricultural Research Institute - INIAP.
GUYANA	Ministry of Agriculture

PERU	The National Agricultural and Agroindustrial Research Institute - INIAA.
SURINEME	Ministry of Agriculture, Animal Husbandry and Fisheries.
VENEZUELA	The National Fund for Agriculture and Livestock Research - FONAIAP.

2. Other National Institutions Participating at Local Level

It is proposed that each country set up an Inter-institutional Coordinating Committee for the purpose of achieving the broadest possible participation. The Full Member National Agencies are to be responsible for determining the Committee's make up, organization and operation.

To date, Peru and Ecuador - under the coordination of INIAA and INIAP, respectively - are in the process of setting up mechanisms similar to those proposed herein, bringing together the principal public and private institutions that undertake research, development and training activities in their tropical regions: Both cases could serve as examples for organizing the Coordinating Committees proposed by the Program.

3. The InterAmerican institute for Cooperation on Agriculture - IICA

The InterAmerican Institute for Cooperation on Agriculture (IICA) should act as a "facilitador" of horizontal liaison between the participating institutions, as a promoter and link between financing agencies and the Program's specific budgets. IICA's participation and support will be on three levels: a) at Central level, with direct participation of Program II, Technology Generation and Transfer and the support of IICA's other four Programs; b) at Regional level, through the support of the Regional Operations Directions for the Andean, Southern and Caribbean Zones; and c) at Local level, through the support of IICA's Offices in each of the participating countries.

IICA will participate in the Administrative and Technical Committees, along the lines established in the PROCI-type Programs. IICA will administer the financial and human resources for the Program through specific agreements with the financing agencies.

4. Other International and Regional Research, Technical and Financial Assistance Centers and Agencies

Among the International Agencies operating in the tropics, the Program will seek the participation of those whose mandates coincide with its objectives and specific projects. Among these, the possible participation of the International Center for Tropical Agriculture (CIAT), whose mandate includes research on four of the region's basic crops (manioc/cassava, beans, rice and tropical pastures), deserves special mention. On the other hand, CIAT at the time of setting its new strategic plan is modifying its institutional model in order to provide more emphases to the topics of sustainability and conservation of renewable natural resources. CIAT should sit on the Administrative Council and the Technical Committees as a guest member.

The International Potato Center (CIP), the Caribbean Research and Development Institute (CARDI) and the Tropical Agronomic Research and Teaching Center (CATIE) may also be considered guest technical institutions with operations in the region for the Program. Contacts could also be made with and technical support requested from the networks FAO operates for Latin America, the same applying to specific Programs in the tropical region operated by OAS, UNPD and agencies from other continents such as IRRI, IITA and ICRAF, among others. Finally, coordination and information mechanisms are to be established with the regional PROCISUR and PROCIANDINO Programs.

The financing agencies interested in the PROCITROPICOS Program could be invited to participate as observers.

I. PROPOSED ORGANIZATIONAL STRUCTURE

The Program should have a basic structure that facilitates the coordination of undertakings in priority areas in the individual countries by means of specific projects.

According to the attached scheme, this basic structure will consist of a central core, national cores and a set of basic activities directly related to the management, negotiation and coordination of specific projects and the promotion of top priority integrating actions.

The Central Core will consist of:

1. A Steering Committee, made up of the heads (Directors or Managers) of the National Agricultural Research Institutions or Participating Ministries. As the Program's governing body, the Committee will be responsible for directing and organizing its operations, approving annual work plans, budgets, reports and financial statements, for selecting and approving specific projects, as well as the terms of agreements drawn up between the National Institutions participating in the Program, IICA and the funding agencies. It will likewise be responsible for approving the

selection of personnel from the participating countries to work on the Program, and other activities related to general aspects of the evolution of the Program. The Committee will hold regular meetings once a year, at a time and place to be appointed by its members.

