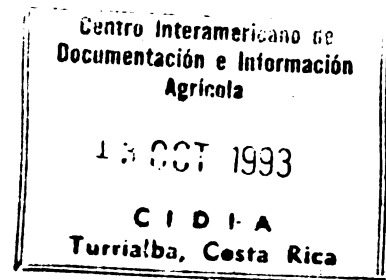


EXTERNAL PROGRAM REVIEW REPORT



PRESENTED TO
THE
BOARD OF DIRECTORS
OF THE
TROPICAL AGRICULTURAL CENTER FOR RESEARCH
AND
TRAINING
(CATIE)

August 1990

WILLIAM K. GAMBLE
Consultant for Agricultural Research,
Development and Education

24 August, 1990

Dr. Eduardo Trigo
Chairman of the Committee
for the External Review
San José, Costa Rica

Dear Dr. Trigo:

The Team Members of the External Program and Management Review of the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) are pleased to transmit the reports to you for distribution and use as desired by the CATIE Board of Directors.

I would like to express my appreciation to you and your colleagues for assembling a team of the quality of Drs. Luiz Barreto de Castro, Mario Contreras, Marc Dufumier, Philippe Lhoste, Patrick Mertens, Raymond Miller, Robert Woodmansee, and Ms. Alicia Mina. Together they were a lively and talented group with a wealth of experience in agricultural research, education, and management.

CATIE's preparations for the review were thorough and the Director General and his staff were most helpful at all times to provide us all needed information and materials.

We have provided two separate reports: one on the Program Review and one on the Management Review. There is some duplication from one report to the other but we wished each to be a "stand alone" document.

I trust you will find these reports satisfactory and helpful to the Board of Directors and to CATIE. All of us have found CATIE to be an Institution of much importance, and highly relevant, to the Central American and Caribbean region. However, as we emphasize in each of the reports, CATIE needs to enter a new phase of program definition and to undertake a number of changes which should help it increase its effectiveness in the years ahead.

In conclusion, all of us on the mission wish to express our thanks to the members of the Ad-hoc Committee of CATIE's Board of Directors for giving us the opportunity to participate in this review.

Sincerely,



William K. Gamble
Leader of the CATIE
External Review Team

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The External Review Team wishes to express its appreciation to the many individuals who helped make the review an enjoyable experience for all the team members.

Special appreciation must be given to the Director General, Dr. Rodrigo Tarté, and Mr. Oscar Fonseca, Deputy Director General for their support, as well as that of all the staff in Administration and Finance who throughout the review process saw to it that the Team received all the information required. The Associate Director General for Education, Dr. José Luis Parisí, and his staff were most helpful to the Team at all times. The Associate Director General for Research, Dr. Eduardo Casas Díaz, was extremely efficient in all preparations for the review, as well as in providing whatever information was required. All Program Directors, Sub-Program Leaders, Project Leaders and their staff members as well as all staff in the Support Groups, met all requests of the Team members for often anticipated information needs or arrangements for visits.

We offer special acknowledgement to Dr. Vladimir Hermosilla for his unflagging support and assistance throughout the review and to Ms. Carmen de Acuña for her translating skills and secretarial support. Also, to Ms. Ariadne Jiménez for her support and translations in the final stages of the preparation of the report.

The office arrangements provided to the Team were excellent and this greatly facilitated the interaction among Team members and provided a pleasant environment in which to prepare the report.

The Team also wishes to recognize the excellent administrative support provided by Ms. Vera Jiménez.

Thanks to all of you our work was a pleasant and rewarding experience.

GLOSSARY OF ACRONYMS

ADG	Assistant Director General
AEK	Kuna Employees Association (Panama)
ASDI	Swedish International Development Agency
BOD	Board of Directors
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CATIENET	CATIE's Computerized Regional Network
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIDA	Canadian International Development Agency
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
COHDEFOR	Honduran Corporation for Forestry Development
COSUDE	Swiss Cooperation for Development
CTEI	Tropical Center for Education and Research (Costa Rica)
DDA	Directorate for Development Cooperation and Humanitarian Aid (Switzerland)
DG	Director General
DDG	Deputy Director General
EEC	European Economic Community
EMBRAPA	Brazilian Agricultural Research Institute
EMR	External Management Review
EPR	External Program Review
ERT	External Review Team
ESNACIFOR	National School of Forestry Sciences
FHIA	Honduran Agricultural Research Foundation
GIS	Geographical Information System
GTZ	German Agency for Technical Cooperation
IABA	Inter-American Board of Agriculture
IARCS	International Agricultural Research Centers
IBPGR	International Board for Plant Genetic Resources
ICRAF	International Council for Research in Agroforestry
IDMC	International Development Management Center (Maryland, USA)
IDRC	International Development Research Center of Canada
IICA	Inter-American Institute for Cooperation on Agriculture
IITA	International Institute of Tropical Agriculture
INAFOR	National Forestry Institute
INCAE	Central American Institute for Business Administration (Costa Rica)
INFORAT	Tropical American Forestry Information and Documentation Center
INIBAP	International Network for the Improvement of Banana and Plantain
INRENARE	Institute of Renewable Natural Resources
IPM	Integrated Pest Management
ISA	Instituto Superior de Agricultura - Dominican Republic
ISNAR	International Service for National Agricultural Research

JIA Inter-American Board of Agriculture
JICA Japanese International Cooperation Agency
MOLISV Movimento Liberazione e Sviluppo (NGO/Italy)
NASPAA National Association of Schools of Public Affairs
NORAD Norwegian Agency for Development
ODA Overseas Development Agency of the United Kingdom
PROCACAO Programa para el Mejoramiento del Cacao (Cacao Improvement Program)
PROMECAFE Programa para el Mejoramiento del Café (Coffee Improvement Program)
R&D Research and Development
REDCA Regional Cooperative Network for Education in Agriculture and Renewable Natural Resources
RENARM Regional Natural Resources Management Project (USAID)
RFLP Restriction Fragment Length Polymorphism
RISPAL Latin American Animal Production Systems Research Network
ROCAP Regional Office for Central American Program (USAID)
SAREC Swedish Agency for Research Cooperation with Developing Countries
SIDA Swedish International Development Authority
UCR University of Costa Rica
UNPHU Universidad Nacional Pedro Henriquez Ureña - Dominican Republic
USAID U.S. Agency for International Development

EXECUTIVE SUMMARY

The External Program Review

The Program Review of CATIE was carried out as a joint exercise with the External Management Review, by a team of nine persons appointed by an *ad-hoc* committee composed of selected members of CATIE's Board and donor representatives.

Guidelines for the Review

The principal guidelines for the review were included in the very comprehensive Terms of Reference. The key elements of the Terms of Reference were:

- * To identify the areas of comparative advantage that CATIE offers as a member of the international scientific community working on tropical agronomic research.
- * Provide clear and precise information on the Center's mandate, as pertains to its Strategic Plan and the instruments it uses for execution;
- * Assess its research programs;
- * Analyze the focus of the postgraduate curricula;
- * Evaluate the Center's structure and administrative management, including the structure and operations of the Board of Directors, and the management of its human and financial resources, and to propose measures for improvement; and,
- * Weigh the pros and cons, both scientific and institutional, of CATIE's becoming a center of excellence for sustainability of agriculture in Latin America.

The Mandate

CATIE's mandate is clearly set forth in its Ten-Year Strategic Plan (1987-1997), Facing the Challenge. It includes: scientific research in agriculture (crops and livestock) and natural resources in the American Tropics, particularly Central America and the Caribbean and education in agricultural sciences and natural resources through graduate studies leading to a Master's degree, and diverse forms of training. While CATIE has a Latin American mandate in training, it strives to focus its research, and hence its development impact, on the people of Central America and the Dominican Republic.

The Review Team found the mandate appropriate for the Center and no changes are recommended.

The Research Program

Research is organized in three programs: Tropical Crops

Improvement (Program I), Sustainable Agricultural Production and Development (Program II), and Integrated Natural Resources Management (Program III). Each has a Program Director or Leader, and staff responsible for planning, operating, and evaluating program performance, as well as teaching in areas of their expertise. There is also a Socio-Economic Unit headed by a Program Leader and this person has just been named Director for Program II. The status of the Socio-Economics Unit, which was approved at the last meeting of the Board of Trustees, was not clear to the Team at the time of the review, but apparently it is to be incorporated into Program II.

The research programs of CATIE, as well as their linkage with national programs, have been analyzed in detail by the Review Team.

The analysis, comments and recommendations made by the Team Members are presented in Chapter 3. The detail of the report on these programs is more extensive than is usually the case in an external program review, due to the emphasis in the Terms of Reference for a detailed program analysis.

In the introduction to Chapter 3, the Review Team presents a preliminary conceptual framework for CATIE's research programs. This emphasizes the potential for integration of the activities for the three Research Program Areas.

Also, throughout Chapter 3, are noted the many significant contributions which CATIE's research program has made in support of development in the region.

A consistent theme throughout all the analyses of the research programs is that there is a need to strengthen the input of socio-economics in many of CATIE's activities. It is proposed that socio-economics serve as a "cross cutting" discipline across all the programs to both strengthen programs and assist in program integration. It appeared to the Team that there are sufficient numbers of socio-economists but there is a need for a better balance among programs.

Comparative Advantage

The Review Team, after analysis of CATIE's existing programs/projects, discussion with staff and observations in the region, believes CATIE to have a comparative advantage in the following areas:

- * Tropical Crops Improvement
- * Integrated Pest Management
- * Management of Natural Resources
- * Integrated Systems Management of Agro/Livestock/Trees/Pasture
- * Ruminant Feeding Systems

* Land System Analysis and Management

CATIE has an opportunity to concentrate its efforts in these areas in both research and education. The stated goal for its overall program could be: research and education for Productive Agriculture for a Sustainable Environment.

Planning

CATIE must establish its own priorities within these six areas through a planning process that involves the Leaders of the three Research Programs, appropriate Section Heads, the Associate Directors General for Research and Education (under the present administrative structure), and Management. It is only through an integrated discussion and planning process that viable priorities will be determined to which staff are committed. It was noted in the Management Review, and applies equally here, that CATIE needs to improve its planning process and have increased interaction among program leaders, program staff and management in this process.

It is clear to the External Review Team that the greatest potential for positive impact of CATIE's research output in Central America and the Caribbean lies in an integrated and concentrated program thrust in those areas where CATIE has a clear comparative advantage.

At present, CATIE is engaged in the implementation of over 30 individual projects. These range from very small to very large and complex. Over the years, projects have become more geared to fulfilling their particular goals, rather than fostering institutional integration as a whole. Thus, CATIE's research programs have become very vulnerable to the lack of continuity. Medium and long term research activities have often been discontinued, or their potential impact unrealized, as donors shift particular goals and interests. There is little evidence at the present time of an integrated program which builds on CATIE's comparative advantage.

A major thrust of the recommendations by the Review Team in relation to CATIE's research program is that renewed emphasis should be placed on the development of a viable program based upon its areas of comparative advantage. CATIE can, once it has developed its program, seek support for projects that fit into the program and help work toward specific program goals. The present start and stop project mode, in many cases due to donor interest, has led CATIE to a "Federation of Projects."

CATIE is very worthy of long term support for a well designed program based upon its comparative advantage. Donors are urged to work with the management and program staff to assure continuity of

research. This will permit programs to develop to the point where they can generate the relevant results which are needed to support agricultural development for a productive agriculture for a sustained environment in Central America and the Caribbean.

Education and Training

CATIE's graduate program provides Master's degree training for the Latin America and Caribbean regions in the areas of:

1) Production Systems

- a) Tropical Livestock
- b) Silviculture and Agroforestry
- c) Tropical Crops
 - Crops Improvement
 - Crops Protection

2) Integrated Management of Natural Resources

- a) Watersheds
- b) Wildland areas

The graduate program of CATIE with almost 1,000 MSc awardees has been very successful and the quality of its graduates is well recognized throughout the region.

Facilities have been markedly improved over the last few years. Student housing is good, classrooms appear to be adequate and of high quality, some additional laboratory space may be needed, a more ready supply of chemicals and materials is needed, and a modest stores and bookstore should be considered.

The faculty for the graduate school program comes from the research staff of CATIE. All professional research staff are expected to devote up to 50% of their time to teaching or in supervision of thesis research. This system appears to work reasonably well but there are some complaints by students of the absence of faculty at critical times both in courses and in supervision of research. This is due to the nature of the work of CATIE's research staff who often must travel outside Costa Rica as a part of their research work in the region.

Continuity of faculty and programs are also of concern to students. There is a fairly high turnover rate for the professional staff (average about 4.5 years). This means some students are faced with the need to change thesis advisors in mid-degree. Also, the high staff turnover can affect the consistency and the quality of course work. Both graduate students and in-country technicians felt that lack of continuity was a major deterrent to them, their programs, and CATIE. Greater effort by

CATIE, donors, countries, and the Board of Directors needs to be made to create as much stability as possible. The graduate program at CATIE has a very good reputation and a continued effort is needed to assure continued quality.

With some 1,000 graduates, CATIE has the opportunity to benefit from the involvement of its former students. Over the last year, a number of country alumni associations have been formed, both CATIE and the graduates are to be commended.

By all reports, the training programs which CATIE organizes and manages each year at CATIE headquarters and in member countries are well organized and considered very useful by those attending and by the organizations which they represent. There were some comments, in member countries, that there is need to hold more of the training outside Costa Rica. However, there are a number of advantages for training at CATIE headquarters, including facilities and the opportunity for greater interaction with larger numbers of professional staff. CATIE is to be highly commended for the quantity and quality of its training courses that it offers in service to the region.

Network

In 1986, CATIE initiated the formation of a cooperative network for education in agriculture and renewable natural resources (REDCA). This has now grown to some 73 public and private institutions of higher education, ministries of agriculture, research institutions, and national councils on higher education of the member countries. Although CATIE was the reason for the establishment of REDCA, in reality, REDCA should be a collaborator and channel for CATIE's activities. CATIE is to be commended for its effort in the establishment of this network and should be encouraged to provide a leadership role in it.

Support Services

In the Management Report, there were many comments on support services. In the case of the Program Review, the Team considered these support services as to how well they serve the research and education programs.

The present situation in research and education is that almost all activities are supported through special project funding. Each special project tries to get its own administrative unit, its own publications and information unit, its own computing facilities and develops its own data base. As a result there is efficiency within projects but considerable inefficiency as an institution. There is need to bring many of the support services -- publications and information, databases, computer services, transport, and others --

together in units which operate under the Center and for the Center rather than for individual projects.

Special Projects

As has been noted in the Management Report, there is need for a Center policy concerning the process for the development, approval, monitoring, and reporting of special projects.

External Relations

The comments which were made in the Management Review on this subject apply equally to the Program review so they are presented again for this document.

CATIE has had a management policy of building close working relationships with the research and education institutions in its member countries and it has had good success. It also has developed good relations with many of the International Agricultural Research Centers of the CGIAR system.

Publication of more research papers and the presentation of more papers at international scientific meetings by CATIE staff could bring more prestige and recognition to the institution. A further benefit of this recognition could be more donor support, as long as the research work is on high priority problems of Central America and the Caribbean. However, there does not appear to be a clear CATIE policy on this matter and there is a shortage of funds for staff to attend international meetings.

Donor relations and fund raising are not now well organized at CATIE. These are very important management issues of which CATIE Management is aware. What is still lacking is a well developed and well articulated CATIE program which will attract donor support to an overall program with assured continuity. A policy and strategy covering fund raising needs further development. Again, management is aware of the issues but the serious funding problem is a constraint for the work. But, it is absolutely essential that progress be made on these issues.

Finally, on the issue of relations, CATIE appears to be well connected with official programs of member governments but is much less well connected with the private sector.

Sustainability of Agriculture

The Team was asked to comment on CATIE's potential to become a center of excellence for sustainability of agriculture in Latin America. The Team did not directly comment on the issue but considered it throughout the analyses of the programs. It is the conclusion of the Review Team that if CATIE develops and carries

out an integrated program in line with the conceptual framework that is presented in the introduction to Chapter 3, its program thrust will be toward sustainability. In doing so, it must take into account the economic and social realities of decision making by the producers.

CATIE does have the opportunity to become a center of excellence in sustainability of agriculture but it first must give much greater attention to program development and implementation and it should first concentrate its efforts in Central America and the Caribbean.

CHAPTER 1. INTRODUCTION

1.1 The Center for Tropical Agricultural Research and Education (CATIE)

CATIE is a regional, autonomous institution devoted to research and education for agricultural development and the integrated management of natural resources. Its research in agricultural production and natural resources management focuses on the American tropics, particularly Central America and the Caribbean. Its postgraduate education and training program has a Latin American geographic scope. CATIE research and education activities cover selected perennial and annual crops, integrated pest management, animal science, agroforestry, forestry, natural resource management, germplasm conservation and improvement, and documentation and communications. In addition, the Center engages in commercial production of crops and livestock .

Research is organized in three program areas and one program unit: Tropical Crops Improvement (Program I), Sustainable Agricultural Production and Development (Program II), Integrated Natural Resources Management (Program III), and a Socio-Economics Unit. CATIE strives to increase agricultural productivity on a sustained basis.

1.2 The External Review of CATIE

1.2.1 The external review had two parts: a Program review and a Management review. The Program review report is presented in this document and the Management review report is presented in a separate document.

1.2.2 The external review was carried out at the request of the Board of Directors. A committee from among the Board Members was named to select an independent review team composed of persons well recognized for their experience in international agricultural research and education, and to provide, on the basis of approval by the Council, the Terms of Reference for the review. The composition of the nine member review team with brief bio-data for each may be found in Annex I.

1.2.3 CATIE has had many reviews of its programs, projects and management. The present review is the first conducted of its total research and education programs, management, and relations with its member countries, by an independent review team.

1.3 The Terms of Reference and Background Documentation

1.3.1 The Catie Council of Directors noted its expectation:

"that the external review will generate criteria and proposals for optimizing support for CATIE and the support CATIE provides to national institutions involved in agronomic research and education and agroforestry/agrolivestock development. This is to be achieved by pointing up the comparative advantages CATIE offers as a member of the international scientific community working on tropical agronomic research."

1.3.2 To achieve this, the Council asked the review team to:

- * Provide clear and precise information on the Center's mandate, as pertains to its Strategic Plan and the instruments it uses for execution;
- * Define the mechanisms that link teaching and research;
- * Evaluate the principal activities carried out by CATIE, both in terms of its research findings and in regard to the ability of those who complete postgraduate studies and training courses to perform as professionals;
- * Assess its research programs;
- * Analyze the focus of the postgraduate curricula;
- * Propose priority areas for both research and education;
- * Establish an order of priorities in research;
- * Evaluate the Center's structure and administrative management, including the structure and operations of the Board of Directors, and the management of its human and financial resources, and to propose measures for improvement; and,
- * Weigh the pros and cons, both scientific and institutional, of CATIE's becoming a center of excellence for sustainability of agriculture in Latin America.

1.3.3 In addition to the general objectives for the review, the review team was provided an extensive list of specific objectives which are noted in Annex 2. Some of these specific objectives are well beyond the possibility for the review team

to achieve within the time frame available and the composition of the team. For example:

- * To provide economic projections for promising crops;
- * To provide a more accurate physical and biological description of the area (soil, climate) in terms of the potential for and sustainability of plant production, including natural forests;
- * To study the competition or synergy between trees and crops, as relates to agroforestry; and,
- * To suggest improvements in the design of experiments, to reflect the objectives of productivity/sustainability.

1.3.4 In regard to background documentation, the Associate Director General for Research conferred with the designated Team Leader on the matter and a provisional list of documents was prepared. CATIE assembled these documents which were available for the team at the start of the review. A few key documents were sent to each team member, along with the terms of reference, before the team assembled at CATIE. Additional documentation was prepared or assembled by CATIE staff on request by team members. A list of the documentation may be found in Annex 3.

1.4 Methodology to Conduct the Review

1.4.1 The team assembled at CATIE in Turrialba to start its review on July 16, 1990. The review can be divided into three parts:

1.4.1.1 A peer review of CATIE's research and education programs.

1.4.1.2 Observations of the research and education output both at CATIE's headquarters and in the member countries.

1.4.1.3 Feedback from senior government officials, educators, scientists, technicians and others in member countries, and from staff of CATIE, on their perceptions of CATIE's program, role, strategy, quality and views on changes or improvements which CATIE should make.

1.4.2 The Team spent the first week at CATIE headquarters where presentations were made on the research and education programs as well as the various aspects of management of the

institution. During this week there were many small group and individual interactions between CATIE staff and Team Members.

1.4.3 Following the first week at CATIE, the Team as a whole visited Guatemala to gain first hand observations and feedback on collaborative programs at the national level. The Team was then divided into small groups for visits to each of the member countries (see Annex 4 for the Program of the External Program Review).

1.4.4 After the visits to the member countries the team reassembled at CATIE for approximately ten days to continue discussions with headquarters staff and to prepare the draft report. The Team Leader, Co-Team Leader and the Administrative Assistant to the Team then finalized the report.

1.5 Follow-Up

On completion of the report it was transmitted to the Chairman of the Committee which had been formed by the Board of Directors to coordinate this review. The Director General had an opportunity to comment on the Report before it was finalized.

CHAPTER 2. THE ESTABLISHMENT OF CATIE AND ITS MANDATE

2.1 Background and History

The Inter-American Institute of Agricultural Sciences (now Inter-American Institute for Agricultural Cooperation (IICA) was founded in 1942. For the next 30 years, IICA developed and operated its Center for Research and Education at Turrialba, Costa Rica. This facility gave specialized agricultural technical assistance to countries in the region, conducted selected research endeavors, and provided postgraduate education (M.Sc.level) to hundreds of students from all over Latin America.

Over the years, the center at Turrialba became more and more specialized in its research and education endeavors, while IICA, its mother organization, assumed a more diverse and continental work scope. A degree of parallelism, overlapping, and occasional competition ensued between the two organizations by the late 60's. This led to the need for a clearer definition of the institutional role and functions and, soon after, new governance and management of the Research and Education Center at Turrialba.

CATIE, as it is known today, was established through an agreement signed by IICA and the Government of Costa Rica on January 12, 1973. Six other countries (Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama) have since become signatories of this agreement.

2.2 Mandate and Major Institutional Activities

CATIE's mandate is clearly set forth in its Ten-Year Strategic Plan (1987-1997), Facing the Challenge. It includes: scientific research in agriculture (crops and livestock) and natural resources in the American Tropics, particularly Central America and the Caribbean; and education in agricultural sciences and natural resources through graduate studies leading to a Master's degree, and diverse forms of training. While CATIE has a Latin American mandate in training, it strives to focus its research, and hence its development impact, on the people of Central America and the Dominican Republic.

To accomplish this, the Institution has as guiding principles the practice of interdisciplinary agricultural research and education on production systems, in a natural resource management and conservation framework and within a network of horizontal institutional collaboration.

2.3 Institutional Growth and Program Development

Since its creation, CATIE has grown substantially in program scope and scale, funding, expenditures, and physical plant. Investment in special projects with donor support, as an example, has increased from US\$6.0 million in 1985 to over US\$10.0 million in 1989. Core budget expenditure has remained at about US\$4.0 million or about 20% of the budget over the same period. Core staff, support personnel and workers number 364 as of today, although there has been a tendency to decrease more recently. Overall CATIE staff, including in-country activities are 761. CATIE is presently the largest and strongest agricultural research institution in the region. Its postgraduate education program at the MSc level is considered the best in the region in the areas it covers.

Soon after its creation, CATIE adopted a farming systems methodology for the improvement of agricultural production in small farms of the region. This approach dominated crops and animal research program operations by the Center for over a decade. Concurrently, activities for the collection and conservation of indigenous and introduced germplasm were strengthened with European donor support. Watershed, forest and wildlands management were initiated in the late 1970's, thus anticipating current and widespread interest in these matters.

CATIE manages large and advanced projects in the field of natural resources management. More recently, the Center has moved into tissue culture and biotechnology, with application to germplasm improvement and conservation.

Concurrent with the growth and development of the research programs, CATIE has been strengthening its education activities. IICA and the University de Costa Rica (UCR) signed an agreement in 1973, which conferred academic responsibility to the latter, for the postgraduate program on agricultural sciences and natural resources management at Turrialba. In 1976, CATIE and the UCR agreed to a postgraduate program that defined academic, operational and financial responsibilities and privileges for each organization. This agreement expired in 1983 leaving issues and difficulties still pending solution at this time. These are dealt with elsewhere in this document. CATIE provides MSc level education and, at the same time, it provides short-term continuing education and training in many different subjects and topics associated to agriculture and natural resources management in the region.

