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Introduction

The Tropical Agricultural Research and Higher Education Center (CATIE, by its Spanish acronym) is a non-profit public institution established in 1973, pursuant to an agreement reached between the Interamerican Institute for Cooperation in Agriculture (IICA) and the Costa Rican Government.

CATIE is a regional organization that boasts a renown trajectory devoted to research, education and execution of agricultural development projects and natural resources management in Tropical America. CATIE's headquarters are located in Turrialba, Costa Rica, and it is honored with the following regular members: Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Dominican Republic, Venezuela, and the Interamerican Institute for Cooperation in Agriculture (IICA). The Department of Natural Resources of Puerto Rico is also an affiliated member of CATIE.

CATIE's mission can be summarized as: "Have the countries in Tropical America implement practices for sustainable development, managing an equilibrium between production and conservation in tropical ecosystems, while improving social and economic welfare of the population". To this end, CATIE carries forth its endeavors in the following four technical fields: Management of Watersheds and Agroforestry, Forest Management & Conservation and Biodiversity, Tropical Agriculture and Economics, and Environmental Sociology. These technical fields are responsible for developing the following institutional activities: research, graduate education, and outreach activities.

The Institution is directed by the Interamerican Board of Agriculture (JIA, by its Spanish acronym); the Council of Ministers, made up of the Ministers of Agriculture of CATIE's Member Countries; and the Board of Directors, which includes representatives of the private, education, finance, and scientific sectors. Its guidelines are executed by the General Director, with the support of a staff specialized in the different fields and areas developed by this international organization.

This report, in conformity with Article Nine of CATIE's Incorporation Agreement, presents the most outstanding results and achievements made by CATIE during the 1999-2000 biennial period.

Executive Summary

This report summarizes the main activities and achievements carried forth during 1999 and 2000 by the Governing Bodies (Board of Directors and Council of Ministers), as well as those of the administrative and financial management, and the Research, Education, and Outreach Activities Programs of CATIE.

In 1999, IICA's Executive Committee approved a new incorporation agreement for CATIE for 20 additional years, ratified in October, 2000 by the Legislative Assembly of the Honorable Government of Costa Rica. This new agreement includes the amendments approved by JIA during past years, as well as other modifications proposed by IICA and the Government of Costa Rica.

In October, 1999, Dr. Pedro Ferreira Rossi, who held the position of Director for Strategic Planning and External Relations of CATIE, was elected General Director for the term 2000-2004. The procedure followed was established in the new Incorporation Agreement, which called for an international contest and prescreening of candidates based on technical criteria.

Colombia was admitted to CATIE as a new Regular Member, and the Department of National Resources and Environment of Puerto Rico was admitted as an Affiliated Member.

In view of the ever-changing needs of the region and the greater emphasis made by the national governments concerning the issue of management and conservation of natural resources, CATIE's Research Program devoted part of its work to this topic. During this two-year period, several studies were conducted in relation with management of secondary forests, environmental services, forest certification, forestry policies, and the appraisal of the service of carbon fixation and storage in natural forests.

It should also be underscored that for the first time ever, the genetic diversity in the coffee germ plasm was analyzed by means of molecular markers, which helps to enhance the genetic base of the cultivated material. Furthermore, as a pioneering endeavor, coffee embryos were produced in a bioreactor, which may be planted directly in the field or the nursery. This implies a significant time reduction, not only in the *in vitro* cultivation, but in the use of labor as well. These results are being transferred to coffee research institutions in Central America and the Caribbean.

In December, 2000, CATIE held the graduation of its first three doctors. The demand for attending the Graduate Program, initiated at CATIE in 1996, has been on the rise, and by the end of 2000, thirty-two applications from eighteen different countries had been processed. After conducting a screening process, twelve professionals were admitted to the Program. Moreover, the demand for coursing the Master's Degree Program has also increased: In the year 2000, the number of students in this Program increased by more than 30%, as compared to 1999, with the most popular subject being Environmental Economics and Sociology. CATIE has subscribed agreements with the University of Wales in the United Kingdom and the University of Idaho in the United States of America.

During the period reported, especially during 2000, CATIE's efforts in the Outreach Activities Program focused on consolidating and implementing regional projects of great significance to Central America – helping to reinforce CATIE's presence in the region-with a heftier participation by governmental, non-governmental, and municipal organizations.