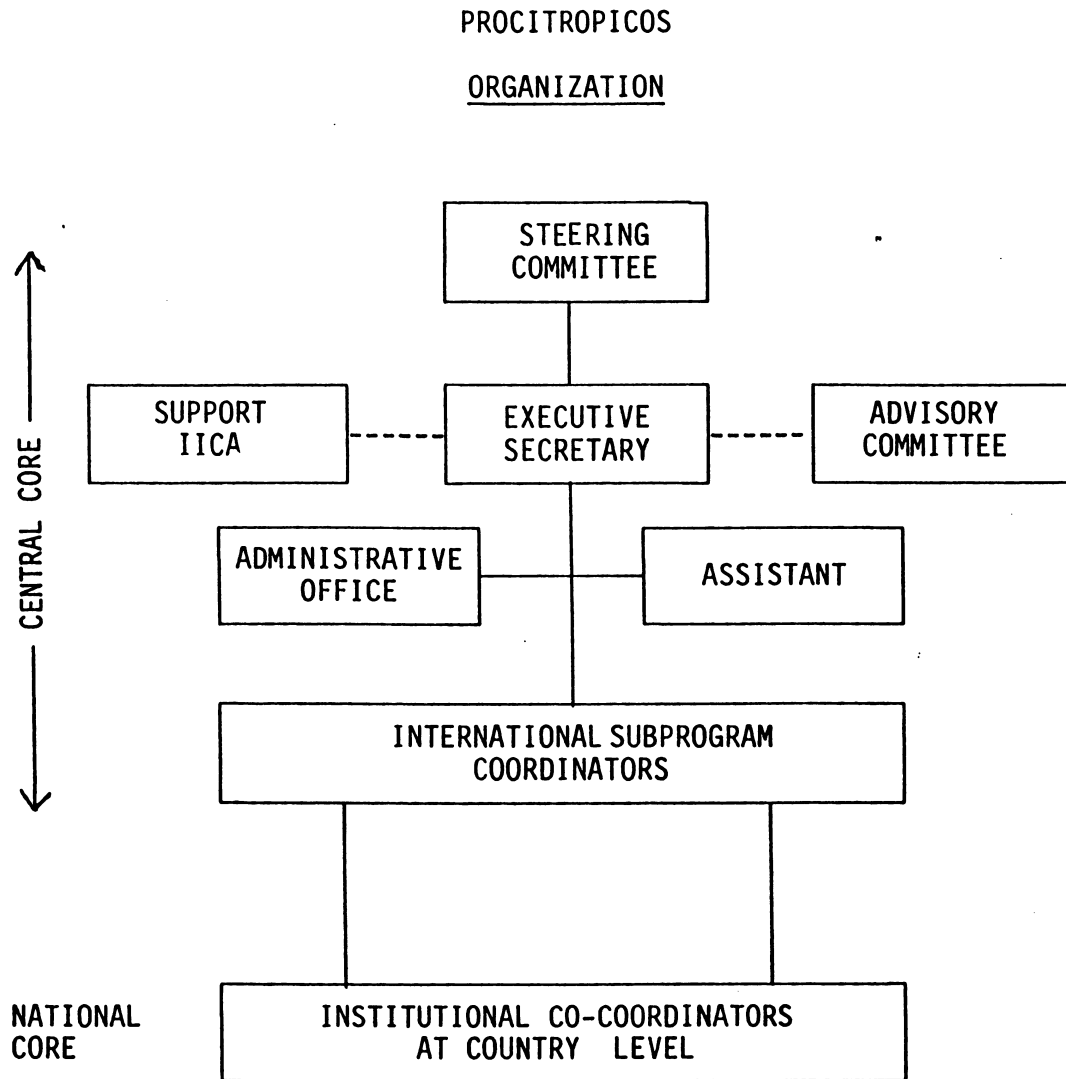
2. An executive Secretary, who should be a high level international specialist, contracted and financed by IICA to work full time at the headquarters of the PROCITROPICOS Program. He will be responsible, among other duties, for supervising the running of the Program's activities, the preparation of specific projects and the annual programming of activities, in addition to the budgets and reports to be submitted to the Steering Committee. He will participate in the Committee's meetings as ex-officio Secretary with the right to express his opinion but not to vote. The Executive Secretary will constantly liaise with IICA's Central Office within the framework of Program II, Technology Generation and Transfer, and will receive support from IICA's other Programs, whenever required as well as of other units responsible for actions of external relations, operations, programming and evaluation and as of those involved in administrative matters related to human resources and finances. The Executive Secretary will have the necessary administrative support for adequate management of Program budget, other financial resources and aspects related to general services in order to perform the routine functions of the Program.

3. An Advisory Technical Committee to assist the Executive Secretary, made up to top-ranking national directors responsible for technology generation and transfer and the development of their respective countries' tropical regions. Internationally renowned specialist in the field of agricultural development of the South American tropics could also sit on this Committee. The Committee should meet as least twice a year and issue technical opinions on: annual progress reports, annual programming of activities, research projects, and the technical matters involving the running of the Program. International Centers with headquarters in the region may appoint Representatives to the Advisory Committee.

4. An Administration Office and an Assistant, to assist the Executive Secretary. The former is to be responsible for managing the Program's Budget and Finances. The assistant will be responsible for the day-to-day management of the Program's activities.

5. The International Coordinators for the Subprograms, who are to work full-time for the duration of their respective projects. They will be based wherever is considered most adequate. They will be responsible for the technical and operations management of projects in progress. In each case, the coordinators will be supported by a Technical Committee which will meet at least twice a year.

Diagram 3.



The National Cores:

National Cores will basically consist of the National Inter-Institutional Coordination Committees, manned by representatives of the "Other National institutions Participating as Local Level", mentioned in the section on Participating Institutions.

These Committees will play a very active part, according to the degree of implementation of activities related to approved national or regional projects, providing the International Coordinators for the Subprograms with direct support.

This means that there will be an Institutional Coordinators in each participating country, appointed by the Inter-institutional Coordination committee as a liaison officer responsible for maintaining fluid and dynamic links with the International Coordinators for the projects.

The specific projects corresponding to integral thematic areas related to the region's production and conservation problems will be implemented for set periods and at determined dates, based on specific objectives, and utilizing resources to be specially negotiated and approved for this purpose.

J. EFFECTS AND IMPACT OF THE PROGRAM

Various effects are expected of the Program, mainly at the level of the national participating institutions and others involved in the Program's activities.