Countries in the region have in general increased their national capacities, in terms of specialized and better-trained human resources. With few exceptions, however, the national institutional capability for conducting effective and extensive research has stagnated. Government sponsored research still shows

well-known deficiencies in their research programs. In addition, civil strife in El Salvador and Nicaragua, and recent events in Panama have significantly weakened national research capabilities in those countries.

Its nature and image as a stable regional research institution gives CATIE a considerable comparative advantage. CATIE, however, must carefully define the boundaries of its research products and participation *vis-a-vis* country programs and activities. Institutionally, CATIE needs to assure its own internal order and sustainability, if it is to serve effectively the region and its beneficiaries.

To illustrate this point, CATIE is currently engaged in the implementation of over 30 individual projects. These range from very small to very large and complex. Over the years, projects have become more geared to fulfilling their particular goals, rather than fostering institutional integration as a whole. Thus, CATIE's research programs became, and still are, very vulnerable to the lack of continuity. Medium and long term research activities have often been discontinued, or their potential impact unrealized, as donors shift particular goals and interests.

CHAPTER 3. RESEARCH PROGRAMS

3.1 Introduction

The CATIE staff is uniquely positioned to accomplish research, education and knowledge transfer programs that will satisfy their responsibilities as stated in their mandate. It is clear to the External Review Team that the greatest potential for positive impact of CATIE's research output in Central America and the Caribbean lies in an integrated and concentrated program thrust in those areas where CATIE has the a clear comparative advantage.

CATIE has achieved considerable recognition for its research and development in coffee and cacao and is making good progress on plantain. Its work in integrated pest management is also well recognized and here CATIE has demonstrated its advantage over other organizations in this field in Central America. Its work in agroforestry is very well recognized throughout the region and its research on integrated crop/livestock/trees/pasture management is recognized for its potential as well as its accomplishments. In ruminant feeding systems, CATIE is in the forefront in research in the region and it has made much progress in land system analysis and management. While CATIE has not yet made great progress in natural resource management, this is an area where it should excel in the future. It has been well recognized that socio-economics is of much importance in all three of CATIE's programs. There are a good number of economists in some of the projects. However, CATIE is now recognizing the importance of this subject throughout all its work, and is systematizing its work in this important field.

It is a recommendation of the Review Team that the staff of CATIE adopt and practice a more holistic, or systems, approach (often called ecosystem approach) to agricultural and natural resource research and management than has been the case to date. The CATIE staff need to pursue, to a greater extent in the future than they have to date, the inter-relatedness of the biological, physical, social, and economic aspects of ecosystems at the organism scale, site scale (less than 1.0 ha) and at larger scales such as mixed-enterprise farms (1ha to several ha), landscapes which may include watersheds, forests, reserves, and communities, (10's of ha to square km's), and regions (very large areas). Figure 1 shows one way in which CATIE's three Research Programs may be inter-related at various levels of organisms (plants and animals), sites, farms, landscapes and regions in a systems approach to the problems of a productive agriculture for a sustainable environment.

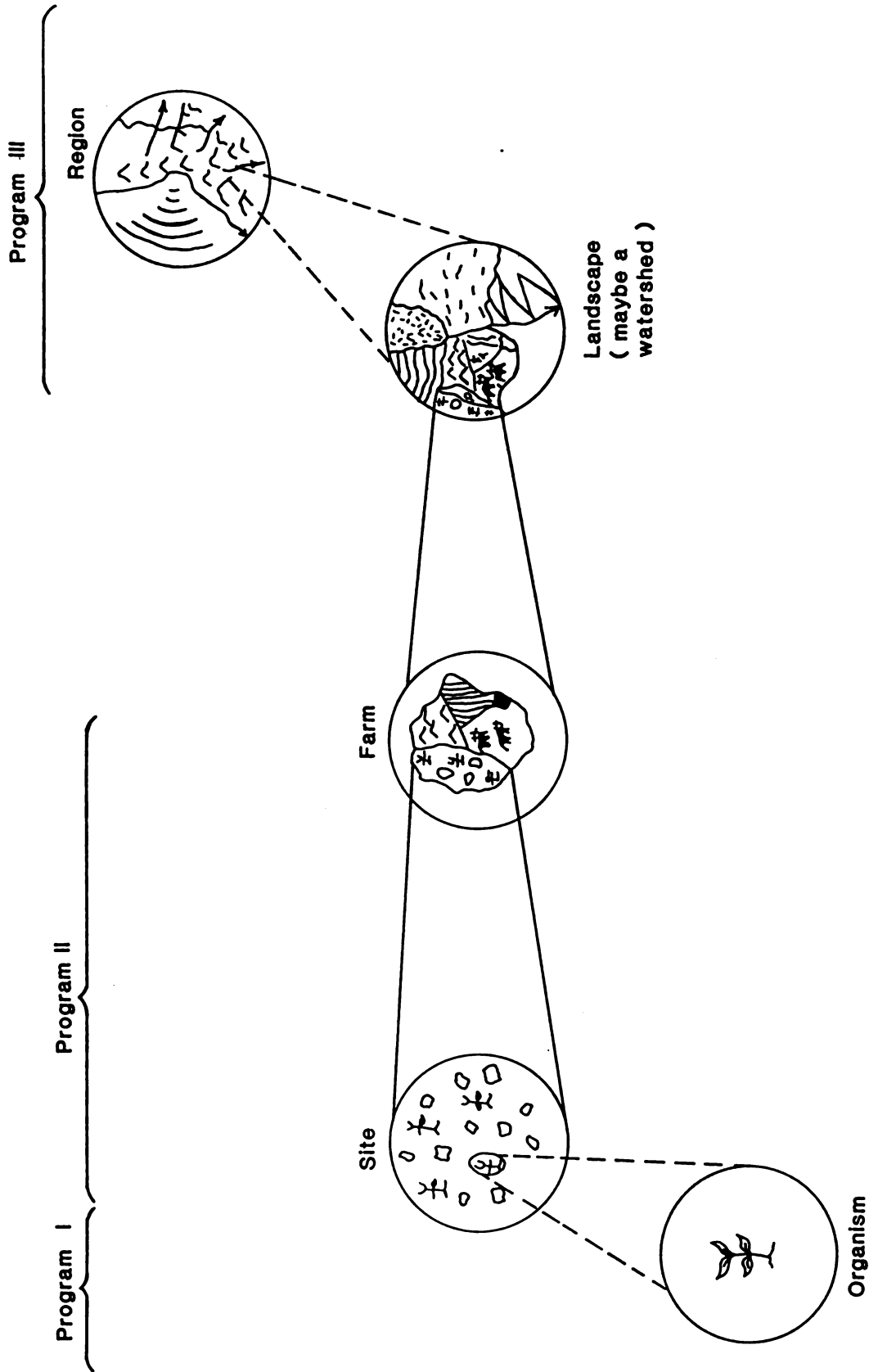


Figure 1 One possible hierarchical arrangement of ecosystems that is consistent with the current mandate of CATIE. At the smallest scale are organisms that are dealt within Program I. The site and farm fit somewhat into Program II and the landscape and region roughly correspond to Program III.

3.1.1 Ecological Hierarchies

Ecological hierarchies are models of human perceptions of environmental reality. They are abstractions, not small versions of nature. The model shown in Figure 1 even though an over-simplification of reality, is intended to represent the CATIE mandate and serve as a helpful communications device.

3.1.1.1 The Organism

Organisms, obviously, are the basis of all biological productivity. However, in the context of Figure 1, organisms are the basis of food, animals and fiber crops, shelter products, firewood, soil protection, and enjoyment. CATIE's interests range from native organisms in natural environments to selected and genetically "improved" organisms in intensively managed environments (Programs I and II). Much of the history and success of CATIE has been achieved through research and education in the propagation, culturing and management of organisms in field or site settings. Knowledge about organisms is essential in developing concepts of ecosystem sustainability.

3.1.1.2 The Site System

The biological and physical features at the site scale of the hierarchy in Figure 1 are relatively uniform and homogeneous. The slope inclination, slope position (relative to top and bottom), and slope aspect (relative to the sun) are the same. The soil is, ideally, one type. The vital functions at the site must be maintained, which include nutrient cycling, water storage by soils, and organic matter production and degradation by plants and microorganisms (Programs II and III). Ideally, if a conscious decision is made to manipulate species in site scale ecosystems through cropping, livestock, or agroforestry practices, the species should be selected that will best maintain the necessary ecosystem functions.

3.1.1.3 The Farm System

The farm system or production unit is made up of one-to-many sites organized to produce food and other products for consumption, shelter, or cash for the farmer. Sustainability of the farm is dependent on both sustainability of its component sites and its economic and social viability as a unit. A farm may be, or may emulate, only one site (a single crop system) or it may be a grouping of sites that produces different products

on each site. Many combinations of sites and site uses are common, and mixtures are typical, particularly when considering livestock (Programs I, II, and III).

3.1.1.4 The Landscape System

The components of landscapes are land units that might be farms, ranches, parks, natural areas, communities, industrial sites, timber production areas, and other locations where land use can be defined as a system (Programs I, II, and III). The landscape system can be defined in terms of economic, social/cultural, political, hydrological or other factors. The real world often indicates that a system that is defined in terms of any one of these factors is constrained by one or all of the others. Land use planning is the formal process of developing reasonable practices or policies that will govern the management of the component systems that make up the landscape. Sensible land use planning integrates important biological, physical, social/cultural, economic and political factors that are present in the selected landscape area.

A special case within the concept of landscape systems and land use planning are the notions of the watershed and watershed management. In this case, the watershed is a well-bounded system defined in terms of water quantity and often quality.

3.1.1.5 Regions

The concept of a region in Figure 1, in its most ideal sense, is a collection of landscapes that are united in a definable manner of which some are biological, physical, economic, or social/cultural. The word region is used in so many different ways that it is almost meaningless. But, herein, a region is strictly a group of landscapes that interact to form a unified whole.

3.1.2 Integration of Hierarchical Systems

As noted before, the greatest potential for CATIE lies not in achieving excellence in any one of these levels within the systems hierarchy of Figure 1, but rather in the thoughtful and prudent integration of knowledge among and between the levels. For example, the fundamental level of biological and physical integrity is the site system or ecosystem. For many good reasons maintenance of viable ecosystem functions at the site scale is essential.

Maintenance of purely natural ecosystems on all sites is unrealistic. Alternative organisms (plants and animals) are needed for food, fiber, and shelter. Thus, the primary goal for sustainability is to substitute economically-viable and socially-acceptable "crop" plants and animals for native organisms in ways that will best maintain the basic ecosystem functions. Selected and appropriate genetic material, appropriate cultural practices, sensible harvesting techniques, and careful management of the soils at the site level can imitate natural ecosystem functions and thereby protect the sustainability of farms and landscapes.

Plants, livestock, crops, and individual sites mean little outside the context of the farm as a system. Most viable farms within the stated scope of CATIE are and must be mixed enterprises with several crops, livestock and other products being derived therein. Thus, the knowledge of the blending of these products and their management becomes the substance of the farm system. This cannot be done without the knowledge of plants and livestock and their management, utilization and marketing as well as their economic viability and social acceptability.

A vast amount of knowledge and institutional relationships concerning plant and animal breeding, cropping systems and cultural practices, farming and agroforestry systems have been accumulated by CATIE (current Programs I and II) over the past decades. That knowledge can form the basis of new research and education activities that emphasizes integration for the purpose of analyzing and understanding the interactions that occur within landscapes. This analysis, which will lead to understanding, is essential if CATIE is to truly serve whole communities rather than individual small to medium size farmers who have been carefully selected as test cases.

Clean, abundant water, viable local economies, wholesome social and cultural systems, are all functions of healthy landscape systems (Program III). However, these systems attributes are impossible if the components that make up the landscape are not themselves healthy.

Thus, since reality is a vast hierarchy of different and overlapping systems, the necessity for people to work together within institutions such as CATIE to provide integrated knowledge for a productive agriculture for a sustainable environment is paramount.

3.2 The Present and Proposed Research Structure and Organization

3.2.1 The Present Structure and Organization

Research is organized in three programs: Tropical Crops Improvement (Program I), Sustainable Agricultural Production and Development (Program II), and Integrated Natural Resources Management (Program III). Each has a Program Director or Leader, and staff responsible for planning, operating, and evaluating program performance, as well as teaching in areas of their expertise. There is also a Socio-Economic Unit headed by a Program Leader but this Leader has just been named Director for Program II. The status of the Socio-Economics Unit, which was approved at the last meeting of the Board of Trustees, was not clear to the Team at the time of the review, but apparently it is to be incorporated into Program II.

While CATIE has an Associate Director General for Research, this person also served until recently as Leader of Program II. He has not been, nor is he now, involved in the planning, coordinating, monitoring and evaluating functions of the research program which are the normal responsibilities of a director for research.

Individual research programs operate in vertical lines and there appears to be little horizontal interchange among them. Research programs are supported by Units for Computer Services, Biometrics and Statistical Analysis which fall under the Research structure. Other support units, such as Communications and Library, are under the direction of the Associate Director General for Education.

3.2.2. The Proposed Research Structure and Organization

CATIE has the opportunity to develop an administrative system that directly involves the persons responsible for programs and activities, and vests in them the authority to carry out the mandates of CATIE.

The Review Team recommends a revised organizational structure which is presented in the Management Review Report. It identifies CATIE's major operations and functions as well as the reporting lines.

The proposed research structure and organization combines Research and Education under the Deputy Director General and no longer provides for Associate Directors General for Research and Education. The Directors of the three Research Program Areas, in the proposed structure, would be a part of the Management Team which includes, in addition to themselves, the Deputy Director General and the Assistant Director General for Finance and Administration. The

functions and responsibilities are presented in some detail in the Management Report.

3.2.3 The following sections of Chapter III are reviews of of the three Research Program Areas of CATIE.

It is clear to the External Review Team that the greatest potential for positive impact of CATIE's research output in Central America and the Caribbean lies in an integrated and concentrated program thrust in those areas where CATIE has a clear comparative advantage.

3.3 PROGRAM I - Tropical Crops Improvement

3.3.1 Priorities

CATIE's Research Program I focuses its activities on the genetic improvement, plant protection, and germplasm conservation of perennial and promising crops of significance to Central America. In addition, the staff participate in the graduate and training activities at CATIE, including regular and extension courses.

Three perennial crops: coffee, cacao, and plantain, and ten promising crops (noted under section 3.3.2 below) were selected as priorities by CATIE. The ten promising crops are being evaluated for their potential but very little research is being carried out on them.

In Chapter 5, the Team presents the areas in which it believes CATIE has a comparative advantage over similar institutions in Central America and the Caribbean. Two of these areas come within Program I: Tropical Crops Improvement, and Integrated Pest Management (IPM).

3.3.2 Present Situation for the Three Perennial Crops and the Promising Crops

Perennial Crops

Coffee is certainly the most important crop in Central America. More than 720,000 Ha were planted to coffee in its seven states, which produced 550,000 tons in 1989. Yields in Costa Rica are at least two to three times higher on the average compared to the other states. Yields in Panama, Nicaragua, and the Dominican Republic are as low as 500 kg/Ha, while in Costa Rica they are close to 1,800 kg/Ha. It has been estimated in Costa Rica that 900 kg/Ha are required to cover labor and input costs of the recommended technological system indicated for the crop. Most countries, with the exception of Costa Rica, fall below this profit margin level. Factors

limiting yields are leaf rust (*Hemileia vastatrix*), coffee borer (*Hypotenemus hampei*) and nematodes.

Central America is the center of diversity of Cacao which has been cultivated there since pre-Colombian times. It is an export product for Costa Rica, Guatemala, Honduras, Panama, and the Dominican Republic. More than 160,000 Ha are planted to cacao in the wet tropics of Central America, which yield an average of 50,000 tons worth US\$60 million. Current production yields are low (350 kg/Ha/year), and can be boosted to 1,000 kg/Ha/year with existing technologies. Yields are limited by the incidence of diseases, the most significant being moniliasis (*Moniliophthora roreri*), Black pod, and Ceratocystis wilt, which cause yield losses from 50% to 80%. This situation will be aggravated when the "Escoba de Bruja" (*Crinipelis perniciosa*) breaks out in Central America.

The third priority among the perennial crops is Plantain, a staple crop which is an important diet component of the populations in Central America who consume an average of 22kg/person/year. In the region, 98,000 Ha are planted to Plantain, which corresponds to an annual production of more than 700,000 tons. The crop, however, is struggling due to the presence of Black Sigatoka which broke out in Central America early in the seventies and reduced the export production of Costa Rica alone by more than 60% by 1984. Other production-limiting factors for Plantain are deficient crop management, as well as the incidence of nematodes (*Radophlus similis*).

Limiting production factors affecting the three major perennial crops in Central America, in addition to the rapidly-falling export prices of these crops, prompted CATIE to search for alternative promising crops based upon the demand by farmers and due to the existence of some hundred species of current economic potential which are adapted or native to Central America.

The choice of priorities by CATIE with respect to perennial crops is adequate. Coffee and Cacao are unquestionably major sources of income for farmers in Central America. Plantain comes next in importance and CATIE can contribute substantially to the management and development of this crop in Central America without duplicating more advanced work done by other institutions in the region, as well as in Africa, with Banana. This was recognized by INIBAP -- International Network for the Improvement of Banana and Plantain -- by appointing CATIE as the headquarters for the Regional Network in Latin America and the Caribbean. The production-limiting factors these crops had to face in the last couple of decades, as well as the challenging competition

for price at the international level, justifies the search for alternatives.

Promising Crops

A wide range of promising crops are being evaluated by CATIE. The most important being: macadamia (*Macadamia spp.*), black pepper (*Piper nigrum*), vanilla (*Vanilla planifolia*), achiote (*Bixa orellana*), pejibaye (*Bactris gasipaes*), guanábana (*Anonamuricata*), zapote (*Pouteria sapota*), and chayote (*Sechium edule*).

3.3.3 Strategy, Approaches, Impacts, and Limitations

Coffee. The activities of CATIE with respect to coffee improvement are restricted to the introduction and selection of coffee breeding lines and varieties of high yields and seed quality which are resistant to leaf rust (*H. vastatrix*), and to nematodes (*M. exigua*), from several countries. These introductions are collected in a germplasm bank which includes more than 1,350 lines and varieties. Selected varieties are being tested regionally in Guatemala, El Salvador, Honduras, Costa Rica, and Nicaragua. As a consequence, seeds of Catimor, Catuai and Mundo Novo have been distributed to member countries in 1990.

An alternative to a formal breeding program at CATIE, since the staff does not include a geneticist, is tissue culture, including micro-propagation and micro-grafting and embryogenesis from somatic tissue cultivated *in-vitro*, all of which are being used routinely at CATIE at present. Member countries have mastered the technique of micro-propagation for the semi-industrial production of selected genetic material resistant (F1 hybrids) to leaf rust which will produce short term results. This was facilitated by the introduction of resistant lines and F1 hybrids from other Countries.

The situation with respect to resistance to nematodes is more difficult to approach without the use of modern techniques such as RFLP (Restriction Fragment Length Polymorphism) to be used as a genetic marker system to speed-up breeding and testing of the germplasm available, combined with somaclonal variation to increase variability and *in-vitro* regeneration by embryogenesis.

Plant protection activities are concentrated on the chemical control of leaf rust and coffee borer (*Hypothenemus hampei*). These activities, linked to extension training courses offered by CATIE, have produced an efficient integrated pest management system for the borer which can

profit from the use of biological control methods such as the fungus Beauveria bassiana.

Cacao. Cacao improvement activities in CATIE started more than 40 years ago with the establishment of a germplasm bank which today holds more than 600 introductions, including eight species of the genus Theobroma and six species of the related genus Herrania. It constitutes the most extensive collection of this species in the world, and the base for all breeding program in progress at CATIE. From 1976 to 1989 more than 26 million seeds of hybrids were distributed in Central America, more than 50% of which were distributed in Costa Rica. Results were contradictory.

Most hybrids used parents which were heterozygous, and 98% of the hybrids included self-incompatibility in their genetic make-up. CATIE staff suspended the distribution of these seeds and completely reviewed their breeding program. Today, more than 260 crosses are available from self-compatible, high-yielding lines. Several of these hybrids are being field-tested and have an estimated yield of up to 1,500 kg/Ha. This material will be readily available as clones micro propagated *in vitro*. CATIE produced a technological system for cacao which, in addition to adequate crop management, including an integrated disease and pest control system, can achieve yields as high as 2,000 kg/Ha.

The breeding program is supported by RFLP gene-mapping of cacao, in cooperation with the University of Pennsylvania, to locate disease-resistant genes in the genomes available. In addition, tissue-culture and cell-culture systems have been optimized to produce somatic embryos which can be used to speed-up the breeding program.

The cacao improvement program in progress at CATIE has the potential to face the major challenges encountered by the crop in the region, both on a short-term basis through integrated disease- and pest-control management, and through the release of high-yield clones by micropropagation. On a long-term basis it can be done by using Biotechnology to increase yields and disease resistance. Sources of resistance to the major diseases are available in different clones, but the combination of resistance to Black pod moniliasis and Ceratocystis wilt needs the help of RFLP to map marker genes and to identify genes responsible for the resistance mechanisms.

Plantain. The improvement of Plantain (Musa AAB) focuses on the major production-limiting factor -- Black Sigatoka -- as its first priority. Genetic improvement of Banana and Plantain is difficult by classical means due to the fact that they do not produce seeds. One strategy is to utilize wild

varieties which produce pollen and viable seeds, although the yield of seeds can be as low as 1 in 10,000 fruits.

The CNPMF of EMBRAPA obtained Bananas which are expected to be resistant to Black Sigatoka and which are being tested at the La Lola Agricultural Experimental Station of CATIE. Similarly FHIA -- Fundación Hondureña de Investigación Agrícola -- produced synthetic diploids of export dessert bananas possessing disease resistance to Black Sigatoka, Race 4 of Panama disease, and burrowing nematodes.

These synthetic diploids can be used to produce triploid and tetraploid hybrids by classical means. However, it is recognized that micropropagation in conjunction with *in-vitro* mutation breeding and RFLP are important to speed-up this strategy. Diploids are available with high disease resistance to Black Sigatoka. However, the behavior of these hybrids, from highly resistant to very susceptible, indicates that the resistance is quantitatively inherited, which limits the use of direct transfer of genes by genetic engineering/recombinant DNA methods. Rather somaclonal variation is the approach of choice followed by clonal multiplication of disease-resistant clones.

This is the strategy followed by CATIE using AAB Plantain genotypes and diploid resistant hybrids made available by the INIBAP Transit Center to the Regional Centers. The first variants obtained from meristem culture are being tested at La Lola. CATIE has established cell suspension cultures from callus cultivated *in-vitro* and regeneration by embryogenesis from these cell suspension cultures. This system is being utilized for *in-vitro* selection of potentially-resistant mutants after challenging the cultures with toxin from the fungus. It is the right approach, although the results cannot be expected on a short-term basis. The technology is, however, powerful and can be used as a breeding tool to focus on any problems in Banana and Plantain breeding in the present and in the future. In addition these techniques can be conjugated to recombinant DNA techniques for the transfer of other genes of interest such as herbicide- or nematode-resistance.

CATIE has produced the most advanced results in Latin America in the area of Musa and Cacao tissue culture. This competence must be combined with the capabilities of other centers such as CENARGEN at EMBRAPA to benefit the genetic improvement of these crops. In the meantime, integrated disease control management was established by the Center, which can reduce the losses caused by Black Sigatoka.

The strategy adopted by CATIE for the so-called promising crops, is germplasm conservation and clonal

multiplication of selected material to supply requests for plants by farmers. Genotypes are being tested at La Lola and are already available as propagative material.

Non-Traditional Food and Export Crops

Non-traditional food and export crops is an area that warrants further exploration and support by CATIE. A wider agricultural base provides additional economic opportunities and stability to the region. Most countries have stated policies that foster and seek agricultural diversification. The region presents a wide range of environmental conditions that permit the cultivation and production of many different commodities. It also is adjacent to one of the most affluent and larger world markets. The selection of these promising crops must, however, be supported by market studies, not only with respect to demand by foreign countries but also as to their aggregate value.

It is acceptable to divert some of the working staff force of CATIE for these promising crops to satisfy farmers demand and prevent genetic erosion. However, the decision of further investments in these crops should come as a consequence of a more accurate market study. In fact, these studies are needed if only to assess the potential of other species available in the region which may not yet have been selected by CATIE as promising. A strategy in this respect was discussed with CATIE staff members.