In the year 2000, the following projects were strengthened: PROMA, PROSELVA, and the Sustainable Development Program in Guatemala; FOCUENCAS, in Honduras and Nicaragua; the Fund for Slope Farmers in Honduras; the El Salvador Environmental Program (PAES, by its Spanish acronym); and the development of non-synthetic phytosanitary products, at the regional level.

In March, 2000, we launched the project "Support to Institutional Management and Outreach Activities" (SIMO), financed by the Danish Agency for International Cooperation (DANIDA, by its Spanish acronym), in Guatemala, El Salvador, Honduras, and Nicaragua. Besides strengthening CATIE in the above mentioned countries, the SIMO project shall provide key feedback for drawing up the new Institutional Strategic Plan for the 2003-2012 period, through the development of priority and demand analyses for the countries in the Region.

The Institution has been fortified by the economic support given by new donors, detailed as follows: FIDA provided funds in the amount of US$880,000 for training NGO members in the region; GEF approved US$750,000 for a project for organic cacao and biodiversity in Talamanca and Siquirres, Costa Rica. Taiwan granted support to IICA-REDCAHOR; and the Dutch government, in turn, supported Transforma through INAFOR. On the other hand, through FOMIN, we have destined US$5,000,000 to training courses on forest certification. In addition, the SIDA and DANIDA support was reestablished; and FINNIDA approved seven projects in CATIE's Research Fund.

ACHIEVEMENTS AND PROGRESS

Top Management

Governing Council

During the period 1999-2000, the Governing Council of CATIE held three regular meetings and one special meeting. The principal outcomes of these meetings were as follows:

- Analysis of the institutional situation of the Programs, Strategic Planning, and Finance.
- Review of policies for the modernization of CATIE's organization.
- Analysis of attainments of the Research, Education, and Outreach Activities Programs.
- Ratification of CATIE Budget, approved by the Board of Directors of the Center for the year 2000.
- Recommendation given to the Interamerican Board of Agriculture (JIA, by its Spanish acronym) for the election of Jamaica as its representative before the Council of Ministers; and the appointment of Dr. Richard Rortvedt, from the Interamerican Development Bank (IDB), as JIA's representative before the Governing Council.
- Approval of the Endowment Fund initiative for graduate scholarships, submitted by Guatemala.
- Approval in support of Guatemala as the seat of the FAO World Forestry Congress to be held in 2003.
- Approval of the amendments made to the Incorporation Agreement of the Center, submitted by the Board of Directors and presented to JIA for ratification. At the same time, JIA submitted these amendments to IICA, which is the organization in charge of presenting them to the Minister of Agriculture of Costa Rica. The last step in this process consisted in submitting these to the Legislative Assembly of Costa Rica, for approval by law, which finally occurred in October, 2000.
- Designation of the Minister of Agriculture of Costa Rica and another member of the Council, in a rotating manner, as members of the Board of Directors of CATIE. Currently, Belize stands as representative of the Council before the Board of Directors.
- Election of Dr. Pedro Ferreira as General Director of CATIE, for a four-year term (March 2000 to February 2004).

- Approval of the affiliated membership to CATIE of the Natural Resources and Environment Department (DRNA, by its Spanish acronym) of Puerto Rico.

Board of Directors

During 1999 and 2000, CATIE's Board of Directors and its committees met on four occasions, with the purpose of analyzing the different activities of the three major institutional programs. The main results generated at these meetings are listed below:

- Election of three candidates for the position of General Director, and forwarding of this list to the Governing Council for election.
- Approval of several modifications made to the General, Financial and International Professional Personnel Regulations, subsequently submitted to the Governing Council for ratification.
- Approval of the Action Plan for Outreach Activities: 1999-2000 and the Biennial Work Plan 2000-2001.
- Approval of the Budget 2000 Program, submitted to the Governing Council for ratification.
- Approval of the affiliated membership to CATIE of the Natural Resources and Environment Department of Puerto Rico (jointly with the Governing Council).
- Exhortation to the member countries of CATIE to become current with their membership dues, based on the internal and external auditing reports.

Administration and Finance

Finance

The basic activities of CATIE are financed by proceeds generated by regular income, profit-generating activities, and the execution of projects and activities linked to pacts and agreements. The management of financial information is controlled in five separate funds depending on the purposes and source of funding of each, as follows: Basic Fund, Agreement Fund, Profit-yielding activities Fund (agricultural and livestock activities and administration of goods and services), Plant Fund, and Trust Fund. All accounting records are kept in dollars of the United States of America (US $) and financial statements are expressed in the same currency.