1. Planning Departments:

Boosting the capacity for generating national policies geared to the development of the tropical region, on the basis of the technological and socio-economic information provided by the Program, specially on aspects such as science and technology, market supplies, social development, infrastructure and services, the degree of development of the agriculture and livestock sector as an effect of development in other sectors that contribute to rural development (health, education, goods and services, human settlements, conservation and environmental impact);

- Making available an up-to-date diagnosis of the region's agricultural sector, grounded on detailed information from the participating countries.

2. Agricultural Research Institutions:

- Boosting the capacity for planning and implementing actions in the tropical region, as well as for giving priority and allocating resources to new of cooperative bi - and multilateral research;

- More up-to-date knowledge of renewable natural resources and their comparative advantages for selecting, elaborating and implementing research projects;

- Increased technical capacity and conviction of the need to form interdisciplinary teams possessing an outlook and knowledge suited to the tropical region;

- Availability of a set of profiles and ideas that will make it possible to set up feasible research projects in priority areas;

- Greater technical capacity for establishing and managing mechanisms for exchanging genetic material (germplasm) and disseminating methodologies and the results of research;

- Making ways and means for providing technical personnel with continuous training and creating incentives that will give them greater stability in their posts;

- Finding ways and means of promoting efficient regional and international technical cooperation;

- Greater access to sources of information in areas that can foster and intensify technological innovation in the objectives of research;

- Stronger units for raising external resources and working out ways of involving private enterprise in activities related to agricultural research;

- Availability or means of access to data banks on regional and international technical cooperation to make the programming of consultancy services and technical-scientific exchange more agile.

3. Technology dissemination and transfer agencies

- Availability of up-to-date records of networks and other existing mechanisms in the region and forms of joint and interrelated action with research institutions;

- Up-to-date diagnosis of technical cooperation needs and capacity for supplying technology to facilitate the programming and implementation of exchange actions and horizontal technology transfer within and between countries;

- Up-to-date knowledge of the agricultural characteristics of the tropical region, predominant production systems, accessibility, problems and priorities, as the basis for programming of dissemination and transfer actions;

- Fostering ways and means of providing technical personnel with continuous training and creating incentives that will give them greater stability in their posts.

4. Training Institutions

- Greater access to sources of technical cooperation to make the revision and up-dating of formal and informal qualification and training Programs and schemes;

- Greater knowledge of ways in which students can participate in cooperative research undertaken jointly with national and regional research centres, the formulation of graduation dissertations and the provision of apprenticeships;

- Availability of efficient mechanisms for up-dating and training of qualified teaching staff (concession of sabbaticals), and access to sources of information, documentation and technical-scientific exchange.

5. Information and Documentation Institutions and Units:

- Availability of efficient mechanisms for improving participation in technology transfer and dissemination;

- Improving the infrastructure and equipment for preparing specialized and informal dissemination material; organizing data banks; elaborating up-to-date diagnoses of existing information networks and adjusting them to the realities of the tropical region.

6. Other Regional and International Research, Financing and Technical Cooperation Organizations:

- Availability of up-to-date information on the region's agriculture sector, present and potential programs and projects, as well as on technical cooperation needs and supply;

- Availability of efficient ways and means of channelling technical and financial cooperation into national institutions involved in the Program.

K. ESTIMATED COSTS OF THE PROGRAM

The Table that follows presents a global estimate of the Cost of the Program over a six-year period (the minimum duration of the initial Subprograms), calculated on the basis of the basic organizational structure proposed and on the initial Subprograms and special supporting studies presented.

BUDGET ESTIMATE FOR 6 YEARS PERIOD

TABLE 3

COMPONENTS	TOTAL
1. CENTRAL CORE	
. STEERING COMMITTEE	75.840
. ADVISORY COMMITTEE	75.840
. EXECUTIVE SECRETARY	480.000
. GENERAL EXPENSES	231.600
. SUB-TOTAL	863.280
2. NATIONAL CORES	
. COORDINATORS IICA	1.100.000
. INSTITUTIONAL COORDINATORS	
. SUB-TOTAL	1.100.000
3. INITIAL SUBPROGRAMS	
. INTEGRATED SOIL MANAGEMENT	22.000.000
. PRODUCTION SYSTEMS	28.000.000
. GENETIC RESOURCES	29.000.000
. INFORMATICS	6.000.000
. SUB-TOTAL	85.000.000
4. SUPPORT STUDIES	
. RESEARCH POLICIES	118.000
. MARKETS AND AGRICULTURAL INPUTS	38.000
. REGIONAL AGROINDUSTRY	38.000
. ECONOMIC INTEGRATION	38.000
. SUB-TOTAL	232.000
5. PRE-FEASIBILITY FUNDS FOR INITIAL PROJECTS PREPARATION	100.000
GRAND TOTAL	87.295.280

TABLE 4.