It is recommended that CATIE analyze its potential role in support of crop diversification in the region. This should be done in relation to expanding and sustaining its participation with the private sector groups.

3.3.4 Staff and Resources

The budget of CATIE for Program I according to the document (Programa Presupuesto) made available to the External Review Team can be divided into two sources:

* The budget from Core funds called Basic Budget (Presupuesto Básico), and

* Funds from special projects (Proyectos Especiales) which result from grants from different sources, or donors. For 1990, a comparison of the source of funds is shown below.

	Personnel	Other Costs	Total	%*
Basic Budget	286,933	63,868	350,801	82
Special Projects	<u>1'454,634</u>	<u>1'462,942</u>	<u>2'917,576</u>	50
Total	1'741,567	1'526,810	3'268,377	53

* Personnel/Other Costs, Productive Activities are not included.

The total budget is well balanced due only to the fact that funds are available from Special Projects, since the Core Budget is almost entirely devoted to personnel expenses, a trend which is also present in other Programs at CATIE. This tendency results in a condition of vulnerability for the Research activities of CATIE.

The technical staff supporting Program I include 15 PhDs, 16 MSc's, and 24 BSc's from the following countries:

Countries	Ph.D.	MSc.	BSc
Mexico	02	-	-
Colombia	04	03	-
Costa Rica	03	12	22
Uruguay	01	-	-
USA	04	-	-
France	01	-	-
England	-	1	-
Ecuador	-	-	1
Nicaragua	-	-	1
Total	15	16	24

Understandably about 67% of the staff comes from Costa Rica, since it should be easier to recruit staff locally. It is, however, very low in the number of staff representatives from other member countries. Technological adoption by member countries could be facilitated by recruiting personnel from those countries, which should be done without sacrificing quality. Among the PhDs only five (33%), and among the MSc's only four (25%), have been in CATIE for more than five years. These numbers probably result from a high turn-over rate at

CATIE, a situation which is not recommended for the continuity of the research activities.

3.3.5 Issues and Assessments

Tropical Crops Improvement is strategically very relevant for the future development of agriculture in the Central America and Caribbean regions. It has a team which has the competence to resolve the main problems limiting agriculture in the region with respect to the crops which it addresses. It is the view of the Team that these are the right crops to address. Because of the importance of the commodities on which the research team is working, the work should not be threatened by uncertainties of budgetary funds.

The scientific production of the team is, however, below their potential. Few publications in international-level journals have been produced. CATIE does not have a policy to stimulate and evaluate scientific production and it is recommended that CATIE have such a policy.

In addition, research projects in the area of genetic improvement of Perennial Crops are long-term with respect to fulfillment of their objectives, particularly with crops of difficult genetic background, such as Musa. These normally require 10 to 15 years to achieve significant results. Therefore, the high turn-over rate of staff should be of major concern to CATIE management and its Board of Directors. Well qualified staff should be given incentives to remain for a minimum of 5 to 8 years for work on the perennial crops.

Plant protection technological achievements can be obtained in a relatively short-term -- 3 to 5 years -- basis, but even here new diseases and insects appear regularly, requiring continued attention.

There are two possible solutions to this vulnerable situation. One is to convince CATIE member countries that they must provide more support to CATIE based upon the potential which this group represents for the future development of these crops and to agriculture in the region.

The second strategy is to distinguish between projects which generate production systems for direct use by farmers and which, although very important, brings no financial dividends to CATIE from research and development projects which can produce technology services, and products which are marketable. A work study in this respect was made by EMBRAPA and is available for analysis by CATIE.

Today, most investments are made in projects of the first category. They are attractive because they produce short-term

results and bring political dividends to the administrations. As a consequence, one can see that the investments that will be made in IPM projects for 1990 in relation to Program I reach the amount of US\$2.23 million, compared to projects in the areas of Plant Breeding and Germplasm Conservation which will invest less than US\$700,000.

Projects which utilize germplasm for breeding purposes supported by biotechnologies are long-term but have a great potential for regional development of perennial and promising crops. These projects must have clear objectives and can only be pursued by international cooperation between CATIE and other research institutions of high competence in Latin America, North America, and Europe. The area of choice is Biotechnology for plant breeding, and Biological Control agents, to name only a few areas having market potential.

Biosafety and intellectual property issues must, and can be negotiated, between Latin America and the developed countries. The competence is available and the germplasm, which is also essential, is on hand. However, CATIE must cooperate for the success of these projects which will require high technology, not always available as fast as needed to produce the necessary impacts. The key strategy is to use genes and high technology for the cooperation and benefit of developing and developed countries. Genes will be a very important "commodity" in the Decade of the Nineties as well as in the next century.

The germplasm conservation by CATIE is strategically important for Latin America and for the world. One cannot preserve all the genetic diversity that will be needed in the next centuries in cold rooms. This germplasm must periodically be field-evaluated in the proper environment to avoid genetic shifts and genetic drifts which also cause genetic erosion. This costly activity must be assigned to more than one institution in Latin America, since the bean collection alone, originally at CIAT, has 30,000 introductions. In Latin America there are frequent political problems which can endanger the ready availability of germplasm for their countries. Therefore, it is important to have a collection at CATIE as a regional center for Central America and the Caribbean.

In Chapter 5 of this report, in addition to indicating the areas in which the Review Team believes CATIE has a comparative advantage in Central America, the Team also recommends the Nucleus Staff that it believes CATIE should have in Program I to cover tropical crop improvement and integrated pest management.

A final recommendation of the Team to Program I is that it should increase its interaction with Programs II and III. There is a sense that Program I is not sufficiently seeking ways and means of integration with the other two research programs of CATIE. The IPM work is an obvious area of integration but there needs to be a continued effort to seek additional opportunities for close cooperation among the programs.

3.4 PROGRAM II - Sustainable Agricultural Production and Development

3.4.1. Annual Food Crops Area

3.4.1.1 Priorities

The production of main staple food crops is not keeping pace with population growth in the region. Per capita production of maize, beans and sorghum has been decreasing, while importation of food has risen considerably in the past decade. Several factors appear to contribute to this phenomenon, which include land tenure and utilization, lack of economic incentives, and primitive production technologies. With the exception of rice, area unit yields have increased only slightly over the past several years. On the other hand, food security is an overriding consideration for most of CATIE's member countries. In this respect, increasing total and unit area yields of staple and non-traditional food crops is of paramount importance to the region. Some of the factors involved in this issue are certainly not technological. However, modern technology inputs are required to move food production forward. This is urgent due to the fact that much of the production of staple food crops is carried out in fragile environments -- such as the hillsides -- in the region.

3.4.1.2 Present Situation and Resources

CATIE has conducted staple food crops research within its farming systems approach, its integrated pest management program, and more recently, as a component of the agroforestry research. Maize, beans, cassava, and other crops have been investigated in crop associations seeking sustained and more efficient use of land and other small farm resources. CATIE in the past has utilized, and still utilizes, improved germplasm from international centers while concentrating on improving production technologies in the management of these crops. In this context, alley cropping experiences by CATIE, using maize and beans in combination with Erythrina and

similar nitrogen-fixing tree species, appear to hold considerable potential for hillside farming and poorer soil ecologies. CATIE has also gained experience in integrated pest management of regional food crops, i.e., maize and beans. The Center serves as a reference for the diagnosis of disease, insect, and weed problems in these crops. In addition, publications and training courses are periodically given by CATIE staff on the subject.

CATIE's research on annual food crops is limited in scope and scale at present. Improvements of these crops is the main responsibility of IARCs such as CIMMYT, CIAT, and CIP. CATIE's present resources include a strong integrated pest management team and some capacity in food crops production agronomy. It has a 20 ha. experimental field at Turrialba, where thesis and other research work are carried out on annual food crops. In addition, CATIE works with an extensive collaborative network of national programs which augments the potential food crops research and outreach capacity of the Center.

3.4.1.3 Opportunities, Limitations, and Strategies

Sustained and abundant production of staple food crops will continue to be a major goal for member countries.

As a regional center, CATIE has the advantage of being able to focus on a more limited geographical area than is possible for the International Centers. It does not engage in crop breeding but does concentrate on crop production management in support of national programs. This implies its active participation through horizontal research collaboration, with both international and national programs. Two distinct issues could thus be addressed at the Center. One is the maintenance of the sustainability of the productive soil base and its fertility. The other is the search for alternative food crops, that may in time contribute to alleviate the pressure on the present staple food crops base.

Food crops production for sustainable environments appears to be the area of immediate feasibility and comparative advantage for CATIE. In this respect, CATIE's present strategy in annual food crops, of focusing on soil management and soil fertility associated with nitrogen-fixing species and integrated pest management, appears sound. An important consideration in this context is to be able to test and validate production models under a wide range of environmental conditions. Thus, sustained collaboration with national

programs is mandatory. CATIE's potential contribution could be more in the realm of developing production models for extensive testing at the national level, crop physiology, soil microbiology, integrated pest management and agroforestry.

3.4.1.4 Recommendations

Food security will continue to be an important issue in the context of the region. CATIE must maintain some involvement in this critical development area. It is the recommendation of the Team that this be done on a sustained basis through collaborative links with international and national food crops programs. CATIE's contribution should be on subjects, such as sustained production with focus on soil management and fertility, integrated pest management, technical support to national programs, and training.

3.4.2 Forestry and Agroforestry

3.4.2.1 Regional Priority of the Forestry and Agroforestry Systems

Agroforestry systems are traditional and important in Central America. These systems are well suited to the needs of small- and medium-size farmers and they are considered priority areas by all CATIE member countries. The need to apply concepts of sustainability at the farm level is important because many Central American ecosystems are fragile and, when mismanaged, become unbalanced and rapidly degrade. Thus, forestry and agroforestry systems become critical elements of the agricultural system in the Central American environment.

The priority given by CATIE to forestry and agroforestry systems research is well justified and the Team recommends that it should be further developed. Future research should focus on the integrated management of natural resources, including watersheds or landscapes as work units, thus integrating Programs II and III.

The goal of the "science" of agroforestry should be to integrate all of the elements within a system including the socio-economic needs, the ecological potential (in a broad sense), and the objective of a productive agriculture for a sustained environment.

It is well known that the social and economic sciences are necessary for studying the needs of the farmers, production changes, and potential markets for

the products generated by the forestry and agroforestry systems. As researchers are aware, it is essential to know the problems and priority constraints which the farmers face, as well as what their response may be to improvements or changes in production systems. Such knowledge should result in the development of technology that is easily transferable and that will stimulate its adoption. The long-term success of the forestry and agroforestry systems is linked closely to product demand which, if favorable, will stimulate the participation by producers/farmers.

3.4.2.2 Strategies, Achievements, Difficulties

As in all other program areas, CATIE's work in forestry and agroforestry is carried out through a series of projects rather than as a well-defined and well-focused program.

3.4.2.2.1 Important Achievements

The execution and management of field projects have been very well conducted. Their results are practical and applicable in larger areas in the region. The dynamism of the field staff should be noted and considered as one of CATIE's greatest achievements and one which gives it a leadership image in the application, consolidation, and improvement of forestry and agroforestry systems in the region.

In some cases, the choices of some experimental sites have not been the most representative for studying the productivity of various species. Some of these have also not been representative of the conditions under which the agroforestry systems will achieve the best social utility. However, the experimental plots have been useful for demonstration and extension purposes.

No consensus exists concerning the methods for reaching the beneficiaries -- the farmers who are owners of small and medium size productive areas. Agroforestry projects in Madeleña, with funding from different sources, have developed their own diagnostic tools for socio-economics, for the selection of work areas, for the selection of farmers, and for the extension of management systems of productive areas. Even though no consensus exists the various projects have some common features including rapid dispersal of

information to farmers, and successful culturing of seed stocks.

Other achievements of great interest for the Madeleña forestry and agroforestry projects are that they have:

- * Established a regional system for experimental data collection accumulated in a data base known as "MIRA", and an experimental regional-level network of measurement plots.
- * Programmed a system for selective recovery and utilization of information.
- * Trained personnel in the utilization of the system of controlled entry and recuperation of experimental data, and
- * Installed the system in the member countries.

This system will allow use of available information to establish "models and response of species growth" to the ecological conditions and to the management of stands. It is recommended that all of these results should be published as soon as possible.

The document "Facing the Challenge" is an important step towards structuring CATIE's activities. However, it is recommended that greater detail be provided when describing the specific objectives, the means for achieving them, and the indicators used in the control of forestry and agroforestry work. The search for clearer definitions will ensure a better monitoring level of the achievements, and a greater feedback between the projects and CATIE Management.

It is noted that CATIE has had very successful training of numerous technicians and professionals within the region through short courses, field practices, in-service training, and graduate degree courses.

3.4.2.3 Staff and Resources

3.4.2.3.1 Staff

The agroforestry area has developed rapidly over the past two years as a result of support by

many donors. There are now more than 60 staff members working in this area at CATIE, mostly supported through short-term project funding. There are very few staff funded on a continuing basis through the Core budget.

The Team recommends that CATIE's programs and special projects have greater technical coordination by Core staff in order to assure continuity. A strong demand for technical staff in the field is evident when dealing with integrated management of landscapes or with pilot watersheds. Forestry and agroforestry projects can be staffed by personnel trained at CATIE, thus placing fewer demands on core staff coordination. In many of these cases, coordination can be accomplished through the existing national organizational structures.

3.4.2.3.2 Financial Resources

At present the forestry and agroforestry areas of Program II are undergoing a transition in funding sources.

The Madeleña project (formerly Leña) is entering its third phase, with a reduced budget. The reduced funding emphasizes the need to diversify the donors and to support the national and regional "institutionalization" of the plantation activities in the forestry and agroforestry systems. This means that a new strategy for the support of forestry and agroforestry activities should be implemented.

Because of the confidence established through the development of the Leña and Madeleña projects in the field at a regional level, authorities in Costa Rica, Guatemala, and Honduras have organized, and Nicaragua is organizing, the national structures needed to "institutionalize" forestry and agroforestry systems by integrating financial sources from various origins.

However, while CATIE has been successful in obtaining donor support for projects, the Team recommends that CATIE develop a well-defined program in forestry/agroforestry which it can present to donors and into which projects will fit.

3.4.2.4 Issues and Assessments

3.4.2.4.1 General Difficulties

Forestry and agroforestry projects have undergone rapid development during the last few years due to a greater awareness by governments of the need to conserve and nurture the natural resources, and to new donor interest.

Assurance of long-term continuity in forestry and agroforestry research is vital because of the long-time needed to evaluate results. This important aspect is well known by Program and Management staff at CATIE. As has been noted several times in this report, there is a need to give increased emphasis to program goals and then develop projects which specifically support the program.

Currently, each of the projects has its own specific objectives, specific methodologies for extension, and selection criteria for work areas. There seems to be little coordination between projects in the field for the sharing of resources and facilities ranging from seeds to technological and/or scientific information on the management of the forestry and agroforestry systems. It is not the co-existence of differing methodologies, as such, which is of concern, but rather the need for more dialogue between projects. It is recommended that there be increased exchange of knowledge within Program II which will be very useful in establishing strategies adapted to regional realities. It is an important goal for CATIE.

3.4.2.4.2 Organization of the Research Program

Forestry and agroforestry in Program II express the characteristics of many of CATIE's projects which have been developed for, or respond to, independent donors who may or may not have common goals.

This independent behavior has led to an institutional culture that does not give high priority to integration and coordination. No core staff have had the responsibility to ensure that these activities are integrated or coordinated within the program or among programs. Further complicating this problem is the project mode of

operation that tends not to be responsive to the issues of coordination and integration. As noted in other areas, the Team recommends increased integration of resources within Programs and across Programs.

Mechanisms to bring about the direct regular exchange between core professionals and staff on related projects would greatly improve the management of research at CATIE. Such mechanisms are important, especially if we consider that CATIE is financed by numerous donors, is regional in geographic orientation, and is multi-disciplinary in character. Any difficulty in managing these complex realities in CATIE will be more easily overcome by initiating round table discussions, and by conducting on-site coordination and regular visits to research locations. This person-to-person interaction is vastly superior to the presentation of reports.

3.4.2.4.3 Recommendations

1. Research in forestry and agroforestry systems

Central American tropical humid areas

Research in the forestry and agroforestry systems has developed greatly during the past decade, achieving results which can be utilized and extended to the humid and warm areas of Central America. The continuity of this successful research phase is strongly recommended to ensure, through the measurement of permanent plots, the input of data into the "MIRA" system, and the analysis of the results. The analysis of the results should help establish Models for the classification of productivity ("Site Index") and, for each agroforestry system or association, the relation of productivity to the eco-climatic site characteristics, and the type of management. These conclusions must be set forth in what could be called a Central American silvicultural guide on forestry species.

In the long-term it is recommended that computerized models be established of the expected behavior of species where the field users themselves enter the plantation conditions and receive answers concerning the most probable evolution of trees under management systems defined by themselves. The real advantage of this

conceptual model is that it is possible to systematically up-date data and models, in addition to being able to forecast, adapt, and control the kind of management of the species being considered. In the Team's view, it is quite a necessary novelty to enter into this type of logic where the researcher acts in a dynamic and self-critical manner, rather than statically, as the case seems to be at present.

Also, in conjunction with Programs I and III, study is recommended on the characterization of soil potentials, according to their recommended uses within the forestry and agroforestry systems. The results expected are vital to the long-term guidance of the institutional and regional coordination of CATIE, as well as for decision-making concerning the research priorities in the forestry and agroforestry systems.

High priority should be given to the existing forest management systems so that their future regeneration can be achieved while, at the same time, take advantage of available production. The potentially-interesting types of products and services in the humid forests must be the subject of complementary studies. The same would apply to the manner in which the environment is handled in order to not lose this potential. A socio-economic dimension, which is of even greater importance, should be added to this technical aspect.

It is not only the native "primary" forests which should be studied, but also the secondary regeneration which appears after exploitation and possible agriculture and livestock use.

These forestry and agroforestry aspects do not depend solely from Program II, and they should, therefore, also be coordinated with Program III.

Central American dry and high altitude tropics

It is recommended that silvicultural research for the tropical dry areas of Central America must be followed very rigorously. The study of the selection of species and their provenance, the plant and plantation production techniques, and the management of the forestry and agroforestry systems, are, in fact, another research priority.

In order of priority, the agroforestry systems to be developed are ones which take into account the need to generate sources of animal food, fuelwood, fence posts, and soil cover using multiple-use species managed with this purpose in mind.

There is a need for the network of trials with species and provenances to be broadened, while at the same time improving the quality of plants in simple, but efficient, production systems. Then, once the plant quality is defined, a search must be made for improved planting techniques and distances in order to raise the survival rate to more than 85%, thus obtaining rapid initial growth rates with the more promissory species. Researchers are urged to refer to specialized literature from the Andean countries concerning silviculture and nursery production techniques, to save several years of research.

As a complement to this, studies are recommended, in cooperation with CATIE's Tropical Livestock section, on ways to feed animals with the food sources generated and on the manner in which these can be integrated into the agroforestry systems. CATIE staff are well aware of the importance of such research.

The interaction in the agroforestry systems

Research on the interaction between components of the agroforestry systems is very important, and yet it is very difficult to analyze. There are very few studies by CATIE on these interactions and it is recommended that they be considered during the coming decade, beginning with some "pilot" systems which may be selected as being representative of the region.

At the beginning of these studies, CATIE's broad experience in the field, and ICRAF's knowledge of agroforestry systems should be kept in mind.

Other research and priority work carried out at CATIE

In order to stimulate the achievement of extension results in the forestry and agroforestry systems, CATIE staff should continue, and increase, discussion between the project representatives

working in this field and the specialists working in the socio-economic and communications "sciences" in Central America. The objective of this exchange is to overcome the difficulties at this basic stage of the multiplication of forestry and agroforestry activities in Central America.

CATIE has an excellent image in training which must be continued, keeping its level as a leader in education. It must, therefore, regularly up-date itself through the exchange of experiences and professional courses abroad.

CATIE is in a good position to take advantage of the development of forestry and agroforestry systems. At present, the consolidation and monitoring of the Central American Tropical Forestry Actions Plans offers many possibilities of support over the coming years. In this sense CATIE must present itself as an "Ideal Institution" to improve the expected results at the regional level.

3.4.3 Tropical Livestock Area Program

3.4.3.1 Research Priorities

3.4.3.1.1 Genetics

In Tropical Livestock research CATIE has placed a priority on cattle genetic improvement. The main work is carried out in Turrialba where a herd is maintained based on two criollo types: Romosinuano, a Colombian Criollo beef breed and Reyna, a dairy Criollo from Nicaragua.

The relatively small herds of about 150 criollo beef cows and about 70 criollo dairy cows) have been closed for many years, which limits the possibilities of improvement which should have a larger genetic variability.

It is the view of the Team that experiments with the several crosses at the CATIE station now have a greater training than a scientific component. The milk production from Criollo, Jersey, and Criollo x Jersey crossed cows is a good support for the feed and grazing experimentation and student research, but this does not appear as original research work for such a station.

Semen and embryo conservation and transfer have been implemented for the purpose of criollo germplasm conservation and transfer. The introduction into Central America of techniques (artificial insemination, embryo conservation and transfer) are potentially useful tools for livestock improvement, but in the present CATIE program are more useful for training purposes.

Embryo transfer could always constitute a useful tool for the dissemination and testing of genetic material. But it is not obvious to the Team, nor was it observed during the Team's visit to member countries, that the transfer of criollo embryos is a high priority for the member countries of CATIE.

Despite several studies on the CATIE herd it is questionable whether:

* There is an objective superiority of this criollo population of Turrialba or if its performance is not more a result of good environment than genetic superiority.

* The improvement obtained by selection at the Turrialba farm could be transferred efficiently in other conditions. The criollo types are supposed to be used in harsher conditions.

* There is sufficient demand for this genotype in the region.

It is useful to remember that:

* There is in the region a large diversity of genetic types of cattle with dominance of Zebu blood for beef and improved breeds for dairy production such as Holstein, Jersey, and Brown Swiss.

* As the disease conditions for cattle are not as aggressive as is the case in many tropical countries such as in some countries in Africa, the livestock producers of Central America seem able to manage improved imported cattle in a profitable way.

* Criollo cattle in many countries are threatened by extinction through absorption crossing with other types.

It is the recommendation of the Team that the priority for genetic improvement of cattle -- beef and dairy -- should be reduced at CATIE.

3.4.3.1.2 Other Means of Cattle Improvement

While taking into account the foregoing, in our opinion there is still a role that Criollo cattle and a fortiori improved selected stock of CATIE (Ramosinuano and Reyna) have, and a place for them is in the livestock systems of the region. However, we believe that a general reflection on the use of different cattle genotypes in different environmental and production conditions is a necessary pre-condition. This reflection should be based on a good knowledge of livestock production systems. This implies:

- * Analysis and description of the diversity of the systems concerned in the different countries.
- * Evaluation of their level of productivity.

On this last point we are not sure (according to what we heard and read) that the means of on-farm animal productivity analysis have been thoroughly studied and the results available in CATIE.

Computer models for good livestock production models are quite efficient. The models can be tested for accuracy at Turrialba, but they must be adapted and available for studies at the farm level.

In this field of cattle improvement we recommend that an experimental base should be kept in Turrialba for training and accurate studies on management, feeding, health, and pasture. But, the program should broaden its activities and its research to reach livestock production systems in the member countries. Helping the countries to define a cattle genetic policy based on a good analysis of their internal diversity could be a better comparative advantage than transferring Criollo semen.

The study of this diversity of breeds, environments, and systems, could also be a large source of learning and training, while the main contribution of CATIE could be in methodology, analysis procedures, and computer tools.

If CATIE is to give high priority to genetic improvement, which the Team does not recommend, then the work should be made in open herd (and not on a small, closed gene pool as is the case at present) with a specific role to be assigned to the station.

3.4.3.1.3 Pastures and Nutrition

We agree on several established facts:

- * The feeding system appears to be the major constraint to improvement of cattle productivity.
- * Deforestation and bad pasture management often lead to a general degradation of the environment.
- * Pasture degradation is often a main factor contributing to the low efficiency of the livestock production systems of Central America.

These statements place a great deal of emphasis on the work already going on in pasture management and improvement, tree foliage, ruminant feeding systems, and nutrition studies.