CATIE's Basic Fund mainly consists of the annual contribution of US$50,000 in membership fees received from member countries and the regular contribution made by IICA. In 1999, this contribution amounted to US$1,293,600, and in 2000, it amounted to US$1,000,000. The proceeds generated by student enrollment in the Master's Degree and Doctorate Programs, as well as in the training courses, constitutes another important item for funding its basic activities. The basic fund has been reinforced by the contributions of the honorable governments of Sweden, Denmark, and Norway, which altogether granted US$2,227,585 and US$2,165,014 in the years 1999 and 2000, respectively. Additionally, other donations were received for these two periods in the amounts of US$470,354 and US$436,328, in that same order.

The funds received by CATIE for carrying out research, development, or higher education activities, which had been agreed upon in contracts with international organizations for the years 1999 and 2000, amounted to US$9,664,700 and US$10,077,102, respectively.

The surplus of income over expenditures on Productive Activities constitutes the annual contribution to CATIE's basic budget. This income proceeds from two large sectors: Business Farm and Institutional Services. The most important agricultural activities of the farm are sugar cane and coffee plantations and

milk production. The institutional services comprise lodging, transportation, production of communications media, among others. In 1999, these activities generated US$232,021 for financing the basic budgetary activities, while in the year 2000, this amount increased to US$337,637, for this same purpose.

An external auditing firm of renown international prestige conducts a yearly audit at CATIE. This same firm performs an audit at IICA and is selected by the Interamerican Board of Agriculture (JIA) at their biannual meeting. The funds administrated by CATIE for the execution of agreements or special projects are periodically audited by different external auditing firms, contracted by the donors. Furthermore, the internal audit contemplates, in its annual work program, the inspection of funds management, the expenses made by specific projects, and institutional accounts in general.

Charts 1 and 2 provide a summary of CATIE's Financial Statements for the years 1999 and 2000.

Chart 1. Assets, Liabilities, and Consolidated Statement on Funds for 1999 and 2000, expressed in U.S. dollars

ASSETS	**1999**	**2000**
Current assets:		
Cash	4,166,981[1]	2,888,629
Marketable securities	576,448	443,066
Accounts and notes receivable		
Members of CATIE	1,352,587	1,540,599
Other items	2,627,585	3,444,118
Total accounts receivable	3,980,172	4,984,717
Inventories	108,897	239,185
Prepaid expenses	21,543	–
Total current assets	8,854,041	8,555,597
Property, machinery, and equipment	3,394,023	3,327,155
Other assets	88,202	99,387
Trust fund	150,000	300,000
TOTAL ASSETS	**12,486,266**	**12,282,139**
LIABILITIES AND BALANCE OF FUNDS		
Current liabilities:		
Accounts payable and accrued expenses	1,027,835	1,111,108
Trust Fund	2,937,940	1,550,469
Donors – agreements and contracts	1,508,593	1,898,246
Accrued income and other liabilities	468,531	304,918
Total current liabilities	5,942,899	4,864,741
TOTAL LIABILITIES	**5,942,899**	**4,864,741**
Funds balance sheets	6,543,367	7,417,398
TOTAL LIABILITIES AND WORK FUND	**12,486,266**	**12,282,139**

For 1999, Chart 2 shows total income of US$17,442,407 and expenditures in the amount of US$17,938,698, revealing an excess of expenditures over income of US$496.291. In the accounting books, however, the 1999 period ended with a surplus (an excess of income over expenditures) amounting to US$86,837. For presentation purposes of the financial statements, the External Audit reclassified several items, which modified the results shown in Chart 2 as follows:

[1]This amount includes US$ 1,786,232 corresponding to the funds for the MAGA/Guatemala project administrated by CATIE at the time.

Chart 2. Statement of Income and Expenditures of the Basic and Project Budgets for 1999 and 2000, expressed in U.S. dollars.