L. CALENDAR OF ACTIVITIES (TENTATIVE) - 1990 AND 1991

A C T I V I T I E S	1990			1991												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
	<ol style="list-style-type: none"> 1. Preparation of Program Proposal, Revised Document <ol style="list-style-type: none"> a. Document is revised by task force b. Document is revised at Program II - IICA c. Document is sent to countries 2. Revision and signature of Technical Cooperation Agreement IICA-Participant Countries to implement the Program 3. I Steering Committee Meeting (Initial Working Plan and Executive Secretary election) 4. Organization of technical missions for projects preparation 5. Preparation of initial projects 6. Search of financial resources 7. II Steering Committee Meeting (Approval of projects and Mechanisms of Implementation and Financing) 	---	---	---												

V. ANNEXES:

1. AVAILABLE RESOURCES IN THE REGION
2. ACTION AREAS
3. AVAILABLE TECHNOLOGIES
4. LIMITING FACTORS FOR DEVELOPMENT
5. DEMANDS ON TECHNOLOGY AND TECHNICAL COOPERATION
6. ESTIMATED COSTS OF THE PROPOSED SUBPROGRAMS

Annex No 1
AVAILABLE RESOURCES IN THE REGION

Resources	Bol (1)	Br (2)	Col (3)	Ecu (4)	Guy (5)	Per (6)	Sur (7)	Ven (8)	Total
1 Institutions	10	24	23	15	26	25	2	8	123
2 Infrastructure									
Exp. Stations & Centers	9	40	11	2	4	15	S.I	8	89
Experiment. Sub-Stations	4					7			11
Exp. Farms				3					3
3 Human Resources	S.I	817	22	12	S.I	153	S.I	142	1146

S.I. Without Information

- (1) Bolivia
- (2) Brasil
- (3) Colombia
- (4) Ecuador
- (5) Guyana
- (6) Peru
- (7) Suriname
- (8) Venezuela

Annex No 2
ACTION AREAS

Technical Areas	Bol	Br	Col	Ecu	Guy	Per	Sur	Ven
1. Genetics and Plant and Animal Breeding	x	x		x				
2. Soil and Water Management	x	x	x			x	x	x
3. Mineral Plant and Animal Nutrition	x	x	x					x
4. Annual and Perennial Production Systems	x	x	x	x		x	x	
5. Seed Technology		x						x
6. Plant Pests and Diseases Control	x	x	x		x		x	x
7. Horticulture and Tropical Fruit Crops		x		x	x		x	x
8. Genetic Resources		x	x		x			
9. Fisheries		x					x	x
10. Agroindustrial Technology		x				x		
11. Forest Sciences		x				x	x	
12. Basic Sciences		x						
13. Tropical Climatology		x						
14. Biological Sciences		x						
15. Animal Husbandry for meat, milk, and double purpose			x		x	x	x	
16. Pasture Management		x	x	x		x		x
17. Animal Physiology and Breeding			x				x	x
18. Animal Health			x		x			x
19. Tropical Crops Agronomy				x	x	x	x	
20. Animal Husbandry (minor species)				x				x
21. Industrial Crops					x	x	x	
22. Cooperatives							x	
23. Native Crops					x			x
24. Tropical Crops Ecology								x

Annex No 3

AVAILABLE TECHNOLOGIES

Technical Areas	Bol	Br	Col	Ecu	Guy	Per	Sur	Ven
1. Production of cultivars in Perennial and Fruit Crops		x	x					
2. Soil Management (soil acidity, amendments and erosion)		x	x			x		x
3. Pasture Reclamation in Degraded Areas		x						
4. Management of Food Crops and Fibers		x	x	x	x		x	x
5. Vegetative Propagation of industrial Crops		x						x
6. Disease Control in Guaraná		x						
7. Production Systems of Food Crops in Flooded Areas (Várzeas)		x						
8. Production Systems in Perennial Crops		x	x			x	x	
9. Breeding Systems in Fisheries		x						x
10. Soybeans and Wheat Crops		x						
11. Variety selection in cassava		x						
12. Production Systems:lentils-beans-wheat		x						
13. Adaptation of Coffee-Rust resistant varieties		x						
14. Pasture Cultivars and Seed Production		x				x		
15. Disease Control in Soybeans		x						
16. Cultivar Production in Annual Crops	x	x				x		
17. Tropical Pastures Management	x	x	x	x		x		x
18. Native Crops Management	x	x				x		
19. Classification of Homogeneous Land Areas			x					
20. Microbiology (Rhizobium)			x					
21. Plant Pest and Disease Management			x					
22. Pasture Management, Grass-Legume Associations			x					
23. Animal Systems Management, Animal Nutrition and Health, Crioulo Breeds or Double Purpose Breeds			x			x		x
24. Agroforestry and Agrosilvo-pastoral Systems Management			x	x		x		
25. Zonation of Annual and Perennial Crops				x				
26. Crop Management under Irrigation					x	x	x	
27. Fruit Crops Production Technology						x		x
28. Agroforestry Management of secondary Forest						x		
29. Natural Resources Inventory								x
30. Nutrient Cycle in Tropical Forest and Agro-systems								x
31. Biomass Studies in Savannas		x	x					x
32. Fauna Studies								x
33. Minimum Tillage in Annual Crops			x					x
34. Management of Agroclimatic Information								x