Presently, in the Tropical Livestock team, there is a good complementarity in the small group working in:

- pasture improvement and cattle feeding,
- nutrition
- utilization of tree foliage for ruminants (cattle and goats)

The Team recommends that this complementarity be maintained and enlarged to livestock production systems in three classes:

* Pasture systems

There is a good technical base in the region on pasture systems, mainly in large private farms. It is obvious that these systems can often be improved but they present a large diversity which can be used as a source of information. In the dry tropics the main problem is dry season feeding. However, here much is known about appropriate technologies but their utilization for animal feeding is still limited. CATIE has an actual comparative advantage in its knowledge on trees. The emphasis could increase on the knowledge of all

the local resources (crop residues, local trees, and shrubs...) and the improvement of their use (hay, silage, treatment of fibrous resources, management of trees and shrubs).

* Silvopastoral systems

In many cases the best proposition to achieve sustainability should be implementation of actual silvo-pastoral systems. Tree species shall preferentially be of multiple use to provide not only fodder for critical periods but also to achieve nutrient cycling and nitrogen fixation. CATIE's work in this area is very good.

It is well known at CATIE that trees can not only be useful as live fences, sources of fruit and wood, but that they usually also provide a richer fodder than common grasses. Additional nutrition studies should be developed in this direction. The use of trees in livestock feeding systems must also be integrated into landscape management, as noted in the introduction to Chapter 3.

3.4.3.1.4 Agro-silvo-pastoral systems

The small farmer, to a degree, is a livestock producer, but to a larger extent is a crop producer. In this case, the program must bear on agro-silvo-pastoral system in which the livestock shall not necessarily be cattle. The goat (see below) has a place in such systems of small farms.

If the risk for soil degradation under grazing conditions is important due to slope or kind of soils, confinement of animals with "cut and carry" feeding systems will be used.

In agro-silvo-pastoral systems research we can underline these priorities:

- * For the nutritionist, the study of the content of nutrients of the new local or introduced resources. For the tree foliage it is important to study so-called "anti-quality factors" such as tannines, alkaloids and others.

- * For the pasture specialists, emphasis should be placed on pasture management and reclamation of degraded pastures. Improved pasture species are better known, especially by CIAT which has a mandate for tropical pasture improvement. The Team recommends that the collaborative CIAT/CATIE program should be strengthened.

- * The necessity for a holistic approach of the system by the tropical livestock improvement staff, including economic studies.

- * An increase on pasture management and silvo-pastoral studies at the experimental station at Turrialba.

- * Work in different member countries within the framework of a complementary design including various ecological situations.

3.4.3.1.5 Fodder-Tree Utilization and Goat Production System

This research program is actually integrated in an agroforestry approach of utilization of shrub and tree foliage in the goat production systems of Central America.

Although limited in number in the region, this animal species still has a relative place in some parts of the member countries (Costa Rica, Dominican Republic, Guatemala, Honduras). Furthermore, goats play an economically significant role in small farms in these areas. The turnover of money can be much faster with small ruminants than with cattle.

As CATIE is in a tropical zone where erosion is often a big problem, the goats should often be integrated in pen-fed systems which are practical, even in small farms with a small number of animals.

Feeding is, again, an important constraint of these production systems, and shrubs and trees still play a large role in the diet of goats. In general, tree foliage have a better nutritive value than the common grasses, but additional studies are still needed, even though CATIE already has noteworthy experience in the knowledge and use of these promising feeding resources for livestock.

The Team recommends that emphasis should be maintained and further developed on:

- * Identification of local useful shrubs and trees.
- * Nutritive value of these resources (in cooperation with the nutrition laboratory).
- * Growing and management of these plants in comparison with introduced materials in agro-silvo-pastoral systems. Sometimes more agroforestry systems with animals in pens in a "cut and carry" feeding system.
- * Animal feeding and management.
- * Economic studies at the farm level.

The small group concerned with research, on this production system is at present composed of one Principal staff and two Associate Principal staff. They have quite a good approach going from the CATIE experimental farm -- where nutrition and tree growing experiments are made -- to the farm and community level in different countries. This kind of study leads to the integration of animals in a farming system from a sustainable ecological and economical point of view.

The work carried out by CATIE on fodder trees and shrubs emphasizes the integrative opportunities within, and among, the three Research programs for livestock production. The links of this approach with the Agroforestry area of Program II, and the Integrated Natural Resources Management (Program III) are real but still need to be strengthened. The education aspect of this program appears to be a strong one attested to by the list of MSc theses carried out, particularly in the field of fodder trees (Erythrina, Gliricidia, spp...)

3.4.3.1.6 Veterinary Medicine

It is, of course, very important to teach animal health and veterinary management in a Master's degree program in Tropical Animal Science.

It is obvious that pathologic problems are not accorded a high priority in the region, and the farmers seem to control more or less well the main diseases and parasites. The actual impact on productivity has to be studied on farms. We recommend that the studies in different livestock production systems in terms of eco-pathology, be reinforced in order to relate disease observations to environmental and management conditions and to animal productivity.

3.4.3.1.7 Animal Physiology

This sector, which again has a good advantage for teaching, is not, in our opinion, of high priority for CATIE's research program. The embryo transfer laboratory installed at Turrialba can, of course, constitute a new tool for experimentation, dissemination, and testing of various cattle genetic materials, but at present the Team does not recommend this be of high priority. Rather it can serve as an important subject in education and training.

The Animal Physiologist of this program is now also CATIE's representative in Costa Rica and has an office in San José. It is probably very difficult, for this additional reason, to plan the development of research activities in this field.

3.4.3.2 Staff and Resources

The Tropical Livestock Area team presents a good diversity of disciplines and high competence. Given its eight Principal Staff scientists, and three associate principal staff members -- its balance, and thrust are more closely linked and justified with Training than with the Research and Development Programs. The staff breakdown is as follows:

- 2 Geneticists (including the Head),
- 1 Nutritionist,
- 1 Pasture Management Specialist,
- 1 Forage Utilization Specialist,
- 1 Animal Physiologist,
- 1 Animal Health Specialist, and
- 1 Goat Production System Specialist

Due to the load of training activities it appears that the education and training are of the highest priority. Much of the research work is carried out by MSc degree students. Their activities as professors and advisors in the MSc degree program are important and recognized as good by various sources in member countries, by students themselves, and by graduates of the MSc program. A list of more than thirty MSc theses for the last five years attests to this activity.

Over the last years, the Tropical Livestock team has had a number of changes of the coordinator. The need to have continuity of high quality staff has been emphasized throughout the report. It is noted here again as an essential ingredient for the harmonious development of the research and education programs, and for the internal and external interactions.

The tropical livestock production group needs to be reinforced in the field of Economics, and the Team strongly recommends the addition of a socio-economist. It appears very important to provide the services of an economist or socio-economist to the tropical livestock research and training sections. This would improve the approach and analysis of production activities.

It is recommended that the staff of this program integrate more with other programs of CATIE, and especially in the agroforestry systems area and Integrated Natural Resource Management (Program III).

A reinforcement of the capacity for animal productivity analysis of the livestock systems seems to be essential. (See below). Also, in Chapter 5, a

nucleus staff for ruminant feeding systems and integrated farming systems (with livestock) is recommended.

Facilities

The facilities and equipment appear satisfactory, on the basis of our short visit.

The experimental farm and herd provide the livestock team a very useful tool for teaching and research training. With its present programs it appears to be more justified for training than for the scientific results produced.

A question must be raised as to whether it is economically and scientifically profitable to keep such large pasture areas and herds. The question can also be raised in terms of opportunity cost, vis-a-vis other possible uses of land. For teaching purposes and research training the livestock farm appears an excellent aid.

On the research side, the size of the herd (and pastures) is linked to the priority given to cattle genetics. This point will be discussed below.

At present the cattle experimentation program tends to keep many different genotypes which include:

- Beef Criollo
- Criollo x Zebu crosses
- Dairy Criollo
- Jersey, and
- Criollo x Jersey crosses (differing levels)

The total cattle herd is about 1,000 head. .

An accurate cost/benefit analysis of the dairy and beef herds should be very useful. The Team recommends that the cattle numbers be reduced and that CATIE should look at alternative use of land for other research or production alternatives. On the other hand, the management of a large part of the herd could be set up as a separate cost center production enterprise without major problems for research and education purposes. This might well be operated on contract rather than by CATIE.

3.4.3.3 Issues and Assessments

3.4.3.3.1 Feeding Systems of Ruminants

It is the recommendation of the review Team that within the general frame of CATIE's programs, the first priority for the Tropical Livestock Area should be placed on the integration of animals into sustainable production systems. This leads to give emphasis to the feeding system of livestock (cattle or goats) in an agro-silvo-pastoral system oriented to small and medium farmers.

Priority themes of this approach should be:

- * Identification, use, and management of fodder shrubs and trees in different ecological zones. Tree species should preferentially be multiple use to fit in other purposes: erosion control, fences, wood, and fruit production, etc.
- * Pasture management and reclamation of degraded areas. The regional challenge is definitely important in various environmental conditions: highland pastures, pasture in clear-cut forest in the humid tropics, overgrazed dry tropics.
- * Nutritional studies of local and introduced fodder resources. For tree foliage emphasis should be given to "anti-quality" factors such as tannines and alkaloids.
- * Feeding systems analysis and experimentation at the farm level in various ecosystems of a regional network in member countries.

3.4.3.3.2 Livestock Systems Improvement

Second priority should be given to the research work on animals themselves. Which species (cattle or goats or others) is more suitable to achieve sustainability in different systems? Which cattle breed is better adapted to different environments, according to farmers' economic objectives? This question leads to a new definition of the genetic approach and induces the following themes:

- * Animal diversity and production study for the different animal genotypes in their environment.

* The use of efficient tools for the analysis of livestock productivity at the farm level (methodology, procedure, computer programs).

* On the base of these estimates, discussions can be proposed on animal genetic policies for the countries concerned, including cross-breeding and flow of animals between the different systems (dairy, double purpose, beef, and fattening.)

Criollo cattle breeds could be a solution for some low input livestock production systems of the region; goats could find an economical place of interest in small farms dealing with agroforestry. In both cases, on-farm validation should be achieved because of the small number of these animals in some areas of CATIE's member countries.

It is the recommendation of the Team that the program of the Tropical Livestock area be better defined on the basis of priorities in member countries and CATIE's comparative advantage.

3.4.4 Economics and Social Sciences

3.4.4.1 Background and Priorities

For many years, research in economics and social sciences has been considered as a supporting activity to the different multidisciplinary programs and projects of CATIE.

The Ten-Year Strategic Plan recommended that consideration should be given to the socio-economic aspects of the following areas: perennial crops, annual food crops, animal husbandry, forestry and agroforestry production, and development of production systems. But this plan did not suggest a specific group in socio-economics.

In December of 1989 a Socio-economics Unit was approved by the Board of Directors, with the expectation that the human and physical resources of the Production Systems Development Area (Program II) would support this effort. The Board of Directors itself put emphasis on the need for CATIE's General Directorate to prepare an institutional position paper, that must contain, among other aspects, the priorities in matters of socio-economic research and the activities that the new Socio-economics Unit will carry out; this position paper is still pending.

3.4.4.2 Present Situation

For the past years, CATIE has accumulated much experience in the economic analysis at the micro level (productive processes and production units).

Research in micro-economics has been dedicated mainly to the following two aspects:

- * The economic and financial evaluation of technological options. The evaluations put emphasis on the different technical impacts on production costs, labor productivity, cash flow at the producer level, and returns to the capital invested.
- * Decision-making and the integrated management of resources within the production units (agricultural exploitations), taking into account the socio-economic characteristics of the farmer and his family.

CATIE's experience in the field of micro-economy has accumulated mainly in the projects related to integrated pest management, agroforestry, and conservation for sustainable development. Very little research has been done in economics in animal husbandry, which unfortunately, does not involve economists.

CATIE's micro-economists handle the main concepts and methodological tools already used and tested at the International Research Centers without the need for many changes and adaptations: cost-benefit analysis, partial budget, linear planning, calculation and value of the level of economic damage, analysis of sensibility in situations of risk and uncertainty, and determination of economic threshold.

It was observed that the questionnaires used in the formal inquiries, and records applied in the field by CATIE staff in the study of productive activities and monitoring of the development of the production units, frequently seem too complex. This is particularly true when it is the counterpart technicians of national institutions who have to carry out this work without being sufficiently aware of how the data collected must be tabulated and interpreted.

It is recognized by CATIE staff that the micro-economic calculations, carried out at the production unit level, often do not take into consideration the criteria of the most representative

effort of what "rentability" of the production systems means to the different categories of farmers. Very often previous information on the type of producers is needed, which takes into account the economic ratios that the different types of farmers wish to strengthen or optimize according to the socio-economic conditions in which each one of them work: marketing, land tenure, and access to credit. CATIE staff are aware of these issues and are taking action to improve their methodology.

Recently, CATIE has been working on sociological research and social communication, and is gaining experience in the economic analysis at the watershed level and other special areas of work. Regional diagnosis is the main approach with the purpose of:

- * Evaluating the value and potential use of available resources in different areas.
- * Understanding how the farmer's socio-economic environment conditions the decision making process and economic results in the agricultural production units.
- * Identifying and organizing hierarchically the main problems and limitations of the different stratum of the producers in the field.
- * Designing "recommendation domains" for selection, verification, adaptation and extension of appropriate techniques to the producers conditions.
- * Evaluating methodologies and the impact of the processes of transfer of technology in determined areas.

The work in general, consists of the characterization of the socio-economic variables most adequate for the selection and delineation of priority areas of action in matters of validation and transfer of technology. The work also contemplates the classification of the different types of units of production in categories more or less homogeneous, beginning with their economic characteristics.

The research techniques used by the scientists in the field of regional economic analysis are those already managed and tested by the large international research centers (rapid explorations, open interviews and formal inquiries, technological inventories, case studies, etc.), but there is still pending the development of simulation models and extrapolation methods that take

into consideration the socio-economic rationalities of the different types of producers of one region. It is recommended that CATIE give increased attention to this area of work.

It is the recommendation of the Team that increased attention be given to the socio-economic events at the regional level. This will require a thorough analysis of these events in relation to the technological change at the world level and the evolution of prices in the national and international markets.

3.4.4.3 Staff and Resources

At present, CATIE has 18 professionals with an academic degree in economics and social sciences:

- * Two of them are in charge of administrative tasks or representative and do not carry out research or teaching;
- * Only one scientist in agriculture micro-economics participates in Program I (IPM Project);
- * Seven economists and one extension specialist are involved in research in forestry and agroforestry production in Program II. But there is no scientist in economics and social sciences working in the animal husbandry or annual crops areas of the same Program;
- * Three economists, one sociologist and one anthropologist carry out research work in Program III (one of the economists is Director of the Program);
- * One economist and one sociologist have been transferred to the new Socio-economics Unit. The Head of the Unit has experience in agricultural policy analysis and has been recently appointed as Program II Director. The sociologist works directly in a project in Guatemala.

The Team does not recommend additional human resources in the field of economics and social science. However, the distribution of these human resources among the different activities needs to be reviewed. The present distribution represents a large concentration of professionals in the agroforestry and natural resource projects, while there is a need for scientists in the livestock systems and marketing studies.

3.4.4.4 Issues and Assessments

Very little socio-economic research has been carried out at the macro level and CATIE has no comparative advantage at present in this field.

CATIE has very little experience in marketing studies and in some cases had to hire specialized consultants in this matter. CATIE has not invested human or financial resources in sectorial analysis by items of production, taking into account the chain of activities that are developed beginning with the supply of input up to the trading of the products in different markets. CATIE has not carried out macro-economic studies either in order to evaluate the impact of agriculture policies and programs for agricultural development on the national economy and well-being of its inhabitants.

Nevertheless, the socio-economic analysis at the macro level is important in order to understand the problems of the agricultural sector and of the natural resources of the Central American and Caribbean region. Consequently, it is also important in the design and the implementation of the long-term research and educational strategy for CATIE. The research in socio-economics at the macro level is necessary so CATIE may design technological options in order to obtain an accelerated and sustainable agricultural development in the region. Not having comparative advantages in the field of socio-economics at the macro level, CATIE must interact with other institutions of the region and other international centers. The new Socio-economic Unit has just recently started doing so, through a mutual work with the University of Costa Rica and IICA on the sustainability concept, but it is still not enough.

The scientists in economics and social sciences that work in CATIE's different interdisciplinary projects, often handle similar tools, but have very little opportunity to exchange ideas related to their problems and methodology difficulties. There are some informal methodological exchanges with results that unfortunately were not published and that the institution cannot really capitalize. It is recommended that the socio-economists help to organize and systematize those horizontal exchanges in order to develop a synthesis in this matter.

The socio-economists will also have an important role in designing courses on economics and social sciences of the two MSc degrees, in close relation with CATIE's Academic Committee and scientists of these disciplines.

3.4.4.5 Recommendations

It is recommended that CATIE strengthen research in economics and social sciences and its full integration to the interdisciplinary programs and projects of the institution.

In relation to economics and social sciences, it is well recognized by CATIE staff that at the farm level the scientists must put emphasis in the relations that exist among the socio-economic conditions of these farmers, production systems and the economic results obtained in the production units. The inter-disciplinary work for in the pilot areas offers a good opportunity to implement a major integration of the research developed at the farm level with that carried out at the regional level.

As far as economics and social sciences is concerned, at the macro level the socio-economists will have to establish and maintain close ties with the national universities and international research centers which have a comparative advantage in this field such as IICA, IFPRI, and CADESCA. These close ties are needed to help CATIE establish research and educational priorities and really take into account the needs and economic conditions of the region.

It is recommended that CATIE concentrate its scientists in economics and social science among the different activities. The Team recommends the appointment of the following socio-economists as soon as possible, although these would come from re-distribution of staff:

- One economist specialist with studies in marketing. He will be in charge of developing research on the opportunities and requirements of the export markets for the perennial crops, and the promissory character of the non-traditional crops (Program I);
- One agricultural economist, with experience in livestock, to work in the animal husbandry area (Program II).

3.5 PROGRAM III. Integrated Natural Resources Management

3.5.1 Mandate

Program III focuses on: 1) providing general biophysical and socio-economic information on integrated regional resources management; 2) planning for the appropriate

utilization of regional resources as a basis for developing sustainable production systems; 3) providing information and assistance related to resources conservation (soil, water, natural forests, biological diversity); and 4) conducting research on resources management. Such a broad mandate requires the application of the systems approach outline in the Introduction. Furthermore, the necessity of utilizing many state-of-the-art technologies (e.g., geographic information systems [GIS], simulation modeling, remote sensing, and other compute-based technologies) to achieve its mandate requires that this program have full capability in these areas. This capability can only be achieved through complete integration of these technical capabilities within CATIE and establishments of working linkages to current developments in these areas of expertise. This latter case can happen only through strong collaboration with institutions that possess these capabilities.

The ERT cautions that programs of the breadth of this one are always subject to criticisms of superficiality, lack of scientific rigor, and inadequate replication. However, management strategies, political and development policies, and human social systems all are organized around whole systems at these multi-dimensional scales and, thus, research, education and training, and political outreach must be applied at the same scales.

3.5.2 Current Status

We have reviewed the areas of Program III in the context of the conceptual model described in 3.1 which we believe is consistent with the strategic plan Facing the Challenge. The areas are 1) agrometeorology, 2) watershed management, and 3) conservation of natural resources for sustainable development.

3.5.2.1 Agrometeorology

The agrometeorology group is currently in a state of flux and uncertainty about the appropriateness of their location in Program III and their future programs. Their relationship to national programs is less clear now than in the past apparently due to reduced financial commitment by donors and participating governments. In the past the focus of the group has been to provide basic meteorological and climatological information for development of irrigated crops and to train extension personnel in the use of that information. These efforts have been viewed as helpful and successful within the countries where the activities have been performed.

New funding is pending that will have a profound influence on continuity of personnel and level of resources required to accomplish meaningful research and educational activities.

The value to Program III of a strong meteorology/climatology group cannot be overstated. Climate and weather as expressed through temperature; rainfall amounts, timing, and intensity; and evapotranspiration are vital for both fundamental physical descriptions of ecosystems and for developing predictive models of the outcome of new management systems of the sites, farms, and landscapes. It is recommended that the current objectives of the agrometeorology activities be examined to determine if they will allow for this more expansive view of their work.

Important strengths of this group, in context of Program III, are climatology and meteorology and their knowledge of the techniques of geographic information systems (GIS), simulation modeling, and remote sensing. For progress to be made in the area of whole system integration at site to regional scales these techniques describing climatological interactions with ecosystems, are essential. Successful use of these tools will be essential if Program III is to successfully accomplish large-scale whole ecosystem analyses in Central America. These capabilities should not be diverted into narrow specializations and projects but rather it is recommended that they should be integrated into the Watershed and Conservation activities.

3.5.2.2 Watershed Management

The watershed management activity is currently in a state of reorganization with staff members from both the old watershed group and several recently hired members. The group is currently seeking its own identity and developing its own internal dynamics. As with the agrometeorology group, the groups future depends largely on new, as yet uncertain funding. The groups legacy of old images of both watershed science and management and land-use planning will need careful attention to create a new modern image that is more in keeping with other large scale development and ecosystem research, planning, and management activities around the world and that is consistent with the stated mandate of CATIE.

The goal-oriented concept (i.e., development of water projects for either or both quantity and quality) of watershed management must be greatly enhanced to

include the concepts of rational and sustainable development of land-use practices at the level of individual farms and other enterprises within the focus watershed and other interacting landscapes. The current makeup of the watershed group seems to have the background to provide such an expansive outlook but they have yet to work together and to successfully demonstrate their viability as a group.

The special strengths of the watershed group are their multi-disciplinary composition, general agreement with the mandate of CATIE, their apparent agreement on a strongly systems view of science and application, and their recognition and some utility with analysis techniques, like GIS and modeling. The group also recognizes the enormous value of remote sensing information when properly integrated with other kinds of land based data.

Great potential for this group lies not in traditional watershed management but rather in its unique role in integrating across farms, forests, natural (or conservation) areas and other land-uses within landscapes with multiple but realistic goals in focus. For example, development of reliable and clean water supplies must occur simultaneously with development of economically sound farming systems, and conservation of as many native ecosystems (genetic diversity) as possible, development of off-farm market products such as handcrafts, etc. To accomplish this potential this group must work well not only within itself but also with others in CATIE, governmental agencies, donor groups and others. The Team recommends that this group become the organizational model for integration.

The group will need encouragement and close facilitation by management to progress from a multi-disciplinary group to an inter-disciplinary team. If successful, they can become a forceful model for interdisciplinary team development that focuses around a strong and relevant theoretical and practical systems philosophy.

3.5.2.3 Conservation of Natural Resources

Current world-wide concern about the destruction of tropical forest ecosystems represents a splendid opportunity, if not responsibility, for Program III and CATIE. Many governmental and non-governmental organizations, including CATIE, are actively involved in ecological, social, economic, and political research and analysis in Central America but there is little, if any, coordination and integration of those activities.

At one extreme, on-going work in Program III is focusing on the use of entire natural landscapes by indigenous people with the goal of enhancing the use of natural products for both local consumption and as valuable export crops such as medicines and handicrafts. Less extreme applications of conservation practices are use of various non-extensive forms of "agroforestry" and conservative utilization practices intermixed within natural ecosystems with the goal of producing valuable products while preserving fundamental ecosystem functional and structural characteristics.

At the other extreme within the activities of Program III is work with non-indigenous people who tend to exploit the forests to a much greater extent than indigenous people thereby threatening loss of the fundamental ecosystem functions. Current objectives of activities with these people are to develop, suggest and demonstrate non-wasteful utilization of forest products, economically viable alternatives, and techniques of land utilization that are less harmful to the fundamental ecosystem properties than traditional methods.

3.5.3 A Model for Implementation

Program III staff, currently, are playing a vital and successful role in facilitating coordinating, providing technical assistance, and providing logistic support for several projects in Central America. These roles are greatly appreciated by researchers and technicians in the field and are of great value to the donors. These current roles, as valuable as they are, should only be viewed as a step toward developing a major CATIE based program in conservation development.

Lacking in this conservation activity (in Program III, and indeed much of CATIE) is a well defined conceptual framework into which the vital components of the biological, physical, social, economic and political realities are all integrated. The apparent reasons for the lack of an integrating concept is that thus far the conservation

activities in Program III and, indeed, other organizations, are in their intellectual infancy; they have been in response to specific donors who have had their own goals and objectives; CATIE has not yet initiated major program related projects; the staff are not trained in some of the important fundamentals ecosystem science even though they are integrally involved with ecosystem concepts; and the interactions of Program III staff with other staff of CATIE has focused on solution of specific problems rather the central, integrating concepts.