INCOME	**1999**	**2000**
Membership fees	1,550,000	1,675,000
Technical support services	226,116	217,204
Teaching activities	381,743	580,294
Profit-yielding activities	1,732,927	2,137,804
Administrative and logistics support	914,287	1,004,974
Difference in exchange rate	(4,037)	(4,946)
Other income	228,662	156,055
Specific donations and contributions	2,747,939	2,601,342
Subtotal	7,777,637	8,367,727
Income from agreements	9,664,770	10,077,102
Total income	**17,442,407**	**18,444,829**
EXPENDITURES		
General Management and Top Agencies	707,908	622,902
Administration and services	1,329,444	977,842
Technical programs	4,735,670	4,704,019
Profit-yielding activities	1,500,906	1,800,167
Subtotal	**8,273,928**	**8,104,930**
Trust expenses	9,664,770	10,077,102
Total expenditures	**17,938,698**	**18,182,032**
Surplus of Income over Expenditures	**(496,291)**	**262,797**

	US $
Surplus in CATIE's books as of 12-31-99	**86,837**
Adjustments performed by external audit:	
a) CATIE's contribution for Faculty I	
Eliminated as expense and reclassified as investment	150,000
b) Overhead received from administrated projects	
Eliminates the effect of projects administrated in Guatemala	(131,994)
c) Accrued income for the construction of a Virtual Classroom	
Eliminated for presentation purposes	(420,000)
d) Reconciliation of Retained Earnings at the beginning of the period	
Eliminated for presentation purposes	(156,218)
e) Technical Support Services	
Eliminated for presentation purposes	(24,917)
Adjusted balance	**(496,291)**

Budget Distribution

CATIE's budget is distributed mainly amongst three technical programs and the administration. Technical programs --specifically Research, Education and Outreach Activities-- have been allotted approximately 75% of the expense budget. Approximately 20% of the budget goes to financing management activities, which include Superior Guidelines, General Management, Support Programs (Strategic Planning, External Relations, and Internal Audit), and the Center's Administration and Finance. The operating reserves and other funds comprise 5% of the budget.

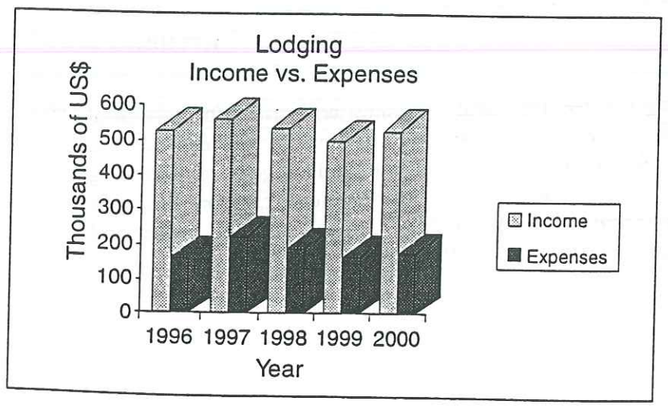
Management

CATIE's management has put forth great effort to improve its processes and strengthen controls during the biennial period 1999-2000. During this period, new controls have been implemented to provide better logistics and administrative support to the technical programs. The most salient results are the following:

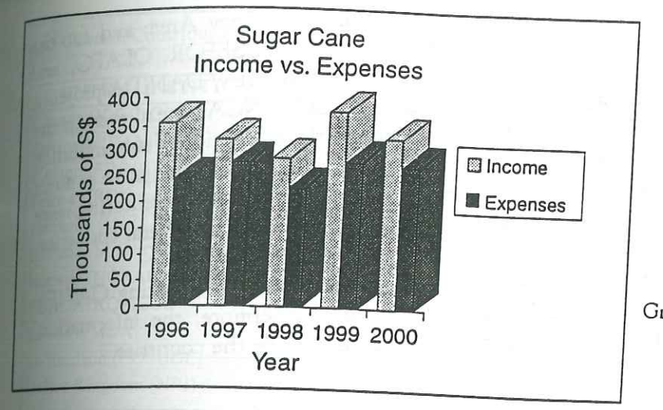
- Repair and remodeling of several buildings and lodging facilities with proceeds from the Basic Plant Fund, aimed at improving accommodations for visitors and students in higher education, short courses, seminars, and other training activities. This activity had decreased, since the funds proceeding from institutional trusts, previously used for this purpose, were destined exclusively to financing graduate scholarships.
- Construction of three additional bridges at CATIE's farm, through the ICE-CATIE agreement, in order to expedite and lower labor costs in the transportation of sugar cane and coffee.
- Replacement of eight vehicles of the basic plant fleet, aimed at maintaining service quality and security, as well as the investment value.
- Establishment of new procedures for the general management of CATIE's assets. More efficient controls were implemented for handling fuel, lubricants, and oil in the Transportation Unit. Improved controls were established in the handling of cash used for paying coffee harvesting, purchase and sale of livestock, and other administrative activities.
- Reinforcement of CATIE's on-campus security through better equipped personnel, with a better disposition towards people, improved training on personal safety, as well as custody and safekeeping of the institution's property.
- An extension of the contract held with the concessionaire operating the Institutional Cafeteria, with an improvement in quality and service, continuing with the priority of food requirements for on-campus students, as well as visitors.