Annex No 4

LIMITING FACTORS FOR DEVELOPMENT

Technical Areas	BoI	Br	Col	Ecu	Guy	Per	Sur	Ven
<u>Institutional and Economical</u>								
1. Lack of adequate policies for the region	x	x	x				x	
2. Insufficient budget and infrastructure for support services	x	x	x	x	x	x	x	x
3. Insufficient technical staff and high turnover of qualified staff	x	x	x	x	x	x	x	x
4. Lack of adequate training for the tropical region	x	x	x	x	x			
5. Insufficient inter-institutional coordination					x			x
6. Deterioration of national economy, lack of foreign currency and of investments in agricultural sector							x	
<u>Technological</u>								
7. Problems in soil management, physical and morphological			x		x	x		x
8. Unfavorable climatic conditions, high rainfall and high soil moisture			x					
9. Inadequate management systems for natural resources conservation, production and evaluation		x		x	x	x		
10. Lack of plant, animal and forest production systems adequate for the tropics	x	x	x	x	x	x		x
11. Lack of knowledge and inadequate use of natural and socio-economic resources		x	x					
12. Lack of agricultural tradition and of knowledge in native and existant production systems		x						
13. Insufficient financial resources for evaluation of knowledge and technologies		x						
14. Lack of knowledge on the nutritive value of tropical food crops and agroindustrial subproducts		x						
15. Inadequate technological information systems, infrastructure and support services		x			x		x	
16. Pasture degradation and low-carrying capacity		x						

Annex Nº 4 (Contd.)

Technical Areas	Bo1	Br	Col	Ecu	Guy	Per	Sur	Ven
17. Excessive dependency of export traditional crops, external resources and state support services							x	
18. High access costs to external technologies							x	
19. Inadequate pests and diseases management services					x		x	
20. Insufficient participation of the private sector							x	
21. Lack of information network on markets		x			x			
22. Inefficient post-harvest and agro industrial mechanisms					x	x		
23. Lack of incentives for production, credit, inputs and specialized genetic material		x						x
24. Insufficient knowledge and information on management and breeding of buffalo cattle species		x						
25. Need to intensify the concept of production systems		x						
26. Insufficient knowledge in water management in the Cerrados		x						
<u>Socio-economical</u>								
27. High rural migration to urban centers		x			x			
28. Settlement projects poorly oriented and limited resources				x				
29. Adverse conditions for human health			x					
30. Inadequate training of producers and persistence of subsistence technological		x	x					x
31. Persistence of drugs traffic and violence						x		

Annex No 5
DEMANDS ON TECHNOLOGY AND TECHNICAL COOPERATION

Technical Areas	Bo1	Br	Col	Ecu	Guy	Per	Sur	Ven
<u>Institution Building, in:</u>								
1. Identification and elaboration of feasible projects and expansion of agricultural frontier	x				x		x	
2. Adequacy of equipments and physical infrastructure	x			x	x		x	
3. Generation of incentives to ensure stability of human resources in the region	x	x			x			
4. Increase in capability to obtain external financial resources and generation of incentives for production, credit etc.		x						
5. Policy generation in research, transfer of technology, training etc.	x	x					x	
<u>Generation of Technology, in:</u>								
6. Adequate production systems for the region		x		x			x	
7. Soil management and conservation		x		x				
8. Management and animal nutrition				x				
9. Plant sanitation in priority crops				x				
10. Soil and water resources management		x						
11. Nutritive value of tropical food crops and agroindustrial sub products		x						
12. Management, breeding and reproduction of buffalo cattle		x						
13. Development and production of agricultural inputs			x					
<u>Transfer of Technology and Technical-Scientific exchange, in:</u>								
14. Production Systems and its effect in the environment and viceversa	x	x	x		x		x	x
15. Reclamation of degraded areas under coca production	x					x		
16. Agroecological zonation	x							
17. Native fruit crops production and agroindustry and post-harvest technologies	x		x		x		x	
18. Interinstitutional coordination mechanisms of national, regional and international information and documentation	x			x				

Annex Nº 5 (Contd.)

Technical Areas	Bo1	Br	Col	Ecu	Guy	Per	Sur	Ven
19. Reclamation and management of degraded pasture areas			x					
20. Production technology of fruit crops and spices			x					
21. Germplasm and genetic resources		x	x			x		
22. Management and conservation of acid and hilly soils			x					x
23. Low-input technology for agricultural production			x					
24. Pasture production and management systems and grass-legume associations		x	x		x			x
25. Animal production systems and management, breeding, reproduction and nutrition			x		x		x	
26. Soil classification systems for homogeneous areas			x					
27. Knowledge and technologies evaluation		x						
28. Technology in settlement projects and reclamation of degraded areas in those projects			x					
29. Development, diagnosis, characterization and management of new areas	x	x	x					
30. Soil, climate, pests and diseases management in savannas and plains					x			x
31. Forest and fauna inventories								x
32. Industrial and export crops production and technology					x			x
33. Biotechnology		x						
<u>Training, in:</u>								
34. Formal training of university faculty staff; revision and reorganization of academic programs			x					
35. Formal and informal training of technical staff, with tropicalized outlook and in production systems	x	x			x	x	x	
36. Informal training of producers		x			x	x		
37. Identification and preparation of cooperative research projects						x		
<u>Information, in:</u>								
38. Generation of computerized information systems in natural resources, support services, markets etc.		x						
39. Generation of technological data base on priority crop products		x						

Annex N° 6

ESTIMATED COSTS OF THE PROPOSED SUBPROGRAMS (US\$)