Great potential exists for CATIE for building upon these relationships with current donors, especially if CATIE elects to aggressively pursue funding for well conceived, conceptually sound, and well integrated projects. Much stronger linkages with personnel from agroforestry, sociology, and economics as disciplines and the expertise from a viable landscape use analysis (watershed) group within the framework presented above in Fig. 1 or some similar framework will further strengthen the position of CATIE in taking a major leadership role in Conservation for Sustainable Development in Central America. Conversion of this potential into accomplishment will require a strong programmatic focus so that projects will be integrated from conception rather than being a haphazard assemblage of independent activities.

3.5.4 Recommendations

3.5.4.1 The ERT recommends thoughtful development of a conceptual framework within Program III with the focus of Land Systems Integration. This conceptual framework would use general systems theory as its overall guiding paradigm and hierarchical ecosystem analysis which fully incorporates the social, economic, and political realities into analysis and application as its operational focus. The goal for this new area of emphasis would be to integrate and synthesize knowledge, both existing and original, from any appropriate hierarchical level using necessary contemporary technology to analyze societally relevant at problems at the landscape and regional levels of reality.

3.5.4.2 The framework would build upon existing strengths in the areas of natural resources, farming systems (especially agroforestry), tropical crops, education, and relationships with member countries and other institutions and organizations. This effort can be greatly enhanced by development of strong working relationships with other institutions that already possess some of the needed skills and technology.

3.5.4.3 The development of the conceptual framework for Land Systems Integration would begin with the formation of a "Land Systems Working Committee".

Under the proposed organizational structure, this committee would be appointed and have its guidelines set by the Management Team. It would integrate appropriate persons from Programs I, II, III, and Socio-Economics and be chaired by the Director of Program III. The committee should establish well defined objectives and a specified time frame. If progress and interest is insufficient to sustain the activity, the committee should be dissolved.

CHAPTER 4. EDUCATION PROGRAM

4.1 Graduate Program

4.1.1 Background and Objectives

The graduate program in agricultural sciences and renewable natural resources was initiated in 1942 when the institution was founded. In subsequent years, the evolution of the graduate program followed that of the institution. In 1973, the degree-granting Master's program became a shared responsibility of CATIE and the University of Costa Rica. This continued until 1983 when a new contract was signed with IICA and the Government of Costa Rica granting CATIE legal status as a separate regional, degree-granting institution. In 1988, the Inter-American Board of Agriculture (IABA/JIA) expanded CATIE's responsibility to all members of the Inter-American system making CATIE's graduate education role a continental one.

CATIE's graduate program provides qualified Master's degree training for the Latin America and Caribbean regions in the areas of:

1) Production Systems

- a) Tropical Livestock
- b) Silviculture and Agroforestry
- c) Tropical Crops
 - Crops Improvement
 - Crops Protection

2) Integrated Management of Natural Resources

- a) Watersheds
- b) Wildland areas

4.1.2 Students

From 1947 to the present, CATIE has graduated 962 Master's degree students with another 113 students enrolled. Over the past 10 years, the number of students per class has increased from approximately 30 to 58. The institution has a capacity of 75 but is limited by the number of scholarships available. In 1989 only 13% of the students had their own funds. The students have come from a large number of countries. Of the total graduates, 36% have come from other countries while 67% of the current students are from CATIE countries. CATIE must be conscious of having some country balance among students, as there are some complaints that one country gets too large a share of the MSc positions.

There is a lack of unconditional fellowships (not related with programmatical or geographical conditions).

The quality and abilities of the students is of continuing concern. In 1986 CATIE established an entrance examination that all applicants must take. This examination accounts for approximately 50% of the entrance score. Other factors are university grades, professional and science experience, commitment, and letters of recommendation. Applicants are supplied with adequate material as to what curricula are available, what is expected of them, and an examination study guide. The examination is given in all Latin America and Caribbean countries through the CATIE or IICA offices. The examination content is evaluated by professionals for its appropriateness.

It is believed that the examinations have increased the quality of the entering students and that improvement will continue. The number of applicants has continued to increase to a present level of about 240 per year. Of the applicants, about 67% take the examination, of these approximately 55% pass the test and on average 65% of these will register. The ratio of men to women is about 80/20.

The initiation of the entrance exam plus the involvement of REDCA in some countries has greatly strengthened these countries' participation. Since students are chosen on a qualification basis, this allows the countries that choose to do so to help identify, motivate, and assist qualified students. Some countries have even developed a system for helping students prepare for the examinations and to enter CATIE.

The students usually have 4-8 years of experience beyond their undergraduate training with an age range of 28-36 years. Some 50-60 percent of the students are married and have an average of two children. No students are admitted directly from their undergraduate program. A small number of special students do study at CATIE, but these are usually persons conducting their research at CATIE while still graduate students at another institution. A reasonable set of requirements have been developed for these students to be accepted. Most CATIE students do return to their place of employment after graduation.

The course study and thesis is planned as a two-year degree program. Over the past two years, about 40% of the students have completed their degree within 27 months. Of the entering students, only about 6% do not finish.

4.1.3 Curriculum

The curriculum is based on 67 courses which is a reduction of some 30 over the last few years as the program has been revised and up-dated. Of these courses, six are required and account for 13 of the needed 40 credits. The program is a system of four quarters of 12 weeks each so students will normally take 3 or 4 courses a quarter. The course work is taken in the first year of the program with the second year being for research and thesis. A qualifying examination, a thesis, and a minimum grade of 70% are required.

Each student has a major advisor and an advisory committee. The goal is to identify these early in the student's career so the research subject can be identified and the rapport between the student and faculty developed. It was observed that more attention needs to be given to having the advisors appointed as soon as possible and to the better organization of the course schedule with fewer changes during the year.

Students and advisors are encouraged to choose a research topic that can be conducted in the student's home country. This is not always possible but when it is, a local advisor as well as the major professor guide the work. Such programs benefit all parties concerned and are of major benefit to the country. All thesis research must be approved by the student's committee. Since the research advisors and the teachers are members of CATIE's research programs, the courses and research appear to be well integrated with the research programs, with the exception of socio-economic programs which are not always included in CATIE's programs.

The goal of the graduate program is to teach the scientific method and, in so doing, benefit all concerned. Some students expressed concerns that need to be considered and include:

- Some of the courses are lacking in rigor and are not as advanced as they should be.
- In many cases, the thesis work needs to extend over more than one year.
- Some professors are not available for advising or teaching.
- Some students did not realize they would not be able to study in the area of their choice.

All of these concerns need to be evaluated and, if true, need to be corrected.

In our opinion, it is better to have too high than too low expectations in a course. All courses need to be examined for their relevancy. In some cases, it may be appropriate to allow students to test out of a course. It is important to start the thesis research as soon as possible, even if it is at a moderate level of intensity. This gets the student involved, gives more time for data collection and, if necessary, allows for changes. In some cases, it may be necessary to plan on a longer-than-two-year degree if that would enhance the thesis and its usefulness. This would more than likely be contingent upon both the home country and the employer being willing to allow the students to return to their positions and also work on their thesis.

If students are to be unable to study in their area of choice due to conditions of the fellowship, they should be informed before they arrive so they can decide whether or not they want to attend CATIE.

There is some feeling among students and staff that the socio-economic aspects are still weak but have been improving and are becoming stronger. Three additional aspects need strengthening. One is that a greater sociological and anthropological component of the countries and their people, and how that affects changes and development is needed. Secondly, that the region needs a larger agriculture and natural resources policy capability and that should be at CATIE. Thirdly, there is a need for more macro-economics (marketing-agricultural policy).

The programs in many ways deal with several environmental issues but there does not appear to be an environmental focus and such a focus should be considered.

The problem between the University of Costa Rica and CATIE covering the awarding of the degree and diplomas needs to be resolved. Some people believe that, either by student pressure or legal means, the issue could be settled but that could be inappropriate and could cause further differences. Rather the responsible individuals should be able to work out an agreement that meets the needs of all. This should be done as soon as possible.

Continuity of faculty and programs is of concern. This is particularly true for faculty. Both the graduate students and in-country technicians felt that lack of continuity was a major deterrent to them, their programs, and CATIE. Greater effort by CATIE, donors, countries, and the Board of Directors needs to be made to create as much stability as possible.

Consideration should be given to longer than two year contracts with satisfactory service. For example, after the first two years have been completed satisfactorily (based on an annual evaluation) a three-year contract may be signed, after that, a four-year and so on until a maximum of a five-year contract is reached

4.1.4 Student Affairs

CATIE's higher education program has done an excellent job of collecting and analyzing student data and has a good student affairs and admissions program.

A good student tracking system has been developed and is going on-line. A Student Council is in place and seems to be functioning and interacting reasonably well. Courses are evaluated by students each quarter. The graduate record system is being updated and a survey of graduates is being planned.

Facilities have been markedly improved over the last few years. Student housing is good, classrooms appear to be adequate and of higher quality, some additional laboratory space may be needed and a more ready supply of chemicals and materials is needed, and a modest stores and bookstore should be considered.

CATIE and its environs provide rather limited opportunities for social and athletic activities for students. The International Club and planned activities are important for students, faculty, and staff. Such activities need to be maintained and enhanced, as appropriate, and as the users are willing to plan and participate. Since facilities for use at night or during inclement weather are not available, lighting for the gymnasium may want to be considered. In the future a facility for cultural and social events will need to be evaluated.

4.1.5 Alumni

With some 1,000 graduates, CATIE has the opportunity to benefit from the involvement of its former students. Over the last year, a number of country alumni associations have been formed, both CATIE and the graduates are to be commended. These are being expanded into other countries. Such associations can accomplish a number of things including suggestions for strengthening the research and training programs, assisting in-country development by proposing and assisting with projects and by working with in-country agencies and institutions to further CATIE's goals, and to assist new graduates.

For these associations to succeed, they will need nurturing and guidance; this should come from the CATIE representative in the country. Each association should probably have its own constitution and by-laws. The international CATIE Alumni Association should consider periodic meetings. CATIE should look into the feasibility of an alumni newsletter to keep the graduates informed as to programs, activities, new faculty, and specific country activities.

The alumni can be an important factor in the continued development of the individual countries as well as of CATIE.

Graduates of CATIE are generally pleased with the quality and appropriateness of the training received. This is reinforced by their employers who believe CATIE graduates are equal to those trained in other countries. That the alumni are capable and qualified is testified to by the number who have assumed highly responsible positions in their countries.

4.1.6 REDCA (Regional Cooperative Network for Education in Agriculture and Renewable Natural Resource)

In 1986, CATIE initiated the formation of REDCA. This has now grown to some 73 public and private institutions of higher education, ministries of agriculture, research institutions, and national councils on higher education of the member countries. It is recommended that the growth continue as appropriate. Through this network, CATIE seeks to strengthen the national research and education programs and institutions. In doing this, it promotes cooperation and the exchange of information and ideas among all of these institutions.

Although CATIE was the reason for the establishment of REDCA, in reality, REDCA should be a collaborator and channel for CATIE's activities. By institutions working together, both within and between countries, they will foster the need and support for an institution, such as CATIE, to serve their needs that goes beyond what individual countries can justify or where the needs are similar among several countries. Such networks also optimize the use of resources and minimize duplication of effort.

However, caution must be exercised as there is the potential that REDCA will ask CATIE for work for which it has little or no capability. This could result in the dispersion of CATIE's resources and capabilities. CATIE must be sure that the countries are aware of its capability and resources.

REDCA appears to be working well. The country components are bringing institutions together, they are

focusing on important issues, and they are very pleased with their interaction with, and response from, CATIE. The assistance CATIE has provided in curriculum development to member institutions in a few cases is excellent and should be continued. Similarly, REDCA has had some input into CATIE's graduate curriculum development. The CATIE representatives are very important in these endeavors, as are the individual agreements between CATIE and the individual members of REDCA. To date, REDCA has functioned largely at the country level. As the organization grows and matures it will likely become more involved with specific areas in the country.

The three major components of REDCA are (1) the General Assembly, (2) the Academic Council, and (3) the individual country components. In several cases, the individual country components are working very well and will serve as models to help strengthen those in other countries. The Academic Council has a representative from each country and meets at least once a year at the time of the General Assembly meeting. The General Assembly, composed of representatives from all the member institutions, meets yearly. These meetings are of utmost importance as they allow the representatives to learn what is taking place in other countries and helps build the necessary interaction.

It is important that both the General Assembly and the Academic Council be asked to assume, and do assume, substantive roles and interaction with CATIE. For example, the General Assembly should discuss its structure and the component roles, how do they assist member countries in strengthening their program, how do they assist in the interaction with donor groups. This means the Assembly has to play a major role in the annual meetings. The Academic Council should be familiar with, and make recommendations on, how to strengthen the graduate and training programs.

It is recommended that the General Assembly consider whether or not a Research Council might be needed to interact with CATIE on the direction and scope of its research programs. To date, the research is largely planned by CATIE and donor groups. It would seem that a Research Council of REDCA could assist both in advising on programs and priorities and, also, assist in gaining support from national organizations.

REDCA is, and can be, a major factor in building a Central American network of institutions to strengthen research, education and economic development in the region. There is no better way to do this than to have a cross-cutting common project. Such an endeavor, if guided properly, can bring people and organizations together for a common good. The donor groups should consider such undertakings in each

country in addition to their specific projects. REDCA and CATIE can foster and be a major player in such endeavors.

4.1.7 U.S. Universities Collaborative Group

CATIE has developed a program of collaboration with seven universities in the U.S.A. This group is still evolving, but it does appear to be providing a forum for discussion of issues and needs, and is fostering an involvement of these institutions in Central America and with CATIE.

Such a group is important and it is recommended that this development be continued and expanded, including the consideration of a European collaborative group. Such expansion is probably the most realistic way for CATIE and its member countries to capture the new and emerging technologies. This expansion might occur through CATIE and some of the members of the collaborative group working together to develop initiatives in key areas, and then working together to secure funding.

4.1.8 Research and Education Linkages

In general, the research and education components of CATIE interact well. The graduate areas are based on the research program areas, and the faculty, in most cases, are involved in both the research and teaching programs. In many, if not most cases, the thesis projects are associated with a research project. Some suggestions are appropriate to further strengthen these linkages.

For any system to work well, the people in that system need to know what is expected of them and how well they are reaching those expectations. CATIE does not have a faculty evaluation system. Such a system needs to be developed and it must include an education component, and faculty must receive credit for their involvement in the education components of CATIE. Such a system should also help keep a person's workload in proper perspective. It is important that the time commitment to education be kept in balance and that some faculty not be asked, or allowed, to assume a disproportionate teaching or advising load. It does appear that this may be the case with a few faculty members. An important part of a teaching faculty evaluation is input from the students. Since the courses are evaluated by the students each quarter, these evaluations need to be part of the faculty evaluations.

Most, if not all, of the theses are written in the traditional format. This is labor-intensive and is not conducive to publication. All theses should be written in publication format, by chapters if appropriate. The thesis or chapters should then, with little modification, be ready for

manuscript submission. This should greatly increase the publication output of the students and faculty, make better use of the results, and gain greater recognition for CATIE.

Two administrative changes would greatly strengthen CATIE's education program. Currently, the education program is operated as a vertical program rather than a horizontal or cross-cutting program. For the education program to gain the integration needed, it should be an integral part of each of the program areas. Thus, the three program directors should have primary responsibility for the education program. This would probably require that a Deputy Director General for Research and Education assist them in coordination.

The second change would be to have as many split appointments as possible. The faculty involved in the education program should receive a proportionate share of their salary and support from the Higher Education budget. This would make them feel a part of the program, have some ownership and, in turn, they could legitimately be called on. Such split or joint appointments would also provide the mechanism for faculty to teach beyond their specialty and thus, more adequately cover the course needs of CATIE.

4.2 Training

An important part in the development of people and of a country is to provide the opportunity for people to continually improve their skills and abilities. This is a major role of a research and training institution such as CATIE. CATIE's training program is very well received by the countries. They feel that they have meaningful and adequate input into the nature and content of the training program; they like having the course offerings both in-country and at CATIE (currently about 45% of the programs are at CATIE and 55% are in-country); and, they appreciate the willingness of the specialists to assist them in many ways. In short, CATIE is respected and appreciated in the countries and they express strong support for what CATIE is, and has done, in its education programs.

The training program has three basic components: (1) short courses, (2) in-service training, and (3) technical meetings. Most people felt the mix of these was appropriate and probably about as good as could be expected in view of the constraint of funds.

CATIE has developed an excellent system for assessing what should be offered each year. Three types of assessment are used:

- (1) Estimation -- is it time to transfer some knowledge that is new or appropriate to a situation?

(2) Need -- the community is canvassed as to their needs. Country components of REDCA are a major part of the survey each year.

(3) Demand -- some unanticipated event occurs that requires some specific training. These might include: a new project or an unanticipated production problem.

This system appears to be working well and appropriate forms have been developed. The program and the education component in general does need to exercise caution not to become form- or committee-driven.

For training programs to succeed, they must have a good science base and support from the countries. This seems to be the case with CATIE's training programs. Training at CATIE headquarters can be important because of the facilities and because it provides the opportunity for trainees to meet and interact with CATIE's professional staff.

The Team recommends that the real costs of the graduate and learning programs be determined. This would greatly facilitate planning and budgeting and would place CATIE in a much better position to solicit funds. At the same time, a better balance of salary and operating funds needs to be sought.

4.3 Additional Recommendations

As appropriate, suggestions and recommendation have been made in specific parts of this chapter. Some additional recommendations are given below.

Socio-economics. At all levels and in all programs, the issue of socio-economics was discussed. These included: more socio-economics in the current graduate program, the need for policy analysis and alternatives, greater marketing capabilities, more sociological research and teaching, and more project evaluations. It is recommended that the current economics in the graduate program be maintained, but that a larger component is needed and that it needs to be an integrated program as it is now.

We also believe that there is a need for an MSc program in Central America dealing with the many aspects of socio-economics that would include the afore-mentioned subjects. CATIE does not have the capability for offering such a program. On the other hand, it does have the technical capabilities that have to be part of any socio-economics program. They also have a small core of socio-economic scientists that are working well with the program areas.

We recommend that a joint program be initiated between CATIE and some institution that has a comparative advantage in this area. Preferably, that institution should be in Central America. By combining CATIE, another institution, and the REDCA network a strong program could be developed. It would have the mechanism to identify the key needs in the countries to provide specialists to present intensive courses in specialty areas (e.g., 2 or 3-week courses) so that existing experts from REDCA institutions could participate. All the ingredients are present for a strong program. If such a program is started, it must build upon CATIE's successes, strengths, and continue the innovation of new ways of programming. It must not be allowed to become territorial.

In situations where the long-term science problem-solving capability is not fully developed, or where instability in government occurs, an outside organization can often serve as a catalyst for cooperation, integration, and cohesion. This is the role CATIE has played through REDCA and the Team recommends that REDCA be continued and strengthened. The country representatives now play a key role in the development of relationships between CATIE and REDCA. They should continue this role for the immediate future. This is important so they will know and understand the countries' needs, problems, and people and provide the day-to-day contact to allow REDCA to succeed. The Team recommends that CATIE serve as the catalyst to work with both the General Assembly and the country REDCA's to develop funding for programs of mutual interest.

There is a great need for additional and unconditional fellowships. CATIE and the countries need to maintain and increase their efforts to enhance these funds. There is also need for some funds to enhance fellowships that may not provide all the resources for the programs. An example is travel to conduct an in-country thesis.

The Team recommends that CATIE investigate the possibility of establishing a foundation. Such a foundation could help solicit and handle gifts, endowments, scholarships, and revenues from patents and copyrights. Along with this, a policy on assignment of rights and royalties from faculty patents and copyrights needs to be developed. As a forerunner to a foundation it is recommended that CATIE form a Research and Development Committee composed of selected individuals from research, education and management to further guide CATIE's development and policies on these issues.

For any program to succeed, the best people possible must be hired and retained. Then, as much assistance as possible needs to be provided. CATIE needs to work towards a better balance between its operation and personnel budgets (now the percentage of funds in personnel is too high). It is also strongly recommended that all scientists be appointed and paid as international scientists on a comparable basis, regardless of nationality. It also must be

recognized that in order to hire the visionary scientists that are needed from time to time, that salary distortions may be necessary.

CHAPTER 5. COMPARATIVE ADVANTAGE, PRIORITIES, AND STAFFING

5.1 Comparative Advantage

A research and education institution operates most effectively in those areas where it has a clear comparative advantage over other agricultural research and education institutions operating in the same region. This is particularly important for an institution that has a regional mandate and is to specifically serve selected countries. CATIE must seek to utilize this comparative advantage in Central America and the Caribbean and strive for excellence in those where it has such an advantage.

The Review Team, after analysis of CATIE's existing programs/projects, discussion with staff and observations in the region, believes CATIE to have a comparative advantage in the following areas:

- * Tropical Crop Improvement
- * Integrated Pest Management
- * Management of Natural Resources
- * Integrated Systems Management of Agro/Livestock/Trees/Pasture
- * Ruminant Feeding Systems
- * Land System Analysis and Management

The Review Team strongly recommends that CATIE concentrate its efforts in these programs in both Research and Education. The stated goal should be for Productive Agriculture for a Sustainable Environment. The instruments to be used for its execution are the specific long-term plans for the individual programs, and integrated collaboration among the three Program Areas. The program must focus on the specific priority problems of the member countries, as they relate to the areas of comparative advantage.

We wish to emphasize that the instruments CATIE uses must be dynamic and responsive to changes, but yet have sufficient continuity to provide significant outputs. The present stop-and-go nature of projects is very counter-productive! One of the most important instruments that CATIE is using effectively, and must continue to strengthen, is its linkages with National Programs in both Research and Development.

The background, description, and analysis of the existing programs which provide a basis for the selection of these areas of comparative advantage are presented in Chapter 3 of this Report.

5.2 Priorities

The areas of comparative advantage noted above must serve as the priority areas in the formulation of CATIE's research and education programs. In the short run, the Team believes that the ordering of priorities within the areas of comparative advantage must be the combined effort of the Directing Management, including Research and Education, and the Research Program Directors. In the short run, resource availability -- human, financial, and physical -- will be a major factor in the ordering of priorities among the list. However, in the long run, the same group of individuals must order the priorities in keeping with the priority problems of the region and the expected time frame for significant and useful results.

The Review Team recommends that CATIE proceed to establish its priorities within these six areas and to develop a well articulated plan, integrating them into a coherent short- and medium-to-long-term program. This should be the program which CATIE management presents to its Board of Directors for approval and then to the donor community for support of components of the program.

5.3 Staffing

A major challenge for CATIE is for it to establish sufficient continuing resources to maintain a high quality Nucleus Staff. It is the Team's recommendation that CATIE consider the following as its nucleus staff requirements for the areas of its comparative advantage and that it begins to balance its staff accordingly.

A natural grouping of the areas of comparative advantage for staffing purposes as follows:

- * Tropical Crops Improvement and Integrated Pest Management
 - + Geneticist
 - + Nematologist
 - + Virologist
 - + Pathologist
 - + Entomologist
 - + Weed Specialist
 - + Soil/Soil Fertility Specialist
 - + Micro-Economist
 - + Cell Molecular Biologist
 - + Crop Physiologist
 - + Marketing Economist

- * **Management of Natural Resources and Land System Analysis and Management**
 - + Soils System Analyst
 - + Systems Ecologist
 - + Watershed Hydrologist
 - + Plant Bio-Geographer
 - + Economist
 - + Social Anthropologist
 - + Climatologist
 - + Natural Resource Economist (Eco-Tourism)
 - + Silviculturist

- * **Integrated Systems Management of Agro/Livestock/Trees/Pasture**
 - + Farming Systems Economist
 - + Soil Classification Specialist
 - + Silviculturist
 - + Tree Physiologist
 - + Ecologist
 - + Animal Management Specialist
 - + Ecophysiologicalist

- * **Ruminant Feeding Systems**
 - + Animal Nutrition/Physiologist
 - + Nutrition Laboratory Specialist
 - + Animal Behavior Specialist/Ethologist
 - + Animal Production Specialist
 - + Animal System Economist
 - + Animal Health Specialist
 - + Pasture/Tree Management Specialist
 - + Pasture Specialist/Agrostologist

- * **Other Needs for Nucleus Staff and Facilities in Support of the Programs**
 - + Soil-Plant Analysis Laboratory
 - + Biometrics
 - + Information Systems
 - + Modeling and Simulation
 - + Geographic Information System
 - + Data Management
 - + Computer Services
 - + Communication/Documentation Specialist
 - + Organization Management Specialist
 - + Macro Economic Policy Specialist
 - + Germplasm Collection and Conservation
 - + Technology Transfer Methodology Specialist

If CATIE is to be a center of excellence, it must have a high quality staff with sufficient continuity to achieve significant results in research and education in response to the problems of the region. It is only through such a staff, and the achievement of significant research and education results that CATIE will have the necessary credibility in the region it serves and with the donor community, for the continued support it requires.