As previously mentioned under the item "Finance," the surplus of income over expenditures for Profit-yielding Activities -institutional services and commercial farms- contribute to CATIE's basic budget. Lodging services and activities related to sugar cane and coffee production, and coffee harvest, constitute the most salient lines in the generation of income, in that order.

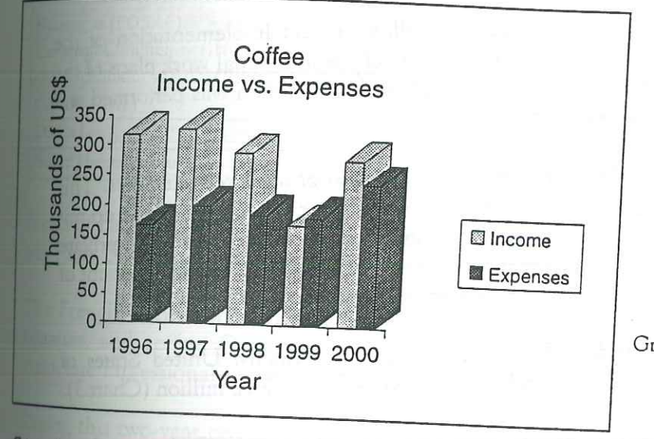
Graph 1 compares the income and expenses for the lodging services during a five-year period. Graphs 2 and 3 show the income and expenses for a five-year period for the coffee and sugar cane activities, revealing the impact of a decrease in international prices, and the consequent reduction in income for those items.



Graph 1. Income vs. expenses: lodging.



Graph 2. Income vs. expenses: sugar cane.



Graph 3. Income vs. expenses: coffee.

Strategic Planning and External Cooperation

During the period 1999-2000, changes took place in what was previously known as Strategic Planning and External Relations Management: in mid-2000, the Strategic Planning Management was established, appointing Dr. Tania Ammour as temporary Director.

Strategic Planning

Based on its work hubs, the Strategic Planning Management achieved the following:

- *Planning policies and methodologies:* A document was drawn up containing the principles and instruments on planning, monitoring and evaluation (PM&E), with the purpose of analyzing the methods and results of the PM&E processes in different areas and projects; the analysis and proposal for the restructure and reorientation of CATIE (procedures for defining criteria and the proposal of priorities in the lines of action).
- *Strategic planning:* In a participative manner, CATIE's regional members and officers prepared an analysis and a set of impact indicators for orienting mid-term planning, as well as studying the impact evaluations on the Institution. Furthermore, an impact evaluation was performed on CATIE's Natural Forests and its members, in Guatemala and Costa Rica, during the past ten years.
- *Mid- and short-term planning:* Mid-term plans were drawn up using a logical framework for the following agencies and projects: Management Planning (2000–2002, 2001–2003), Forest Management &

Conservation and Biodiversity Area, Environmental Economics and Sociology Area; and for the following six projects: TRANSFORMA, SIMO, MIP-CABI Mission, PROSEFOR, OLAFO, and FOCUENCAS. Monitoring and evaluation of PROSEFOR, and the Agroforestry/ DANIDA projects, as well as monitoring plans for MIP, TRANSFORMA, OLAFO, and FOCUENCAS are already in the preparatory phase. Also, the validation of the MARPS methodology for the evaluation of sustainability, and the design of a monitoring system for the municipalities of the Estero Real in the mangrove swamps of the Nicaraguan Pacific seaboard were completed. Training courses on planning and monitoring were given to CATIE's management staff and officers, as well as to NGO technicians in several countries, such as Colombia, for example.

- *Human Resources policies and management:* A new instrument was created for evaluating CATIE's technical staff, taking into account efficacy and efficiency criteria. Furthermore, the information system on human resources was completed and updated, to be used, in turn, by the countries.