SUBPROGRAM: INTEGRATED MANAGEMENT OF SOILS

a. Diagnostic

A survey of methodological aspects, of technologies, human resources and infrastructure	120.000
Workshop on soil classification: 05 consultants+20 invited participants: 25 x US\$2.000	50.000
Logistics	5.000
Unexpected expenses	3.000
Honoraries	15.000
04 workshops in yrs.1,2,4 and 6:US\$73.000 each	292.000
Preparation first map on potential land use	40.000
Support to countries:US\$50.000 each	400.000
Publication of workshop memoirs	50.000
TOTAL (a)	1.102.000

b. Development and production of inputs, implements and equipment

A survey of local resources: US\$100.000/country	800.000
Feasibility studies for inputs production: US\$100.000/study x 3 x 2 subregions	600.000
Implements:US\$100.000 x 3 x 2	600.000
TOTAL (b)	2.000.000

c. Research

Basic Research: dynamics of physical, chemical and biological characteristics: US\$100.000/modulex3 topicsx3 ecosystemsx 3 countries	2.700.000
Applied Research: Soil management, nutrition and biology:US\$100.000/modulex3 topicsx3 ecosystemsx3 production systemsx3 countries	8.100.000
TOTAL (c)	10.800.000

d. Transfer of Technology	
Visits to 3 selected modules/4yrs./6persons/ country:576 visits x US\$2.000	1.052.000
1 biannual magazine with updated information: 2 x 6 x Us\$15.000	180.000
Technical bulletins	120.000
Publications(texts,memoirs etc.)	100.000
Logistic support	60.000
Transfer of technology on industrial production of inputs	200.000
3 seminars	180.000
	<hr/>
TOTAL (d)	1.892.000
e. Support for laboratory equipment and infrastructure:US\$150.000/country	1.200.000
	<hr/>
TOTAL (e)	1.200.000
f. Training	
2 courses in yrs.1 and 6; 4 persons each country: 32+6 instructors: 38 x 2 x US\$2.000	152.000
Instructors' honoraries	36.000
Publications	20.000
Scholarships and grants: 100 theses/US\$5.000 each	500.000
40 sabbatical leaves	1.900.000
20 postgraduates	1.500.000
	<hr/>
TOTAL (f)	3.298.000
g. Subprogram coordination	
1 International coordinator:US\$60.000/yr.	360.000
Operational costs:US\$15.000/yr.	90.000
Travel and perdiem:US\$60.000/yr.	360.000
	<hr/>
TOTAL (g)	810.000
 SUMMARY OF ESTIMATED COSTS	
a. Diagnostic	1.102.000
b. Development and production of inputs etc.	2.000.000
c. Research	10.800.000
d. Transfer of Technology	1.892.000
e. Support for lab equipment	1.200.000
f. Training	3.298.000
g. Coordination	810.000
	<hr/>
TOTAL	22.302.000
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SUBPROGRAM: SUSTAINABLE PRODUCTION SYSTEMS

a. Diagnostic

A survey of available technologies, research knowledge and techniques, human resources and infrastructure, progress in production systems research	120.000
An initial international workshop for presentation and discussion of survey results: 2 consultants+16 country representatives+8 additional participants: Consultants' honoraries	50.000
Travel and per diem: 26 particip. US\$1.300 each	33.800
Logistic support and memoirs	12.000
TOTAL (a)	215.800

b. Research

Research on production systems:	
(i) to preserve environmental conditions 4 modules/ecosystem/4 countries/6 yrs: US\$25.000/module	4.800.000
(ii) systems of minimum negative impact on environmental conditions	4.800.000
(iii) systems to improve environmental conditions	4.800.000
(iv) systems to recover environmental conditions	4.800.000
Elaboration of technical packages from the various research systems	800.000
Seminars for presentation of results and publications of memoirs	180.000
TOTAL (b)	20.180.000

c. Transfer of Technology

Visits to representative research modules: 8 mod./4 persons/country/4yr./US\$1.300 each	1.164.800
Visits of cooperating farmers	1.164.800
Seminars: 3x8 persons/country+9 add. particip.	120.000
Publication of memoirs and documents	30.000
Exchange of documents	30.000
Technical and scientific exchange	800.000
Publication of texts, bulletins, technical magazine, others	350.000
TOTAL (c)	3.659.600

d. Training	
Seminars and workshops:4/yr,US\$40.000 each	960.000
Logistics, memoirs and documents	120.000
Grants, theses, sabbatical leaves:	
100 theses, US\$5.000 each	500.000
Grants:8/country/6yr.:US\$5.000 each	1.920.000
Sabbaticals:4/country/3yr.;US\$20.000 each	1.920.000
Short courses:3/country;US\$60.000 each	1.440.000
	<hr/>
TOTAL (d)	6.860.000
e. Subprogram coordination	
1 International coordinator:US\$60.000/yr	360.000
Operational costs:US\$15.000/yr.	90.000
Travel and per diem:US\$60.000/yr.	360.000
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TOTAL (e)	810.000

SUMMARY OF ESTIMATED COSTS

a. Diagnostic	215.800
b. Research	20.180.000
c. Transfer of Technology	3.659.600
d. Training	6.860.000
e. Coordination	810.000
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TOTAL	27.295.400
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SUBPROGRAM: MANAGEMENT AND CONSERVATION OF GENETIC RESOURCES

a. Diagnostic

Identification of methods for genetic resources management and of promotions of joint management systems	400.000
Application of genetic resources in the technological innovation process	80.000
Inventory and characterization of infrastructure and human resources	80.000
Inventory of genetic resources and of management and utilization systems	80.000
Technical meeting for presentation of results:8persons/country+consultants and invited speakers	50.000
Logistics and materials,publication of memoirs	25.000