CHAPTER 6. SUPPORT SERVICES

6.1 Introduction

Efficient support services and an adequate physical plant are basic requisites for a dynamic and effective research and education organization. They facilitate institutional performance and convey an image of efficiency and effectiveness which is attractive to clients and donors. Often, the first contact for a visitor is established through some service action, such as transportation, publications or physical appearance of facilities. Thus, these services also become part of the institutional outreach and image projection. Three important CATIE support services and its physical plant are examined below. They serve to highlight the importance of these areas as a part of the research and education activities of an institution.

6.2 Publications and Information

6.2.1 Background and Objectives

The ultimate purpose of science and education is to solve problems for the social and economic benefit of society and to help people grow and develop to their fullest potential. For any science and education organization to reach these goals, it must have a system for making material and information available in a readily accessible and usable form. At the present time, CATIE has at least five (5) components that work in this area. They are the library, documentation and information capabilities in higher education, integrated pest management, agroforestry, and natural resources. Although CATIE does not appear to have a management policy which addresses publications and information, these units have begun, in limited ways, to work together.

6.2.2 Program Activities

The documentation centers of the IPM, natural resources, and agroforestry projects are producing good material that meet the needs of the technical users. There appears to be some overlap, particularly of capabilities, among these units. The publications produced which are geared toward technicians in their respective fields, include newsletters, manuals, bibliographic material and some journal articles. Few publications were seen that were targeted for use by extension to work with the farmers.

6.2.3 Issues and Assessments

Even though there are many similarities among the crops, geography, and climate of Central America, there are some substantial differences. Some of the publications, particularly manuals, require adaptation to make them more usable for specific locations.

The only video capability the Team saw was that of recent development in Higher Education. This is an important area and will assume greater importance, particularly in work with users who have little or no capabilities with written material. CATIE may not have the responsibility to reach the end user of research and education -- the farmers in the member countries -- but it does have the responsibility to reach those who are working with the end users. Videos are an important tool in the methodology for the transfer of technology. CATIE assists in making appropriate information and material available and assists where appropriate, but the local agencies and people must be the conduit.

It is very important that periodic surveys be conducted to determine the value of the material being produced. This allows for adjustment and improvements as needed.

Computer and electronic capabilities will become increasingly important for the storing, sorting, disseminating, and printing of information. Much of this will be done in a decentralized mode but, a larger capability will also be needed for libraries and bibliographies. CATIE has several data bases which it uses as part of its research and education activities. At present, there does not seem to be a clear institutional policy as to the management of these sets of data. The Team recommends that CATIE, as an institution, develop a management policy on the conservation, management, updating, utilization and control of its several databases.

6.2.4 Recommendations

It is recommended that CATIE develop an institutional policy on publications and information which will facilitate staff and public knowledge on the subject and which will provide guidelines for all staff. Further, it is recommended that the several publication and information units now operated on a project basis be brought together as one CATIE center.

No future project should be permitted to have its own documentation center. In doing this, CATIE must determine and update, on a periodic basis, the role and functions of such capabilities in information management and publishing.

As suggested in several sections of this report, CATIE research and education staff are not publishing in international journals to the extent that their research output warrants. The Team recommends that management encourage its staff to publish more and, when appropriate, to present more invited papers at international workshops and professional meetings than they are now doing. There must be incentives for staff to carry out such activities and recognition of their work in the Institution's evaluation process.

6.3 Library and Documentation Center

6.3.1 Background and Objectives

The Orton Library is a support unit for both IICA and CATIE, through an agreement reached by both institutions. The Library building belongs to CATIE, but the Library is still administered by IICA.

Its objectives are:

- * to conserve, update, and loan the bibliographical collections needed by both institutions in their scientific and educational fields;
- * establish and coordinate a biographical database to serve CATIE, IICA, and national institutions of the region.

6.3.2 Activities

At present the Library offers the following basic services:

- * acquisition and conservation of books and documents;
- * library loans of books and documents to scientist, students, and inter-library loans;
- * retrieval, automation, and dissemination of bibliographical references, and editing and diffusion of bibliographical bulletins;
- * information to users; and,
- * training courses for librarians and users of databases.

The Library currently has 82,000 books and pamphlets and 11,300 specialized scientific periodicals. It is one of the largest libraries in Latin America in the field of agricultural and forestry sciences. The majority of the

titles are in the biology and physical disciplines, with less references in the economics and social sciences.

The Library receives most of its periodicals through the exchange of Turrialba, a periodical edited by IICA. Others are obtained through subscriptions or are publications prepared by several of CATIE's projects. At present, most of the books are purchased through special project funds and are retained in project centers. It is expected that in the future all documents purchased by the projects will be deposited in the main Library after an initial analysis.

IICA is presently funding all Library personnel, but starting next year, part of this personnel will be transferred to CATIE and the Library will be administered by both institutions.

6.3.3 Problems and Recommendations

The coordination between the main Library and information networks or databases managed by various CATIE projects (such as IPM and INFORAT) is very informal and there are cases of duplication. It is recommended that CATIE work on a centralized system for the compilation of bibliographical data. All the projects should cooperate in this effort.

6.4 Computing and Biometrics Services Program

6.4.1 Background and Objectives

Efficient computerized data processing and biometrics support are essential for CATIE's research, education and management functions. CATIE, as stated in its Strategic Plan, proposes to strengthen both services. The Center already has some experience, equipment, and personnel on which to base its effort. The following observations are meant to highlight some issues and areas of consideration in this matter.

6.4.2 Program Activities and Resources

Computers at CATIE are used, among other purposes, for statistical analysis, modeling, data storage and organization, bibliographical references, word processing, and financial management. CATIE has a proposal for installation of a regional information computer network (CATIENET).

CATIE is in the final stages of implementation of a an up to date computerized financial management system, which has been much needed, to assist in the accounting and reporting on its many special projects.

There are approximately 100 microcomputers used routinely in the several program/project areas of the Institution. There is no overall policy on standardization of computers or computer services. CATIE has a central computer building facility, headed by one principal staff scientist and support personnel. It also has one statistician among its principal staff.

6.4.3 Issues and Assessments

The organization of the Computing Services is a part of CATIE's Strategic Plan. In its present initial stages of implementation, it is looking for means to reach its goals as described in "Facing the Challenge".

The implementation of the computing services in CATIE's administrative operations (SIIF System) is slow. The limiting factors are of an organizational nature i.e., the organization of files and their interaction. For example, the files on personnel management and accounting do not yet have an interactive relationship. Training of personnel for more effective use of the available systems should be given high priority. Personal computers work in an individual manner with low usage rates. Therefore, on-going training of administrative personnel working on data management is recommended. This, in turn, should facilitate the services provided by management.

"CATIENET" is to offer the services of electronic mail, file transfer, remote processing, and access to CATIE's databases. The Team does not see this as a high priority item and recommends that CATIE first establish its policies and internal procedures before it attempts to start CATIENET. The problems with the implementation are found at another organizational level, which is linked to the management of CATIE through the projects, and not through the programs as would be desirable. In practice, this means that each project develops its own data management system, with its own differentiated levels of organization and without feeling the need to share information at other levels.

The co-existence of data bases from the projects within the central computing system is useless, unless the tools to inter-relate the files and the common fields exist. This means that an internal information network must be achieved before it can be opened up to the Central American and Caribbean region. This organizational stage must be developed jointly through the program directors and the project leaders operating under clear policy guidelines from management.

A first stage to test an electronic mail network to improve communication services among the member countries could be through RACSANET. However, such an investment could lose its appeal if information is not available in a timely

manner. This means that the internal information must be organized before more powerful communication tools are provided.

Less than 20% of the documentation references in the IICA/CATIE Library have been entered into a bibliographic database using the "MICRO-ISIS" management system. This partial result includes only references on coffee and cacao, thanks to the thrust provided by institutions interested in the rapid management of this information. But, neither the material infrastructure nor the human resources are sufficient to continue entering all other references into this system. However, the Team recommends that highest priority be given to the completion of the Library data base, and to providing physical facilities to be able to take advantage of, and update, the information available with the use of the "MICRO ISIS" system. Therefore, financial support on a regional level, which can be amply justified, must be made available as soon as possible, in order to complete this high priority work which has already been initiated.

A generalized and systematic precaution in the management of files and programs within CATIE's central computing system must be kept in mind, in order to avoid loss of information caused by the presence of "Viruses".

The training of personnel in computer sciences and in the management of "statistical packages" such as S.A.S., etc., must be additional priorities for the computing center. It would be advisable to use the old IBM 4331 computer for this purpose and, thus, free the new computer for CATIE's data management. In addition to training personnel in the use of operating systems and in the use of the most common word processing, electronic spread-sheets, databases, and graphics "packages", CATIE's technicians and scientists will achieve enormous flexibility in their work if they are trained on systems for the exchange of data within packages, and in the management of a programming language (Pascal, C, Expert Systems, etc.)

CATIE's Biometrics and Statistics Office is providing training for students in the area of Biometrics and in the use of statistical packages. However, the importance of this office for CATIE's researchers is diminished since almost every project develops its own statistical data analysis system, with the occasional participation of a computing specialist to provide some assistance. Without wishing to minimize the importance of the need for computing services within projects, a duplication of investment in personnel, and computing sciences materials and biometrics does exist which must be analyzed and reduced at the CATIE institutional level. The Team recommends that management appoint a committee of

users of computer services to draft a policy and procedures for computer services of CATIE.

In the future, the Biometrics and Statistics Office must broaden its service to include data and management and analysis of knowledge. The goal is to improve the experimental designs in order to study the inter-actions between components of the production systems and to analyze the knowledge and data through models and expert simulation systems. These relevant experiences already exist at CATIE and can be used and adapted.

To describe the Computing and Biometrics services without mentioning the "MIRA" forestry data base would be incomplete. A broad knowledge concerning the management of this forestry data system already exists, and at this level of evaluation one can, in a few words, summarize its importance and project it into the future.

The "MIRA" data base is regional and has four large components: silviculture, soil-climate, socio-economics, and extension. Data has been entered on more than 10,000 plots of land (more than 32,000 measurements of approximately 150 species). The socio-economic data is more of a micro-economic nature concerned with direct costs, and the extension section facilitates the information needed to analyze the extension and research activities.

In the future, the "MIRA" regional forestry database should provide support for research and monitoring of projects. There already exists an international move to have the forestry databases make their variables and measurement media more homogenous, and to inter-relate them with other information systems. CATIE, through its "MIRA" system, should always maintain the international levels of recognition for this work in order to keep it up to date and to open it up to the possibility of its being integrated as a tool for the management of the natural resources.

6.5 Physical Plant

6.5.1 Overview

CATIE's center of operations is located adjacent to the city of Turrialba, Costa Rica. It is located on 940 Ha of land in one of the most productive areas of the country. Its campus comprises administration, research, teaching, meeting, housing, recreational, agricultural production areas, and support services. The central physical plant of the campus contains at least three main activity areas, as follows:

- * The campus core is made up of the main administration building (which includes a few support facilities) and research, teaching, and library facilities, and student housing.
- * A faculty housing area has been developed contiguous to the above. It includes recreational facilities and an elementary school.
- * Experimental plot areas, tree plantations, and the world-renowned cacao and coffee collections. A commercial production farm is also operated by CATIE which is dedicated primarily to livestock, sugarcane, and coffee. In addition, CATIE also operates an important 80 Ha cacao research facility, located about 40 miles north of the main campus.

6.5.2 Facilities, Resources, and Staff

CATIE has maintained and developed a significant physical plant. This includes some 100 small and large buildings and related structures, covering approximately 50,000 square meters of construction. Their estimated value is US\$6.0 million. A small maintenance unit cares for buildings and grounds at the Center. The maintenance budget is US\$70,000 for 1990. The Center also formulated a Master Facilities Development Plan in 1985-86, that serves to guide its growth. In spite of recurrent financial difficulties, the institution has managed to provide limited maintenance to its physical plant to keep up its appearance. Many more resources are required to carry out essential maintenance and repairs to eliminate deterioration of this important facility.

6.5.3 Issues and Assessments

CATIE has a good basic physical plant which provides excellent research and education facilities for the Central American region. It has a long term plan and management is aware of the need to regularly revise and update this plan.

As has been noted in the External Management Review, it is recommended that CATIE establish a section for Physical Plant Services with a well qualified technical head. Also, CATIE must have increased funding for this section or it will not be able to maintain the essential teaching and research facilities to serve the Central American region.

6.5.4 Recommendations

As noted before, a physical plant service section should be developed with appropriate staff, facilities and equipment. This section should be oriented and supported by an institutional-level committee, with responsibilities for

setting policy, advising, and deciding on major physical plant issues.

Yearly budgetary provisions for physical plant maintenance should maintain a level that permits adequate upkeep of the facilities. CATIE's physical plant reflects in part the institutional culture and life of the Organization.

The Team recommends that management and the Board assure that this asset is maintained and developed, in accordance with the level of functional excellence sought for the various components of the organization.

CHAPTER 7. EXTERNAL ENVIRONMENT AND RELATIONSHIPS

7.1 CATIE and its Member Countries

CATIE has, as part of its mandate, that it will serve a specific set of countries in Central America and the Caribbean and each of these countries has a representative on CATIE's Board of Directors. Therefore, the links with the countries it serves are very direct and are regularly reinforced.

To a certain degree, CATIE is expected to provide equal service to all seven member countries, but due to resource availability and program priorities this equality cannot be achieved. It happens, and is only normal, that at times there are a great many more activities in one country than in another. However, there is a need to try to achieve some balance over a number of years. It is important that in cooperating with member countries, CATIE fills a complementary rather than a competitive role.

7.2 Relations with IICA

CATIE evolved out of IICA in 1973 and has maintained a close relationship since that time. IICA provides the largest single contribution to the core budget of CATIE and two of its senior staff persons serve on the CATIE Board of Directors. Also, a representative of IICA's Inter-American Board of Agriculture serves on CATIE's Board. Therefore, CATIE and IICA are closely linked at the management level.

The relationships between CATIE and IICA should continue to be complementary and not competitive. The Team noted what appears to be a growing separation of the two organizations -- CATIE and IICA -- and recommends that management give attention to the matter if they are to continue to be inter-dependent. Both institutions have programs in Central America and the Caribbean and they need to establish clear lines of comparative advantage for each institution while maintaining their individual identity.

The Government of Costa Rica has extended the same privileges and immunities for CATIE non-Costa Rican professional personnel as it had granted to IICA under their joint agreements. Further, CATIE staff serving in its member countries are considered associate members of IICA and are granted the same privileges and immunities as IICA. The Orton Memorial Library of IICA, which is located at CATIE, operates under a joint agreement between CATIE and IICA.

7.3 Country Representatives

CATIE has appointed its Representative in each of the member countries. The response by government officials in member countries with whom the Review Team met was consistently positive on this issue.

The Team received a number of comments from CATIE senior professional staff that CATIE should review the specific requirements for the Representative in each country. However, the Team did not feel it had sufficient information on this matter to enter a specific recommendation.

The Team did note that the Representatives appear to have little contact with the private sector and it is recommended that they develop more contact with leaders in this sector.

7.4 Relations with Donors

It is important to note that donors are major stakeholders in the programs of institutions which they help fund. There must be regular contact between management and these stakeholders to alleviate any problems and to try to assure continuity of support.

The Team found some donor dissatisfaction with CATIE's management, particularly with its fiscal management in the past although this now seems to be overcome. But, also, the Team found CATIE's program to be "donor driven". That is, there are far too many projects being carried out at CATIE that appear to have been donor-generated rather than having originated through a CATIE institutional program development process. This would seem to imply that relationships with donors must be sufficiently good that CATIE is viewed by the donor community as a reliable source through which they can channel project support to Central America. However, the project approach by donors is difficult for CATIE to refuse and the donors must accept some responsibility for placing the Center in its present situation of a "Federation of Donors."

It is the team's recommendation that CATIE needs to take much greater hold of its own program and work with donors to support projects within the central program rather than support a series of limited time frame projects. In both the short and the long run this would be much more beneficial to the member countries than the present system and would enable CATIE to develop a consistent and viable research program.

The Team would like to bring to CATIE's attention some points which are noted in the CGIAR document entitled Overview of the

Management of CGIAR Centers:

"A significant portion of each director's time now goes to handling relations with donors..."

"Most centers have assigned one or more of their staff to day-to-day coordination of these relationships..."

"As a result, the centers are better able to, and spend more effort in, monitoring donor trends and exploring new funding opportunities. They also respond more promptly to requests for information and satisfy the reporting requirements of donors."

7.5 Relations with the International Agricultural Research Centers (IARCs) and the International Scientific Community

Relations with the IARCs in general appear to be good. CATIE seems to be well linked to the international agricultural research and education community.

CATIE could, however, strengthen this position if it would take the opportunity to present more research papers and project itself more in some of the international scientific meetings. It is the recommendation of the Team that management encourage its staff members to publish more in scientific journals and to present more research papers at international scientific meetings. This will enhance CATIE's image in the international scientific and donor community.

7.6 Collaboration with Research and Education Institutions in Member Countries and their Perception of CATIE

CATIE has developed close working relationships with national research and education institutions in member countries. There are several perceptions of CATIE by member countries. All have a very clear, positive, and similar perception of the Education program. All are aware of CATIE's role in the formation of REDCA, and the countries have high expectations for its utility, as a means of linking institutions within a country and among countries.

There is a concern in several countries over an apparent inequality in the distribution of all forms of education, particularly in the allocation of scholarships, the participation in training courses, and the distribution of training courses outside Turrialba.

Officials in all the countries visited noted, with few exceptions, the stop and go nature of projects with short time periods and short-lasting benefits.

CATIE's Institutional projection to the region has been oriented almost exclusively towards governmental programs. The participation with private enterprise has been very little and sporadic although some of CATIE programs, i.e., Tropical Promissory Crops seem, initially, more applicable to this sector.

In general, the net result of all this is that CATIE is fairly well-known by government technical and development personnel, but is known much less by private enterprise and the general public. This statement goes beyond the superficial awareness about the institution, but rather attempts to draw attention towards the need to broaden CATIE's outreach to these two general audiences. It not only opens up avenues for more technical projection and outreach, but it also enhances opportunities for much needed additional political and financial support from the countries.

The Team recommends that CATIE management give increased attention to linkage with the private sector in its member countries.

CHAPTER 8. RECOMMENDATIONS

Chapter 3

INTRODUCTION

It is a recommendation of the Review Team that the staff of CATIE adopt and practice a more holistic, or systems, approach (often called ecosystem approach) to agricultural and natural resource research and management than has been the case to date.

The Review Team recommends a revised organizational structure which is presented in the Management Review Report.

TROPICAL CROPS IMPROVEMENT

It is recommended that CATIE analyze its potential role in support of crop diversification in the region.

The scientific production of the team is, however, below their potential. Few publications in international-level journals have been produced. CATIE does not have a policy to stimulate and evaluate scientific production and it is recommended that CATIE have such a policy.

The Team also recommends the Nucleus Staff that it believes CATIE should have in Program I to cover tropical crop improvement and integrated pest management.

A final recommendation of the Team to Program I is that it should increase its interaction with Programs II and III.

ANNUAL FOOD CROPS

It is the recommendation of the Team that this be done on a sustained basis through collaborative links with international and national food crops programs. CATIE's contribution should be on subjects, such as sustained production with focus on soil management and fertility, integrated pest management, technical support to national programs, and training.

FORESTRY AND AGROFORESTRY

The priority given by CATIE to forestry and agroforestry systems research is well justified and the Team recommends that it should be further developed.

This system will allow use of available information to establish "models and response of species growth" to the ecological conditions and to the management of stands. It is recommended that all of these results should be published as soon as possible.

However, it is recommended that greater detail be provided when describing the specific objectives, the means for achieving them, and the indicators used in the control of forestry and agroforestry work.

The Team recommends that CATIE's programs and special projects have greater technical coordination by Core staff in order to assure continuity.

However, while CATIE has been successful in obtaining donor support for projects, the Team recommends that CATIE develop a well-defined program in forestry/agroforestry which it can present to donors and into which projects will fit.

It is recommended that there be increased exchange of knowledge within Program II which will be very useful in establishing strategies adapted to regional realities.

As noted in other areas, the Team recommends increased integration of resources within Programs and across Programs.

The continuity of this successful research phase is strongly recommended to ensure, through the measurement of permanent plots, the input of data into the "MIRA" system, and the analysis of the results.

In the long-term it is recommended that computerized models be established of the expected behavior of species where the field users themselves enter the plantation conditions and receive answers concerning the most probable evolution of trees under management systems defined by themselves.

Also, in conjunction with Programs I and III, a study is recommended on the characterization of soil potentials, according to their recommended uses within the forestry and agroforestry systems.

It is recommended that silvicultural research for the tropical dry areas of Central America must be followed very rigorously.

As a complement to this, studies are recommended, in cooperation with CATIE's Tropical Livestock section, on ways to feed animals with the food sources generated and on the manner in which these can be integrated into the agroforestry systems.

There are very few studies by CATIE on these interactions and it is recommended that they be considered during the coming decade, beginning with some "pilot" systems which may be selected as being representative of the region.

TROPICAL LIVESTOCK IMPROVEMENT

It is the recommendation of the Team that the priority for genetic improvement cattle -- beef and dairy -- should be reduced at CATIE.

In this field of cattle improvement we recommend that an experimental base should be kept in Turrialba for training and accurate studies on management, feeding, health, and pasture.

The Team recommends that this complementarity must be maintained and enlarged to livestock production systems in three classes:

- * Pasture systems
- * Silvopastoral systems
- * Agro-silvo-pastoral systems

The Team recommends that the collaborative CIAT/CATIE program should be strengthened.

The Team recommends that emphasis should be maintained and developed on:

- Identification of local useful shrubs and trees.
- Nutritive value of these resources (in cooperation with nutrition laboratory).
- Growing and management of these plants in comparison with introduced materials in agro-silvo-pastoral systems.
- Animal feeding and management.
- Economic studies at the farm level.

We recommend that the studies in different livestock production systems in terms of eco-pathology, be reinforced in order to relate disease observations to environmental and management conditions and to animal productivity.

The tropical livestock production group needs to be reinforced in the field of Economics, and the Team strongly recommends the addition of a socio-economist.

It is recommended that the staff of this program integrate more with other programs of CATIE, and especially in the agroforestry systems area and Integrated Natural Resource Management (Program III).

Also, in Chapter 5, a nucleus staff for ruminant feeding systems and integrated farming systems (with livestock) is recommended.

The Team recommends that the cattle numbers be reduced and that CATIE should look at alternative use of land for other research or production alternatives.

It is the recommendation of the review Team that within the general frame of CATIE's programs, the first priority for the Tropical

Livestock Area should be placed on the integration of animals into sustainable production systems.

It is the recommendation of the Team that the projects of the Tropical Livestock area, mainly in member countries, should be better discussed and defined on a consistent scientific base.

SOCIO-ECONOMICS

The research techniques used by the scientists in the field of regional economic analysis It is recommended that CATIE give increased attention to this area of work.

It is the recommendation of the Team that increased attention be given to the socio-economic events at the regional level.

It is recommended that the socio-economists help to organize and systematize those horizontal exchanges in order to develop a synthesis in this matter.

It is recommended that CATIE strengthen research in economics and social sciences and its full integration to the interdisciplinary programs and projects of the institution.

It is recommended that CATIE concentrate its scientists in economics and social science among the different activities.

The Team recommends the appointment of the following socio-economists as soon as possible, although these would come from re-distribution of staff:

- One economist specialist with studies in marketing. He will be in charge of developing research on the opportunities and requirements of the export markets for the perennial crops, and the promissory character of the non-traditional crops (Program I);
- One agricultural economist, with experience in livestock, to work in the animal husbandry area (Program II).

INTEGRATED NATURAL RESOURCE MANAGEMENT

It is recommended that the current objectives of the agrometeorology activities be examined to determine if they will allow for this more expansive view of their work.