External Cooperation

The most outstanding activities carried out in 1999 were the follow-up and implementation of the Institutional Development Plan, and the revision and reprogramming of the individual work plans of the professional officers of CATIE. An in-depth examination of CATIE's Strategic Plan was performed and the modifications made were approved by the Board of Directors.

During the year 2000, a campaign was launched for preparing a portfolio of affiliated members. This category, as defined in the Incorporation Agreement of CATIE, is constituted by countries that do not belong to the interamerican system, or by domestic or foreign institutions and of the public and private sector, whose mission is related to that of CATIE. The first affiliated membership, i.e. the Department of Natural Resources and Environment of Puerto Rica, was approved this year.

Donations were received from Denmark, Sweden, Switzerland, Norway, Germany, United States of America, Holland, and France, among others. These contributions amounted to US$ 12 million (Chart 3).

We were able to execute very important projects in benefit of member countries of CATIE. Among these actions, we can underscore the renegotiation of DANIDA's support, and the visit of an evaluating mission, directed by Dr. Elizabeth Tarp, in charge of launching of the SIMO Project aimed at supporting CATIE's institutional management and outreach activities. Likewise, the negotiation of the Focuencas Project was conducted in support of the post-Mitch watershed management project, financed by the Swedish Agency for International Cooperation. This project is being implemented in Honduras and Nicaragua, having also provided 30 scholarships for the new Master's Degree Program on Watershed Management.

We welcomed the visit of a joint mission in charge of the SIDA-NORAD Evaluation, with the participation of Börje Wallberg and Rolain Borel (SIDA) and Åsbjörn Skaaland (NORAD). This group evaluated the progress of the Institutional Development Plan and the financial situation of CATIE. They submitted their findings to CATIE's Group of Donors during their annual meeting held on December 8, 2000.

The donors' meeting is a yearly activity, held for the purpose of submitting the reports on CATIE's programs, as well as receiving suggestions from donors. In 1999, representatives from SIDA, FINNIDA, NORAD, COSUDE, DANIDA, USDA, and the Spanish Cooperation agency, as well as several regional NGOs (CCAD-SICA and RUTA), participated in the meeting. Also present were members of CATIE's

Chart 3. Contributions to CATIE's research and education activities (1999).

COUNTRY / INSTITUTION	CONTRIBUTION (US $)
Canada (IDRC, CIDA)	7,929
Denmark (DANIDA)	2,174,552
Finland (FINNIDA)	158,618
France (IRD)	6,773
Germany (GTZ, BMZ, KfW)	727,020
Holland (Ministry of Foreign Affairs, UAW)	186,351
Norway (NORAD)	1,281,722
FUNDATROPICOS	193,824
Sweden (SIDA)	64,815
Switzerland (COSUDE)	1,309,944
United Kingdom (NRI)	86,244
United States of America (AID, USDA, ACRI)	1,101,301
Nicaragua (POSAF)	35,667
European Community (INCO)	132,698
Other Institutions (BID, CIRAD, FAO, UICN, ITE, WWF, IPGRI, CIFOR, CIAT)	950,114
TOTAL	8,417,572

Note: These amounts do not include the contributions made to CATIE's basic budget.

Board of Directors. The participants set forth several recommendations for CATIE's future management. Mr. Kent Blom from SIDA was elected president of the group as of December 8, 1999.

The French institutions CIRAD and IRD continued their work at CATIE in the fields of agroforestry, bananas, and coffee. Currently, several scientists from both of these institutions work at CATIE as Associate Professionals.

During this two-year period, 75 new projects were approved for an approximate total of US$19 million. The most important donors are: COSUDE, ASDI, DANIDA, NORAD, GTZ, USDA, ACRI, and CIFOR, which clearly evidences the donors' confidence in the Institution.

During that same period, 63 institutional agreements were subscribed between CATIE and diverse institutions from inside and outside the Region, aimed at satisfying the countries' needs. It should be highlighted that the contributions received by CATIE from its strategic allies as counterpart support, are mainly in the form of human resources.

FUNDATROPICOS, a foundation established in Costa Rica, received a contribution for US$1,25 million from the Swiss Development Corporation, COSUDE, through CATIE, for establishing the Latin American Faculty on Diversified Tropical Forest Management. CATIE will contribute with an equal sum for a seven-year period. This foundation also contributed US$206,000 to CATIE's basic budget during the year 2000. These proceeds were used for scholarships in Master's Degree programs.