TOTAL (a)

715.000

b. Research

Cooperative actions for recollection, classification and evaluation, conservation and sistematization of information,data bank,utilization and exchange,for the following groups of products:

Industrial crops,US\$150.000/yr.	1.200.000
Medicinal plants,US\$100.000/yr.	800.000
Native Fruit Crops,US\$150.000/yr.	1.200.000
Spices,US\$100.000/yr.	800.000
Potential crops,US\$250.000/yr.	2.000.000
Imported species,US\$100.000/yr.	800.000
Animal species,US\$300.000/yr.	2.400.000

Activities on population dynamics, botanical classification and evaluation in pilot modules:3 interdisciplinary teams, US\$150.000/yr

1.200.000

Activities in introduction,conservation and utilization of genetic resources;development and management of germplasm banks;US\$300.000/yr.

2.400.000

Activities related to the use of agrobiotechnology and genetic engineering, participation of private sector;legislation and patents:US\$300.000/yr.

1.200.000

Regional and international technical events

800.000

TOTAL (b)

16.000.000

c. Transfer of Technology	
Support and participation in horizontal coordination and cooperation systems:	
US\$50.000/yr.	400.000
Germplasm exchange activities:US\$50.000/yr.	400.000
National,regional and international technical events	1.900.000
Technical and scientific exchange and observation visits	1.600.000
Publications	400.000
	<hr/>
TOTAL (c)	4.700.000
d. Training	
Support to formal and informal training	1.600.000
Seminars and workshops	800.000
Support to technological innovation, consultancies,technical events:	
US\$200.000/yr.	1.200.000
	<hr/>
TOTAL (d)	3.600.000
e. Support in laboratory equipment and maintenance	
	3.000.000
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TOTAL (e)	3.000.000
f. Subprogram coordination	
1 International coordinator,operational and logistic support	850.000
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TOTAL (f)	850.000
SUMMARY OF ESTIMATED COSTS	
a. Diagnostic	400.000
b. Research	16.000.000
c. Transfer of Technology	4.700.000
d. Training	3.600.000
e. Support in lab equipment	3.000.000
f. Coordination	850.000
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TOTAL	28.550.000
	=====

SUBPROGRAM: MANAGEMENT AND CONSERVATION OF GENETIC RESOURCES
(Alternative B:CENARGEN/EMBRAPA PROPOSAL)

a. Diagnostic

Inventory and characterization of infra-structure and human resources	40.000
Inventory of genetic resources, management and utilization systems	100.000
Technical meeting for presentation of results: 8 persons/country + consultants and invited speakers	28.000
Logistics and materials, publication of memoirs	25.000
TOTAL (a)	193.000

b. Research

Cooperative actions for recollection, characterization and evaluation, documentation and information, data bank, utilization and exchange for the following groups:	
Conservation "ex-situ" (germplasm banks):	
Industrial crops, 500 ha., US\$250.000/yr.	1.500.000
Forest crops, 3000 ha., US\$1.500.000/yr.	9.000.000
Fruit crops, 200 ha., US\$1.000.000/yr.	6.000.000
Medicinal plants, 100 ha., US\$50.000/yr.	300.000
Food crops, 100 ha., US\$50.000/yr.	300.000
Palm-tree crops, 1000 ha., US\$500.000/yr.	3.000.000
Animal species, US\$300.000/yr.	1.800.000
Microorganisms, US\$100.000/yr.	600.000
Conservation "in-situ" (Genetic resources):	
Maintenance and studies in 100 conservation units, US\$500.000/yr.	3.000.000
Activities in population dynamics, botanical classification and evaluation by interdisciplinary teams, US\$300.000/yr.	1.800.000
Germplasm recollection, 100 expeditions/yr. US\$200.000/yr.	1.200.000
Field and lab germplasm characterization and evaluation, US\$300.000/yr.	1.800.000
Exchange, inspection, quarantine, clonal cleaning and laboratory conservation (seeds in "in-vitro"), US\$300.000/yr.	1.800.000
Biotechnology development and use, participation of the private sector; legislation and patents, US\$500.000/yr.	3.000.000
Regional and international technical events	300.000
TOTAL (b)	34.400.000

c. Transfer of Technology	
Support and participation in horizontal cooperation systems, US\$50.000/yr.	300.000
National, regional and international technical events	300.000
Technical and scientific exchange; observation visits	600.000
Germplasm exchange, US\$50.000/yr.	300.000
Publications	300.000
	<hr/>
TOTAL (c)	1.800.000
d. Training	
Support to formal and informal training	1.600.000
Seminars and workshops	500.000
Support to technological innovation, consultancies, technical events, US\$200.000/yr.	1.000.000
	<hr/>
TOTAL (d)	3.100.000
e. Support in laboratory equipment for quarantine, conservation and biotechnology	10.000.000
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TOTAL (e)	10.000.000
f. Subprogram coordination	
1 international coordinator, operational and logistic support	850.000
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TOTAL (f)	850.000
SUMMARY OF ESTIMATED COSTS	
a. Diagnostic	193.000
b. Research	35.400.000
c. Transfer of Technology	1.800.000
d. Training	3.100.000
e. Support in lab equipment etc.	10.000.000
f. Coordination	850.000
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TOTAL	51.343.000
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SUBPROGRAM: TROPICAL AGRICULTURE AND FOREST INFORMATICS