These capabilities should not be diverted into narrow specializations and projects but rather it is recommended that they should be integrated into the Watershed and Conservation activities.

The Team recommends that this group become the organizational model for integration.

The ERT recommends thoughtful development of a conceptual framework within Program III with the focus of Land Systems Integration.

Chapter 4

It is recommended that the growth (of REDCA) continue as appropriate.

It is recommended that the General Assembly (of REDCA) consider whether or not a Research Council might be needed to interact with CATIE on the direction and scope of its research programs.

CATIE has developed a program of collaboration with seven universities in the U.S.A. Such a group is important and it is recommended that this development be continued and expanded, including the consideration of a European collaborative group.

The Team recommends that the real costs of the graduate and learning programs be determined.

It is recommended that the current economics studies in the graduate program be maintained, but that a larger component is needed and that it should continue as an integrated program.

We recommend that a joint program be initiated between CATIE and some institution that has a comparative advantage in this area. Preferably, that institution should be in Central America.

In situations where the long-term science problem-solving capability is not fully developed, or where instability in government occurs, an outside organization can often serve as a catalyst for cooperation, integration, and cohesion. This is the role CATIE has played through REDCA and the Team recommends that REDCA be continued and strengthened.

The Team recommends that CATIE serve as the catalyst to work with both the General Assembly and the country REDCA's to develop funding for programs of mutual interest.

The Team recommends that CATIE investigate the possibility of establishing a foundation. Such a foundation could help solicit and handle gifts, endowments, scholarships, and revenues from patents and copyrights.

As a forerunner to a foundation it is recommended that CATIE form a Research and Development Committee composed of selected individuals from research, education and management to further guide CATIE's development and policies on these issues.

It is also strongly recommended that all scientists be appointed and paid as international scientists on a comparable basis, regardless of nationality.

Chapter 5

The Review Team, after analysis of CATIE's existing programs/projects, discussion with staff and observations in the region, believes CATIE to have a comparative advantage in six areas. The Review Team strongly recommends that CATIE concentrate its efforts in these programs in both Research and Education. The stated goal should be for Productive Agriculture for a Sustainable Environment.

The Review Team recommends that CATIE proceed to establish its priorities within these six areas and to develop a well articulated plan, integrating them into a coherent short- and medium-to-long-term program.

It is the Team's recommendation that CATIE consider a proposed listing of specializations as its nucleus staff requirements for the areas of its comparative advantage and that it begins to balance its staff accordingly.

Chapter 6

The Team recommends that CATIE, as an institution, develop a management policy on the conservation, management, updating, utilization and control of its several databases.

It is recommended that CATIE develop an institutional policy on publications and information which will facilitate staff and public knowledge on the subject and which will provide guidelines for all staff.

Further, it is recommended that the several publication and information units now operated on a project basis be brought together as one CATIE center.

The Team recommends that management encourage its staff to publish more and, when appropriate, to present more invited papers at international workshops and professional meetings than they are now doing.

It is recommended that CATIE work on a centralized system for the compilation of bibliographical data. All the projects should cooperate in this effort.

On-going training of administrative personnel working on data management is recommended.

"CATIENET" is to offer the services of electronic mail, file transfer, remote processing, and access to CATIE's databases. The Team does not see this as a high priority item and recommends that CATIE first establish its policies and internal procedures before it attempts to start CATIENET.

The Team recommends that priority be given to the completion of the Library data base, and to providing physical facilities to be able to take advantage of, and up-date, the information available with the use of the "MICRO ISIS" system.

The Team recommends that management appoint a committee of users of computer services to draft a policy and procedures for computer services of CATIE.

It is recommended that CATIE establish a section for Physical Plant Services with a well qualified technical head.

CATIE's physical plant reflects in part the institutional culture and life of the Organization. The Team recommends that management and the Board assure that this asset is maintained and developed, in accordance with the level of functional excellence sought for the various components of the organization.

Chapter 7

The relationships between CATIE and IICA should continue to be complementary and not competitive. The Team noted what appears to be a growing separation of the two organizations -- CATIE and IICA -- and recommends that management give attention to the matter if they are to continue to be inter-dependent.

The Team did note that the (Country) Representatives appear to have little contact with the private sector and it is recommended that they develop more contact with leaders in this sector.

It is the recommendation of the Team that management encourage its staff members to publish more in scientific journals and to present more research papers at international scientific meetings. This will enhance CATIE's image in the international scientific and donor community.

It is the team's recommendation that CATIE needs to take much greater hold of its own program and work with donors to support projects within the central program rather than support a series of limited time frame projects. In both the short and the long run this would be much more beneficial to the member countries than the present system and would enable CATIE to develop a consistent and viable research program.

The Team recommends that CATIE management give increased attention to linkage with the private sector in its member countries.

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BIOGRAPHICAL INFORMATION ON THE TEAM MEMBERS

Dr. William K. GAMBLE, Leader of the External Review Team, retired in 1985 from the position of Founding Director General of the International Service for National Agricultural Research (ISNAR). He previously served as Director General of the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria following 20 years of leadership in international agriculture positions with the Ford Foundation in Asia, Latin America, and Africa. Since retirement he has participated in many consulting assignments in agricultural research, education, and development in Latin America, Asia, and Africa.

Dr. Luiz Antonio BARRETO DE CASTRO is the Coordinator of the National Research Program of Biotechnology for Agriculture at EMBRAPA since its establishment in 1986. Since 1981 he works at CENARGEN - National Center of Genetic Resources and Biotechnology located in Brasilia, the headquarters for the activities of EMBRAPA in Biotechnology and Genetic Resources. From 1985 to 1988 he coordinated the National Program of Science and Technology/Biotechnology in Brazil. From 1965 to 1981 he worked as an Associate Professor in the Agronomy Department at the Federal Rural University of Rio de Janeiro and from 1978 to 1980 as a Visiting Professor at the Biophysics Institute at the Federal University of Rio de Janeiro. His activities in research include ten years in the areas of Plant Breeding and Seed Technology and 17 years in the areas of Plant Physiology and Molecular Biology.

Dr. Mario CONTRERAS is the Regional Pest Management Specialist, in the USAID Regional Office for Central American Programs (ROCAP). He is a former Head of the National Agricultural Research Program of Honduras and, more recently, Research Director for the Honduran Agricultural Research Foundation. His experience includes organizing and implementing research programs in food crops, as well as, in traditional and non-traditional export commodities.

Dr. Marc DUFUMIER, is a Professor of Comparative Agriculture and Agricultural Development at the National Agronomic Institute, Paris-Grignon (INAPG). He is President of the Institute for Research and Application of Development Methods (IRAM-PARIS). He has participated in numerous scientific and technical support missions concerned with agro-livestock projects in Latin America, Asia, and Africa.

Dr. Philippe F. LHOSTE is a French Animal Scientist from CIRAD/IEMVT (Centre de Coopération Internationale en Recherche Agronomique pour le Développement <CIRAD>, and Institut d'Élevage et de Médecine Veterinaire pour les Pays Tropicaux <IEMVT>). He is Head of IEMVT-CIRAD Mission in Montpellier and of the Livestock Production System Program of IEMVT-CIRAD (12 animal scientists).

He previously served (approximately 20 years, from 1964 to 1983) in different countries of Africa (Cameroon, Ivory Coast, and Senegal) as Animal Scientist and Research Director within the framework of the French Cooperation Programs.

Dr. Patrick MERTENS, evaluator of the forestry and agroforestry areas, as well as the computing and biometric activities of the Institution, worked in the Andean Region of Perú, Bolivia and Ecuador as a silviculturist in forestry and agroforestry systems. Effective September 1990 he will work with the Catholic University of Louvain in Belgium.

Dr. Raymond J. MILLER, is Vice-Chancellor for Agriculture and Natural Resources, the University of Maryland System. As such, Dr. Miller is responsible for the Cooperative Extension Service and Agricultural Experiment Station, and coordinates the Education Program of the University System. He was Dean, College of Agriculture, University of Idaho, and has held positions at the University of Illinois and North Carolina State University. Dr. Miller has been active in both national and international activities concerning agriculture and natural resources.

Dr. Robert G. WOODMANSEE is Director of the Center for Analysis of the Dynamics of Regional Ecosystems (CADRE) at Colorado State University, Fort Collins, Colorado. He is also Director of the Natural Resource Ecology Laboratory and a Professor of Range Science, College of Forestry and Natural Resources at CSU. He previously served as Program Director for Ecosystem Studies, National Science Foundation, Washington, D.C. His scientific career has focused on grassland ecosystem analysis, particularly biogeochemistry. More recently his interests have emphasized the role of terrestrial ecosystems in contributing to and reacting to global climate change. He has participated in many international scientific committees and consulting activities in agriculture and natural resources.

Ms. Alicia MINA, Administrative Assistant to the Team is a free-lance translator in Mexico. Her experience includes service as Assistant to the Representative of the Ford Foundation's West Africa office based in Lagos, Nigeria; Supervisor of Personnel Services at the International Maize and Wheat Improvement Center (CIMMYT) in El Batán, Mexico; and more recently Administrative Officer of the International Service for National Agricultural Research (ISNAR) in The Hague, Netherlands. Since returning to Mexico she has worked with the Secretariat of Foreign Affairs on various international congresses, and with the IICA office in Mexico on the coordination of the 1986 JIA conference held in Mexico City.

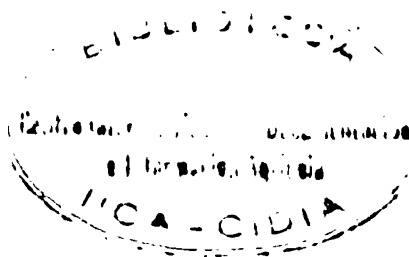
TERMS OF REFERENCE
EXTERNAL REVIEW OF CATIE

GENERAL OBJECTIVE

The CATIE Council of Directors expects that the external review will generate criteria and proposals for optimizing support for CATIE and the support CATIE provides to national institutions involved in agronomic research and education and agroforestry development. This is to be achieved by pointing up the comparative advantages CATIE offers as a member of the international scientific community working on tropical agronomic research.

To achieve this, the Council asks the review team to:

1. Provide clear and precise information on the Center's mandate, as pertains to its strategic plan and the instruments it uses for execution;
2. Define the mechanisms that link teaching and research;
3. Evaluate the principal activities carried out by CATIE, both in terms of its research findings and with regard to the ability of those who complete post-graduate studies and training courses to perform as professionals;
4. Assess its research programs;
5. Analyze the focus of the post-graduate curricula;
6. Propose priority areas for both research and education;
7. Establish an order of priorities in research;
8. Evaluate the Center's structure and administrative management, including the structure and operations of the Council of Directors and the management of human and financial resources, and to propose measures for improvement; and
9. Weigh the pros and cons, both scientific and institutional, of CATIE's becoming a center of excellence for sustainability in Latin America.



SPECIFIC OBJECTIVES

For each component, the review team should provide information, comments and proposals on the following:

1. Research Component

1.1 Evaluate research findings

1.2 Propose priority areas for research, bearing in mind the regional (7 countries) and international situation, and the regional outlook for development.

1.3 Comment on the Center's ten-year plan and position papers, and the report by W. K. Gamble.

1.4 On the subject of perennial and promising crops, comments are expected regarding:

1.4.1 The capacity of the member countries to conduct activities related to the evaluation of varieties, plant protection and crop management;

1.4.2 The outlook for research into biotechnology applied to coffee, cacao, plantains and promising crops;

1.4.3 Economic projections for promising crops; and

1.4.4 The current budget structure, and the level of budgetary support that must be assured.

1.5 With regard to forestry, agroforestry and natural resources, the two experts on the review team are to study how these activities can be made complementary in order to maximize CATIE's capacity, especially in dealing with concepts of conservation in production and sustainable production on individual farms and for watersheds.

The team is asked to:

1.5.1 Provide a more accurate physical and biological description of the area (soil, climate) in terms of the potential for food and sustainability of plant production, including natural forests.

1.5.2 Study the competition or synergy between trees and crops, as relates to agroforestry.

1.5.3 Suggest improvements in the design of experiments, to reflect the objective of productivity/sustainability.

1.5.4 Comment on the use of remote sensing.

- 1.6 Regarding livestock, the expert shall issue an opinion on genetic improvement, bearing in mind the capacities of CATIE and the countries, as well as the potential of the existing herd in the region. As a complement to this, the outlook for activities related to forage resources, especially bushes, should be defined, and they should be evaluated as a source of nutrition for small and large ruminants. The Council wants to know whether CATIE should set aside more than 300 hectares of its experimental fields for livestock research with very low financial returns, or whether it should seek research alternatives on small-and medium-scale farms.
- 1.7 In the area of the economic and social sciences, the expert is to set priorities among the microeconomics of production (farm management), macroeconomics (analysis by commodity, from production to the international market) and other topics such as agricultural policies and technology generation and transfer.

2. Education Component

One of the most important issues concerns improving the curriculum of the post-graduate program, bringing it into line with the needs of the countries, assessing current real possibilities at CATIE and the ties of the graduate program with research. Of particular importance is the topic of socioeconomics, as part of the current curriculum and as a proposal for a specialized course of post-graduate studies. Another point for study is the validity of the diploma granted by CATIE as compared with those granted by other schools and universities in the countries. Should CATIE develop specific activities in support of graduate schools in the countries? If so, what kind?

A second topic of importance in this component is the quality of the communication in the training courses and short courses offered by CATIE. The present situation should be evaluated and recommendations for improvement should be offered. An evaluation should also be made of how closely topics covered in the training courses match current development and research priorities.

3. Institutional Management Component

After an evaluation of same, proposals should be made for improving:

- 3.1 The structure and role of governing bodies of CATIE.
- 3.2 Financial management, its flexibility with recommendations on how to overcome existing constraints.
- 3.3 The management of production activities.

- 3.4 Human resource management (evaluation, promotion, training).
- 3.5 Structural problems such as a definition of the minimum critical mass of personnel needed to ensure sustainable levels of research, education, management and administration; the need for CATIE to be associated with development institutions, in order to transfer the technology the Center has helped to generate; the ways the pilot areas can contribute to overcoming current constraints and to formulating a model or models for technology generation/transfer/adoption.

DOCUMENTATION

Strategic Plan - 10 Years

Program Briefing Document

Program and Budget for 1990

Chronology of Development of CATIE

Program Highlights -- 1989 and 1990

List of Principal Staff

CATIE Contract - The original which was signed by IICA and the Government of Costa Rica in 1973 and the modifications which were approved by the Inter-American Agriculture Board.

Agreements between CATIE and Member Countries for the Network for Education, Training, and Research on Agriculture, Forestry, and Natural Resources Management (REDCA)

Board of Directors

Membership

Election of Appointment Procedure and Term of Office

Committees and Responsibilities

Guidelines or Manuals

Staff Regulations

Publications and Reports

Accounting and Finance

Education

Staff Development

Staff Appointments

Office Operations

Statement of Process for the Development of the Program and Budget

Personnel

Staff Profile

Number of Persons

Classification - Professional Core Supported
Professional Special Projects
Supported
Support Staff

Position Descriptions (Samples)

Compensation - Salary scales and set of grades and ranges

- Number and area of specialization of consultants for past 12 months

Position papers and Background documentation for Livestock, Perennial Crops, Promising Tropical Crops, Socio-Economics, Forestry, and Agroforestry, and Food Crops

CATIE publications (samples and lists)

Revista Turrialba

Project Reports

Thesis

Project Bulletins

Conference and Seminar Proceedings

Graduate Education and Training Programs

List of Alumni from Graduate Program and their country of origin

Samples of Active Programs or Project Proposals

Matrix of achievements and Transfer of Results

ANNEX IV

PROGRAM OF THE EXTERNAL PROGRAM REVIEW16 JULY - 10 AUGUST 1990

The main phase of the External Program Review commenced with a visit to CATIE Headquarters in Turrialba, Costa Rica where comprehensive presentations were made by the Director General, the Deputy Director General, Associate Directors General, and Program Leaders of CATIE. In addition, visits by the entire team were arranged to most of the research being carried out in the fields and laboratories located on the Headquarters campus, thus giving the team an opportunity to become acquainted with CATIE's overall program and staff.

Individual visits and meetings were held by the team members to each of their specific areas of specialization, in order to acquire greater in-depth knowledge of those programs and projects.

Visits were carried out to CATIE's member countries, where the Team members were able to discuss CATIE's program with government officials and with national research directors, scientists, university officials and others who have been, or will be, affected directly or indirectly by CATIE's activities, and to observe collaborative projects between CATIE and national organizations. In the case of Guatemala, two team members met with representatives of bilateral aid donors.

The entire team, except for Dr. Luiz Barreto de Castro, travelled to Guatemala July 22 to 25, where meetings had been arranged by the Country Representative and staff members. Here, again, the team spent part of the time together for discussions with Guatemalan officials and part as separate teams to visit specialized activities.

Separate groups of the team then visited the following countries:

Dr. William K. Gamble visited El Salvador from July 25 through July 28.

Drs. Marc Dufumier, Philippe Lhoste, Ray Miller, and Ms. Alicia Mina visited the Dominican Republic from July 25 to 29.

Drs. Mario Contreras, Marc Dufumier and Robert Woodmansee visited Panamá from 29 July through 1 August, 1990.

Drs. Philippe Lhoste and Patrick Mertens visited Nicaragua from July 29 through August 1.

Drs. Patrick Mertens and Robert Woodmansee visited Honduras from July 25 through July 28.

The team members, except for Drs. Barreto and Miller, reassembled in Turrialba on August 2, 1990 and were joined by Drs. Barreto and Miller on August 5, 1990 to complete their deliberations, meetings, and to finalize the report.

CONSTITUTION

FINAL VERSION OF THE MODIFIED CONTRACT BETWEEN
THE GOVERNMENT OF COSTA RICA AND
THE INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE,
ON THE CENTER FOR TROPICAL AGRICULTURAL RESEARCH AND EDUCATION

CHAPTER I

Nature, name and domicile

ARTICLE I

The objective of the present Contract is the constitution of a Civil Association, scientific and educational in nature, with its own legal status, whose purpose is research and postgraduate training in agriculture and natural renewable resource sciences, applied to the American tropics, in particular to the Central American Isthmus and the Caribbean, in benefit of the Member Countries of the Inter-American Institute for Cooperation on Agriculture, according to the agreements and programs that may be made with public or private, national or foreign universities.

ARTICLE II

The Center will be named: Centro Agronómico Tropical de Investigación y Enseñanza (CATIE).

ARTICLE III

Its headquarters will be in Turrialba, province of Cartago, Costa Rica and will have the power to determine other special domiciles, for carrying out activities in areas of its competence, within the country.

CHAPTER II

Of the members and admission

ARTICLE IV

CATIE members may be Regular or Adherents.

ARTICLE V

CATIE's Regular Members are: IICA, the Government of Costa Rica and Governments of the rest of IICA's member countries, through the authorized governmental entity according to the legal

ordinance of each country that subscribe the present contract or those that will join CATIE after acceptance of the Contract.

ARTICLE VI

Adherent Members of CATIE will be, previous approval by the Board of Directors, the Government of IICA's non-Member Countries, international, governmental and non-governmental organizations, International Centers and private organizations whose objectives --academic or scientific-- are compatible with those of CATIE.

ARTICLE VII

The Regular Members will join CATIE immediately or in the manner indicated in Article V, with all the rights and obligations, by just accepting the Contract and by canceling the corresponding annual contribution. The Adherent Members will be admitted by decision of CATIE's Board of Directors, who will in each case establish the corresponding rights and obligations.

CHAPTER III

Of the governing bodies

ARTICLE VIII

CATIE will have the following governing bodies:

- a) The Inter-American Board of Agriculture
- b) The Board of Directors
- c) The General Directorate
- d) The Executive Committee
- e) The Technical Committee
- f) The Academic Committee
- g) The Administrative Committee

ARTICLE IX

The Inter-American Board of Agriculture, hereinafter called JIA, is the superior governing body of CATIE. The JIA is responsible of studying the bi-annual report on CATIE's activities and can formulate observations and comments deemed convenient, as well as to decide on the dissolution of the Civil Association. The report will include technical, financial and administrative matters. The bi-annual CATIE report to the JIA will be submitted by the Director General of CATIE and said presentation will be included in the provisional agenda of each bi-annual ordinary meeting of JIA. Consequently, IICA's Director General, in his condition as ex-officio Secretary of the JIA, will include this report among the documents to be presented for the consideration of the same.

ARTICLE X

The Board of Directors is the administrative body and has the permanent responsibility of the supervision and control of CATIE. The Board includes a representative from each regular member country of the Central American Isthmus and the Caribbean, who is a regular Member of CATIE; a representative from the Inter-American Board of Agriculture and two representatives from IICA, designated by the Director General. Moreover, it incorporates into its ranks three independent agricultural scientists of recognized prestige, selected and designated by the Board, from candidates presented by IICA's General Director in consultation with CATIE's General Director. The members of the Board of Directors, with the exception of JIA's representative will govern for three years in their posts and their designation may be renewed for an additional two-year period. In case each mandator wishes to change their representative, the substitution must be made known to the Board three months in advance. CATIE's General Director will be the ex-officio Secretary of the Board and will assist in the deliberations with voice but without vote. Representatives of the Adherent Members may attend the sessions of the Board of Directors as observers, with voice but without vote.

ARTICLE XI

The Representative from Costa Rica will preside the Board of Directors; the Vice-President will be one of the two representatives from IICA.

ARTICLE XII

The President will convene the ordinary and extraordinary meetings of the Board, will preside its sessions and will conduct the debates. As CATIE's representative, he will subscribe those documents that the Board of Directors will delegate powers to do so.

The Vice-President will replace the President when necessary.

ARTICLE XIII

The Board of Directors will meet at least twice a year. Half plus one of the members with the right to vote will be considered as quorum. Their decisions will be taken by majority of votes, except those cases in which this Contract or CATIE's Regulations requires a different majority. The ordinary meetings will be convened by the President of the Board of Directors, upon request of CATIE's General Director. The extraordinary meetings will be convened by the President of the Board of Directors, upon his initiative, or by at least two representatives of the Regular Members. All budgetary decisions in order to be approved, will need two thirds of the votes from members with the right to vote.

ARTICLE XIV

The Executive Committee will be an advisory body to the Board of Directors. It carries out the functions assigned by the Board of Directors and does the preparatory work for the Board of Directors' meeting. Their functions will be specified through regulations.

The Executive Committee is constituted by the President, Vice-President and JIA's representative in the Board of Directors, as well as the representative of one of the other Regular Member Countries that integrate the Board of Directors who has been selected in the rotation form for a period of one year by the Board of Directors. CATIE's Director General will be its ex-officio Secretary.

ARTICLE XV

The Technical Committee is an advisory body to the Board of Directors; it fulfills the functions assigned to it by the Board of Directors and sees to it that the policies and strategies set by the Board of Directors with respect to research and transfer of technology are carried out, making recommendations to the Board of Directors. Its functions are specified through regulations.

The Technical Committee is made up by five members of the Board of Directors, selected and named by the Board. The following is the composition: two representatives of the Regular Member Countries, one representative from IICA and two of the three scientists that make up the Board of Directors. The rest of the members of the Board of Directors, representatives of the Adherent Members and representatives from entities invited by the Board of Directors, as proposed by the Technical Committee, may attend the meetings of the Technical Committee as observers with voice but without vote. CATIE's General Director will be ex-officio Secretary.

ARTICLE XVI

CATIE's head office will be exercised by the Director General, who should be a national from one of IICA's Member Countries, with preference from one of CATIE's Member Countries. He will be elected by the Board of Directors by majority of two-thirds of its members, among candidates proposed by Representatives of the Regular Members with vote in the Board of Directors and his mandate will be for four years, and may be re-elected once. He may not be succeeded by a person with the same nationality.

ARTICLE XVII

The Director General will be responsible for directing and administering CATIE, within the guidelines and policies set by the Board of Directors and under its supervision.

In particular, and in strict accordance with the rules approved by the Board of Directors and corresponding contractual, regulations and budgetary dispositions, will administer the financial resources; will determine the number of members of CATIE's personnel, will rule their functions, rights and obligations, will determine their salary, their appointment and removal, will prepare the annual budget program to be submitted to the Board of Directors and will present to the Board and the JIA, through the established channels, the corresponding reports and others that may be requested.