a. Diagnostic

Inventory of national capabilities in equipment, programs and services:	
1 consultant, US\$5.000/month; 4 mo.	20.000
Travel and per diem, 8 countries/3mo.	17.000
International inventory of data bank, programs and services:	
1 consultant, US\$5.000/mo., 3mo.	15.000
International communications	3.000
Materials, programs, manuals, documents	30.000
	<hr/>
TOTAL (a)	80.000

b. Research

An international seminar on agriculture and forest informatics, for proposal presentation, discussion and orientation:	
8 country representatives, 100 other participants.	
5 consultants, US\$10.000/mo.	50.000
Travel and per diem, 18 participants, US\$1.500 each	27.000
Logistic support and publications	10.000
Conceptualization and design of:	
Programs for tropical soils, US\$30.000/yr. 3 yr.	90.000
Programs for genetic resources, idem	90.000
Programs for production systems, idem	90.000
Development of a "Program Shop", oriented to the agricultural and forestry domain:	
3 consultants, US\$60.000/yr. 3 yr.	540.000
Modeling, simulation and validation of production systems:	
of minimum negative impact on environmental conditions, US\$25.000/yr x3yr.	75.000
to improve environmental conditions, idem	75.000
to preserve environmental conditions, idem	75.000
to recover environmental conditions, idem	75.000
System design for data captation, processing and dissemination for the tropics (INFOTROP):	
2 consultants, US\$5.000/mo. x5mo.	50.000
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TOTAL (b)	1.247.000

c. Equipment and programs for computer use and informatics

Core Work station for computer use	440.000
Periferial stations: 16 computers, US\$35.000 each	560.000
Telephone network, physical installations, communications in "modem" 8/10/US\$10.000	80.000
	<hr/>
TOTAL (c)	1.080.000

d. Transfer of Technology

Implementation and operation of the INFOTROP system:	
Implementation of the system's core	60.000
Linkage with member countries	60.000
Access to international data banks	60.000
Operation of INFOTROP/6 yr.	240.000
Reciprocal technical cooperation: 4 visits/us\$1.000/8 countries/6yr.	192.000
TOTAL (d)	632.000

e. Training

An international seminar for updating, follow-up, validation and diffusion of INFOTROP's technologies and services, consultants' honoraries	50.000
Travel and per diem: 18 participants/US\$1.500	27.000
Logistic support and memoir of the event	10.000
3 regional seminars for development and evaluation	120.000
Travel and per diem 18 participants/US\$1.500/3 yr.	71.000
Logistic support and memoir of the event	30.000
8 courses in years 2, 4 and 6/8 countries: 40 persons, 6 instructors: 46/US\$1.400/3yr.	515.200
Publications	50.000
TOTAL (e)	873.200

f. Publications and diffusion

Computer program: 3/8/US\$200/6yr.	28.800
Documents, technical manuals: 3/8/US\$100/6yr.	14.400
Bulletin, soils data: 4/8/US\$300/6yr.	57.600
Bulletin, genetic resources data bank: 4/8/US\$300/6yr.	57.600
Bulletin, production systems data bank: 4/8/US\$300/6yr.	57.600
Diffusion through INFOTROP network: 12/8/US\$200/6yr.	115.200
Soils geographic maps: 12/8/US\$5.000/1yr.	120.000
TOTAL (f)	451.200

g. Subprogram coordination

1 International coordinator, US\$60.000/yr.	360.000
Operational costs, US\$15.000/yr.	90.000
Travel and per diem, US\$60.000/yr.	360.000
TOTAL (g)	810.000

SUMMARY OF ESTIMATED COSTS

a. Diagnostic	80.000
b. Research	1.247.000
c. Equipment and programs	1.080.000
d. Transfer of Technology	632.000
e. Training	873.200
f. Publications and difussion	451.200
g. Coordination	810.000
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TOTAL	5.173.400
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SUMMARY OF ESTIMATED COSTS OF THE PROPOSED SUBPROGRAMS

1. INTEGRATED MANAGEMENT OF SOILS	22.302.000
2. SUSTAINABLE PRODUCTION SYSTEMS	27.295.400
3. MANAGEMENT AND CONSERVATION OF GENETIC RESOURCES	28.550.000
4. TROPICAL AGRICULTURE AND FOREST INFORMATICS	5.173.400
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TOTAL	83.320.800
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SUMMARY OF ESTIMATED COSTS OF THE PROPOSED SUBPROGRAMS
(Alternative B)

1. INTEGRATED MANAGEMENT OF SOILS	22.302.000
2. SUSTAINABLE PRODUCTION SYSTEMS	27.295.400
3. MANAGEMENT AND CONSERVATION OF GENETEIC RESOURCES(CENARGEN/EMBRAPA PROPOSAL)	51.343.000
4. TROPICAL AGRICULTURE AND FOREST INFORMATICS	5.173.400
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TOTAL	106.113.800
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