ARTICLE XVIII

CATIE's General Director will have the legal and extrajudicial representation of the Association, with the faculty of Proxy up to an amount of US\$150,000.00 or its equivalent in other currency. For the subscription of contracts exceeding \$150,000.00 or its equivalent in other currency, he should act jointly with IICA's General Director. CATIE's Deputy Director will have the same faculties when acting as Delegate of the Director General, in his absence.

CATIE's General Director must submit every six months, accounts to the Board of Directors, including financial situation and execution of the budget.

ARTICLE XIX

The Academic Committee advises the Board of Directors in matters relating to education policies and strategies. In matters related to postgraduate education it will act according to what is specified in the contracts established with the University of Costa Rica and other public or private, national or foreign universities. Furthermore, he must elevate the recommendations and opinions formulated by said Board. The Committee will be constituted by three members of the Board of Directors designated by the Board; the rest of the members, as well as its function, will be made through policies. CATIE's General Director will be the ex-officio Secretary.

ARTICLE XX

The Administrative Committee advises and supports CATIE's Director's Office in technical, administrative and financial matters.

It is constituted by Heads of Departments and by three members of CATIE's personnel, selected by the Board of Directors from a list of candidates proposed for each post by CATIE's General Director, for a period of two years being eligible for re-election.

The Committee must meet at least once a month and will be presided by CATIE's General Director. His functions will be made through regulations.

CHAPTER IV

IICA-CATIE Relation

ARTICLE XXI

IICA and CATIE will mutually collaborate and support each other with the fundamental purpose of giving the best service possible to the member countries, within their respective areas of responsibility. IICA will offer CATIE all the needed facilities, in its offices in the member countries, for the adequate research and educational performance. This cooperation will be expressed in specific agreements and joint projects.

ARTICLE XXII

IICA may grant the status of Associate Specialist to CATIE's professional staff and provide CATIE and its staff legal and institutional protection, similar to that granted to its personnel, for the development of activities outside of Costa Rica, according to the Bilateral Agreement between IICA and the corresponding country. For this purpose, an agreement will be signed between IICA and CATIE.

CHAPTER V

Patrimony and Financial Resources

ARTICLE XXIII

In order to carry out its goals and according to the actual legislation, CATIE may buy, sell, mortgage, pawn, lease or any other way or through any other manner, buy, own and dispose freely of all types of real estate, furniture and livestock, real personal rights, including title values of any type, can receive all kinds of property as guarantee, deposits, trusteeship, donation, inheritance or legacy, obtain credits and in general, will have the faculty to celebrate all kinds of acts, contracts or operations with any person, physical or judicial, national or foreign or international.

ARTICLE XXIV

CATIE's capital is made up of: a) use, during the entire period of this Contract, of the patrimony constituted by the farms, buildings, equipment and other real estates and goods, provided by IICA in the same manner to CATIE Association, constituted by

Contract signed January 12, 1973, plus the improvements made to this patrimony; b) properties that the CATIE Association has purchased; c) the property that CATIE Association may purchase in the future. For the properties mentioned in a) and b), an inventory will be made through a notarial certificate; a copy will be given to the JIA.

ARTICLE XXV

IICA is committed to include in its Biennial Program Budget, a request from CATIE's Board of Directors in relation to financial support in order to contribute to the Center's basic budget. Said sums will not exceed five percent of IICA's quota budget; the use of these resources may be submitted to auditing by IICA, when considered convenient. The regular Member Countries of CATIE are committed to include in their budget, during the period of this contract, an annual sum of no less than fifty thousand U. S. dollars (US\$50,000.00), or its equivalent, previously approved by CATIE's General Director, in order to contribute to CATIE's expenses. This contribution may be increased once agreed to by the Board of Directors; these contributions will be used in the maintenance and operation of CATIE's basic expenses and will not be considered as capital contributions. The contributions made by Adherent Members are not considered as capital contributions.

CHAPTER VI

Administration and financial control

ARTICLE XXVI

The Board of Directors, within a period of no more than six months beginning with the date of signature of this Contract, will dictate the corresponding regulations of CATIE's governing bodies, as well as the financial and personnel regulations.. These last two will be based on IICA's rules and regulations. Until this happens, the actual rules will be in force.

ARTICLE XXVII

CATIE will establish its own internal audit. For this purpose an auditing unit will be created assisted by one or two highly qualified professionals, appointed and named by the Board of Directors who will also approve its regulations. Copy of the reports submitted by the Director General will be given to the Board of Directors.

IICA's External Auditors will also be that of CATIE.

CHAPTER VII

Privileges and Immunities in Costa Rica

ARTICLE XXVIII

The Government of Costa Rica will grant CATIE and non-Costa Rican professional personnel, the rights, privileges and immunity granted to IICA under Contract Law No. 29 dated December 19, 1942, in agreement approved under Legislative Decree No. 3367 dated August 6, 1964 and in the Contract approved by Executive Decree No. 51 dated November 26, 1968, as well as other advantages that may result from subsequent contracts, agreements and understandings between the Government of Costa Rica and IICA or CATIE.

CHAPTER VIII

Duration and modification of the contract

ARTICLE XXIX

The duration of the present Contract is for 20 years, beginning on the date of the modification proposed. The duration may be extended for equal and consecutive periods, and the extension will be effective if one year before termination of period, IICA's General Directorate, in observance of the Inter-American Board of Agriculture's agreement, does not communicate the Board of Directors the resolution to terminate this Contract and to dissolve the Association. The remaining governments of the Regular Member Countries of CATIE, when desiring to terminate the membership, must notify the Association with a minimum of one year in advance.

ARTICLE XXX

The modifications to the present Contract may be made through the initiative of any of the Regular Members and will require the approval of at least two-thirds of the Board of Directors and of at least two-thirds of the Inter-American Board of Agriculture.

CHAPTER IX

Destination of the properties

ARTICLE XXXI

When the present Contract terminates, all property given by IICA, mentioned in Article XXIV, together with its improvements, will be returned to IICA. The remaining property will be distributed between IICA, the Government of Costa Rica and the rest

of the regular members that at the moment of termination are active members, proportionately according to each ones contribution.

CHAPTER X

General dispositions

ARTICLE XXXII

Staff appointed by IICA that are working at present at CATIE, will continue doing so for the Association according to the actual conditions of their respective appointments and will be paid with contributions assigned according to Article XXV of this Contract.

In the same manner, IICA will assume repatriation costs, according to the respective regulation of the staff in the named group who will not have their contracts renewed and will not be under the direct responsibility of the Association. All professional staff appointed by the Association according to its rules, will be granted, in relation with social security, equivalent rights granted to IICA personnel.

ARTICLE XXXIII

The Orton Memorial Library will not be included in IICA's contribution to the Association's capital, but will be located in CATIE offering services under the conditions agreed to under specific agreements between IICA and CATIE.

ARTICLE XXXIV

The Association may freely dispose of its foreign exchange for its operation in or from Costa Rica.

ARTICLE XXXV

All that may be applicable and does not contradict the letter of the spirit of this contract, the Association will be governed by the Law of Associations of Costa Rica.

ARTICLE XXXVI

The present Contract for the constitution of the Association, will be recorded in the corresponding Registration Office, as well as the corresponding commitments of contributions referred to in Articles XXXIV and XXV. Such inscription will be exempt from fees and tax payments that correspond to these operations.

ARTICLE XXXVII

IICA's General Directorate will be the depository of the present Contract. It will certify its copies and amendments and adhesions that may be produced.

CHAPTER XI

Transitory dispositions

CHAPTER XXXVIII

CATIE will assume all rights and obligations of the Civil Association of the same name, created by IICA and the Government of Costa Rica, by contract subscribed on January 12, 1973, ratified by the Legislative Assembly of Costa Rica on June 1, 1973.

NOTE: The Legislative Assembly of Costa Rica approved the Contract through Law No. 6873 dated June 3, 1983, ratified by the Executive Power on June 17, 1983.

MODIFICATIONS to this version of original Contract have been included, approved by the Inter-American Board of Agriculture through resolutions IICA/JIA/Res. 107 (III-E/86) and IICA/JIA/Res. 172 (V-00/89).

ANNEX VI

SUMMARY OF CATIE ACTIVE SPECIAL PROJECTS*

Funds in US\$

(1)

Title: Regional Project for Higher Agricultural Education
Purpose: To collaborate with CATIE on the expansion and improvement of the scope and purpose of its higher education and training programs.

Terms: May, 1985 - May, 1993

Fund Source: USAID US\$6'500,000

(2)

Title: Regional Project for Higher Agricultural** Education

Purpose: To collaborate with CATIE on the expansion and improvement of the scopes and purposes of its higher education and training.

Term: August, 1985 - August, 1991

Fund Source: USAID US\$7'000,000

(3)

Title: Multiple Use Trees

Purpose: To develop and strengthen the capacity of CATIE, and of the national institutions involved, to promote and extend technologies for the growing of multiple-use trees.

Term: August, 1985 - August, 1991

Fund Source: USAID US\$9'000,000

* Information provided by CATIE

** Agreement is for amount to be paid in Costarrican Colones.
The original estimate was prepared in US\$.

(4)

Title: RENARM/MIP/Watersheds/Forest Production

Purpose: To bring about the conditions through which public and private institutions can generate, transfer, and apply the information and technology which is essential for the sustained use of natural resources and the protection of the environment.

Term: September, 1989 - September, 1995

Fund Source: USAID/ROCAP US\$16'404,500

(5)

Title: CATIE-IICA-FHIA

Purpose: To establish and operate the Regional Network for the Generation and Transfer of Technology on Cacao cultivation. To organize a network of national institutions which support the improvement and coordination of the agricultural research, extension, and education activities on cacao in the countries, in aspects such as disease and pest management, improvement of the genotypes and cropping systems.

Term: April, 1988 - December, 1990

Fund Source: USAID/ROCAP US\$692,700

(6)

Title: Survival of Bacteria from Pathogen Plants Marked with Monoclonal Antibodies.

Purpose: To determine the limits of survival of the pathogen in tropical acid soils, and to determine under what conditions the pathogen bacteria of the plant could determine the disease.

Term: July, 1989 - July, 1993

Fund Source: USAID/ROCAP US\$149,800

(7)

Title: Use of Poró and Madero Negro as a source of protein for dairy cattle.

Purpose: To develop food strategies for the use of "Erythrina" and "Gliricidia" as a source of protein for dairy cattle under tropical conditions.

Term: August, 1989 - July, 1992

Fund Source: USAID/ROCAP US\$140,100

(8)

Title: Preparation of the Forestry Action Plan for Central America.

Purpose: To help the Central American Commission on Environment and Development to prepare the Tropical Forestry Action Plan for Central America, while at the same time achieving the participation of a wide scope of national and international institutions and donors.

Term: July, 1990 - July, 1991

Fund Source: USAID/ROCAP US\$310,400

(9)

Title: CAMCORE - Arboreal Species

Purpose: Maintenance of the biological diversity of arboreal species in Central America.

Term: January, 1989 - January, 1992

Fund Source: USAID/SCIENCE US\$74,400

(10)

Title: Silvo-Pastoral Systems

Purpose: Silvo-Pastoral Research in Costa Rica's Atlantic Zone

Term: September, 1985 - December, 1992

Fund Source: IDRC US\$536,000

(11)

Title: Nitrogen Fixing Trees - Phase III

Purpose: To develop improved plantation techniques on grafting for leguminous trees of the "Erythrina", "Gliricidia" and "Inga" genus, and to promote their incorporation into the agroforestry systems of small farms in the Central American humid tropics.

Term: December, 1989 - December, 1992

Fund Source: IDRC US\$668,600

(12)

Title: Network for Research on Animal Production Systems in Latin America (RISPAL)

Purpose: To establish and coordinate a research network on production farms systems

Term: May, 1986 - August, 1990

Fund Source: IDRC US\$117,000

(13)

Title: Somaclonal Mutation

Purpose: To design and adapt "in-vitro" cultivation techniques as a complementary method for the improvement of banana and plantain

Term: January, 1987 - July, 1991

Fund Source: IDRC US\$390,000

(14)

Title: Silviculture of Natural Forests

Purpose: Contribute to the development and the adoption of sustainable forestry management systems as an alternative to the use of land, strengthening research and forestry teaching.

Term: January, 1990 - December, 1992

Fund Source: DDA US\$468,000

(15)

Title: Agroforestry Cooperation in the Central American Isthmus
- Phase III

Purpose: Development and evaluation of agroforestry techniques

Term: August, 1989 - December, 1992

Fund Source: GTZ US\$850,400

(16)

Title: Research and Training in Coffee-culture

Purpose: To carry out research for the development of coffee-culture

Term: January, 1988 - December, 1990

Fund Source: PROMECAFE US\$750,000

(17)

Title: Agroforestry Courses

Purpose: Preliminary aide memoire for the implementation of an annual course in Agroforestry

Term: Yearly basis

Fund Source: JICA US\$71,000

(18)

Title: Research and Training Activities in the Costa Rican Atlantic Zone. Phase II

Purpose: To carry out studies and training in socio-economic, ecological, and soil use aspects in the Costa Rican Atlantic Zone.

Term: April, 1986 - December, 1990

Fund Source: U. of Wageningen US\$211,300

(19)

Title: Technical Assistance Contract

Purpose: To offer technical assistance to carry out the Integrated Rural Development Project for the Northern Region of Nicaragua (PRONORTE); specifically in tasks related to agro-silvo-livestock planning and development.

Term: April, 1987 - December, 1990

Fund Source: PRONORTE US\$249,800

(20)

Title: Conservation Project for Sustained Development in Central America.

Purpose: Establishment of demonstration pilot areas, including buffer zones to protect areas in the region.

Term: July, 1988 - July, 1991

Fund Source: ASDI/NORAD US\$2'179,000

(21)

Title: Integrated Pest Management

Purpose: To set up the national capacity to develop and implement plant protection in integrated pest management, in coordination with other Central America countries.

Term: June, 1989 - June, 1994

Fund Source: ASDI/NORAD US\$3'557,000

(22)

Title: Project on the "Genetic Improvement of Multiple Use Tree Species"

Purpose: To contribute to the development of a forest area through the identification of genetically superior planted material, as well as to strengthen the national institutions in the area of genetic forestry resources.

Term: September, 1988 - September, 1992

Fund Source: NORAD US\$433,800

(23)

Title: Nitrogen Fixing Trees: "Leucaena", "Calliandra", Soils and Animal Nutrition Labs"

Purpose: To increase the level of knowledge and understanding of the "Leucaena" and "Calliandra" genus, and to promote its incorporation within the agroforestry system on small farms in the Central American humid tropics.

Term: December, 1989 - December, 1992

Fund Source: SAREC US\$1,030,400

(24)

Title: Cryopreservation of Banana and Plantain

Purpose: To explore the possibilities for using cryopreservation techniques in the maintenance of "musa" germplasm

Term: April, 1990 - April, 1992

Fund Source: IBPGR US\$75,000

(25)

Title: Capsicum

Purpose: Characterization of the morphology, taxonomy, and agronomy of one part of the capsicum collection.

Term: January, 1990 - January, 1992

Fund Source: IBPGR US\$325,000

(26)

Title: Seed Unit

Purpose: Establishment of a Seed Unit

Term: January, 1990 - December, 1990

Fund Source: IBPGR US\$39,800

(27)

Title: Project for the study on resistance to Black Sigatoka in Plantain.

Purpose: To carry out a study on resistance to Black Sigatoka in Plantain

Term: March, 1989 - February, 1993

Fund Source: EEC US\$88,500

(28)

Title: Management of the San Blas Territory

Purpose: Wildlands Management

Term: September, 1987 - December, 1990

Fund Source: AEK US\$32,500

(29)

Title: Sustainable Agro-Silvo-Pastoral Systems for Small Farmers in the Central American Dry Areas

Purpose: To provide assistance in the development and implementation of improved dairy and beef production systems, without using the dual purpose cattle system and without using the approved agroforestry system, which allow the conservation and regeneration of soil and forest resources.

Term: August, 1989 - August, 1993

Fund Source: CIDA US\$2'400,000

(30)

Title: INFORAT

Purpose: Information and documentation on Renewable Natural Resources

Term: February, 1989 - December, 1990

Fund Source: MOLISV US\$81,400

ANNEX VII

LIST OF PERSONS MET*

CATIE HEADQUARTERS

OFFICE OF THE DIRECTOR

Eduardo Casas	Associate Director General for Research, Ph.D
Oscar Fonseca	Deputy Director General, Ing. Agr.
José L. Parisí	Associate Director General for Education, Ph.D.
Rodrigo Tarté	Director General, Ph.D.

RESEARCH AND DEVELOPMENT PROGRAMS

PROGRAM I. Tropical Crops Improvement

<u>Name</u>	<u>Project and/or Title</u>
Orlando Arboleda	RENARM/IPM Project, M.S.
Marc Berthouly	PROMECAFE Project, Ph.D.
Helga Blanco	RENARM/IPM Project, M.S.
Elkin Bustamante	RENARM/IPM Project, Ph.D.
Gustavo Calvo	RENARM/IPM Project, Lic.
Manuel Carballo	RENARM/IPM Project, M.S.
Daniel Coto	RENARM/IPM Project, Ing. Agr.
Ramiro de la Cruz	RENARM/IPM Project, Ph.D.
Jorge Echeverri	PROMECAFE Project, M.S.
Jean V. Escalant	Plantain Project, Ph.D.
Lorena Flores	RENARM/IPM Project, Ing. Agr.
José J. Galindo	PROCACAO, Ph.D.
Ramiro Jaramillo	INIBAP, M.S.
José M. Jiménez	RENARM/IPM Project, M.S.
Nahum Marban	RENARM/IPM Project, Ph.D.
Róger Meneses	RENARM/IPM Project, M.S.
Jorge Morera	PROCACAO/Promisory Crops, Ph.D.
Nidia Morera	PROMECAFE, M.S.
Alfredo Paredes	PROCACAO, Ing. Agr.
Mario Pareja	RENARM/IPM Project, Ph.D.

* The External Review Team wishes to express its regrets for any and all inadvertent omissions in this list.

Wilberth Phillips
 Jorge Sandoval
 Phillip Shannon
 Ana C. Tapia
 Víctor Villalobos
 Nelly Vasquez
 Tomás Zoebisch

PROCACAO, M.S.
 Biotechnology, M.S.
 ODA/IPM Project, M.S.
 Plantain Project, Ing. Agr.
 Program I (Director), Ph.D.
 PROCACAO, M.S.
 RENARM/IPM Project, Ph.D.

**PROGRAM II. SUSTAINABLE AGRICULTURAL PRODUCTION AND
 DEVELOPMENT**

John Beer
 Jorge Benavides
 Arnim Bonnemann
 Gilles Brunschwig
 Yael's Camacho
 Eduardo Casas
 Jonathan Cornelius
 Eugenio Correa
 Dean Current
 Bryan Finegan
 Manuel A. Gómez
 Ian Hutchinson
 Jorge Jiménez
 Donald Kass
 María Kass
 Julio Marschall
 María Julia Mazzarino
 Luis Meléndez

GTZ Project, M.S.
 Goat Project, M.S.
 GTZ Project, Ph.D.
 Goat Project, Dr.
 AFN-CATIE Project, Ing.For.
 Program II (Director), Ph.D.
 Forest Geneticist, M.S.
 Forest Geneticist, M.S.
 Information Management, M.S.
 ODA Project, Ph.D.
 ROCAP/MUT Project, M.S.
 Agroforestry, B.S.
 AFN-CATIE Project, Lic. C.A.
 AFN Project, Ph.D.
 Livestock Nutrition, Ph.D.
 Livestock Farm Manager
 AFN-CATIE (Soils) Project, Ph.D.
 CATIE/GTZ Research Assist., Ing.
 Agr.

Thomas McKenzie
 Francisco Mésén

ROCAP/MUT Project, M.S.
 Forestry Genetic Improvement
 Project, M.S.
 Forestry and Agroforestry, Adm.
 Emp.

Claudia Monge

Gustavo Morales
 Miguel Musalem
 Fernando Mujica
 Carlos Navarro
 Ovidio Novoa S.
 Lucio Pedroni
 Danilo Pezo
 Carlos Reiche
 Carlos Rivas
 Emel Rodríguez
 Gerardo Rodríguez
 Francisco Romero

Livestock Health, Ph.D.
 ROCAP/MUT Project, Ph.D.
 Livestock Breeding, Ph.D.
 MUT-CATIE Project Coord., M.S.
 Administrator, Forestry Farm
 COSUDE-CATIE Project, Ing.For.
 Forage Crops, Ph.D.
 ROCAP/MUT Project, M.S.
 ROCAP/MUT Project, M.S.
 MUT Extensionist-Hojancha
 Chemist, Nutrition Laboratory
 Silvopastoral Systems Project,
 Ph.D.

César Sabogal
Rodolfo Salazar
Germán Sánchez
Eduardo Somarriba

Richard Taylor
Assefaw Tewolde
Luis A. Ugalde
Edgar Víquez
Jean-Jacques Waelput

COSUDE-CATIE Project, Ph.D.
ROCAP/MUT, Ph.D.
CATIE-CIID-SAREC Project, Ph.D.
CATIE-GTZ Agroforestry
Researcher, M.S.
Livestock, Ph.D.
Livestock Breeding, Ph.D.
ROCAP/MUT Project, Ph.D.
AFN-CATIE Project, M.S.
Goat Project, Ing. Agr.

PROGRAM III. INTEGRATED NATURAL RESOURCES MANAGEMENT

Tania Ammour

Conservation for Sustainable
Development, Ph.D.

Sergio Castillo
Miguel Cifuentes

RENARM/IWM Project, Ph.D.
World Wildlife Fund, Regional
Rep., M.S.

Jean Collinet

Watershed Management Project,
Ph.D.

Fernando Ferrán
José G. Flores
Juan Carlos Godoy
Carlos Guimaraes

RENARM/IWM Project, Ph.D.
Program III, Director, Ph.D.
SDCCA Project, M.S.
Conservation for Sustainable
Development, M.S.

Alejandro Imbach
Francisco Jiménez
Enrique Lahmann
Jean Paul Lhomme
Florent Maraux

IUCN, M.S.
Agrometeorology Project, M.S.
IUCN/CATIE Team Leader, Ph.D.
Agrometeorology Project, Ph.D.
Agrometeorology, Project, Ing.
Agr.

Carlos Rivas A.

Watershed Management Team
Leader, Ph.D.

Xinia Robles
Tomás Schlichter
Prem Sharma

Library, Ing.For.
SDCCA Project, Ph.D.
Watershed Management Project,
PhD.

Hernán Solís

Watershed Management Project,
Ph.D.

Tomás Statdmuller

COSUDE Project Coordinator, M.S.

SOCIOECONOMIC UNIT

Rafael Celis

CIDA Project, Ph.D.

EDUCATIONAL PROGRAMS

Virgilio Cozzi

Training Program, Higher
Education Project, Ph.D.

Magaly Jurado
Ramón Lastra

Communications Unit, Lic.
Graduate Studies Program, Higher
Education Project, Ph.D.

José Luis Parisí	Associate Director General for Education, Higher Education Project, Ph.D.
Roberto Pérez José Ramírez	Construction Program, Arch. Student Affairs, Higher Education Project, Ph.D.

DATA PROCESSING AND EXPERIMENTAL METHODOLOGY

Rafael Oreamuno Gilda Piaggio	Data Processing, M.S. Experimental Methodology, Ph.D.
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ADMINISTRATION AND FINANCES

Agustín López	Director, Administration and Human Resources, Lic.
Donald McArthur	Finance Director, B.Comm.

OFFICIAL RELATIONS

Vera A. de Fernández	Head, Official Relations
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INTERNAL AUDITING

Carlos A. Vincenti	Internal Auditing, Lic.
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LIBRARY ORTON

Laura Coto	ORTON Library (Director), Bach.
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POSTGRADUATE STUDENTS

Pekka Nygren Edgardo Mejía	Class of 88-90 Ex member Technical Academic Committee, Student Rep., Ing. Agr.
Julio Tejada	President, Student Council, Ing. Agr.

COSTA RICACATIE-OFFICE

Richard Taylor

CATIE's Representative, Ph.D.

REDCA

Walter Arana Naranjo
 Israel Calvo González
 Carlos Chávez
 Luis A. Fournier
 Ana Lorena Jiménez París
 Gladys Jiménez V.
 Margarita Mesequer

Alfio Piva

Alvaro Rodríguez Aguilar
 Graciela Siles
 Elidier Vargás Castro

UNED
 ITCR Representative, Lic.
 EARTH
 MICYT
 CONICIT, Planning Director
 MIRENEM
 C.R. Association of Graduate
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