On its part, The Tropics Foundation, which operates from the United States since 1998, received a donation from the Wallace Foundation on Genetics in the amount of US$50,000 in support of CATIE's basic activities.

ACHIEVEMENTS AND PROGRESS IN THE GENERATION AND TRANSFER OF KNOWLEDGE

Program on Education for Development and Conservation

During fifty-four years, CATIE's Graduate School has provided studies conducive to a Master's Degree, and since 1996, conducive to a Doctorate, in specialized studies related to agriculture, and sustainable management and conservation of natural resources. The School's objective is the formation of professionals who are committed to sustainable development, and who are endowed with the necessary knowledge and skills to effectively and efficiently perform their roles as agents of change, in the use of natural resources in a productive and conservationist fashion and in the protection of the environment.

The Institution offers two education options: a Master's Degree (two years) and a Doctorate (three years). It is worth mentioning that during 1999 both programs were reviewed and updated, and the decision was made to renew the Master's Degree on Integrated Management of Watersheds, which initiated in January, 2000. The bilingual (Spanish-English) program was also reinforced during this year as a substantial part of CATIE's integral education.

Among the activities carried out for promoting the funding and support of the Program, an agreement for complementary resources was signed with the OAS, aimed at granting scholarships to young professionals from the agricultural sector from countries in the Interamerican System. This initiative is expected to become a reality in the year 2001. Likewise, progress is being made in the negotiations with ARS/USDA for supplying resources to support graduate education at CATIE. In principle, these funds shall benefit the IDIAP/Panama officers.

On the other hand, complying with JIA's mandate, the policy on scholarships-loans was prepared for implementation in 2001. With this, a revolving fund shall be reinforced to allow for financial support to other students on a mid-term basis.

At the regional scope, proposals were made to reinforce CATIE's Master's Degree Program by reestablishing specialized studies in Watershed Management, submitted to the USAID representatives in Central America, with the purpose of responding to the need for human resources specialized in that field. As a result of this initiative, the Guatemalan and Honduran offices approved these proposals, having obtained financing for eight Master's Degree students in 2000 and 2001. This represents an investment of US$280,000.

The plan to reactivate the Master's Degree in Watershed Management was strengthened with the approval by the Swedish Agency for International Development (ASDI) of the Regional Project for Management of Watersheds, involving over US$4,0 million during a three-year period. This contemplates the financing of 30 Master's Degree scholarships for students of the Region. In Panama, we have provided training, advisory services, and support to the University of Panama in the steps it is taking towards establishing a Master's Degree in Environmental Economics.

Additionally, during the year 2000, agreements for a joint Doctorate were negotiated with the University of Idaho (U.S.A.) and the University of Wales (United Kingdom), which are expected to be in full force by 2001.

Master's Degree Program

During the 1999-2000 period, 83 (45 in 1999 and 58 in 2000) out of 103 students (41 in 1999 and 42 in 2000) graduated. These students, proceeding from 16 different countries of America, had begun studies conducive to the *Magister Scientiae* degree. Their theses' subject areas focused on the evaluation of sustainability, clean technologies, and integrated management of natural resources, to mention a few.

It is important to highlight that in 2000, the number of students for this program increased by over 30% as compared to 1999. This led to a significant increase in the general, academic, and administrative activities of Graduate School.

During this two-year period, over 580 applications were processed for the Master's Degree Program, and in 2000, 155 students were admitted to the 2001-2002 academic cycle.

Charts 4 and 5 show the distribution of the Master's Degree students by to subject area and countries. It is worth highlighting that 50% of all students in this Program are women.

Chart 4. Classification of Master's Degree students according to majors selected.

	Class of 98-99	Class of 99-2000	Class of 2000-01
I. Ecological Agriculture	10	8	14
Phytogenetic Resources and Biotechnology	3		11
Sustainable Tropical Agriculture	7	8	3
II. Tropical Agroforestry	6	8	13
Watershed Management			14
III. Management and Conservation of Tropical Forests and Biodiversity	13	16	10
Management of Forest Production Systems	2	5	6
Conservation of Biodiversity	11	11	4
IV. Environmental Socioeconomics	12	13	10
Administration and Management	11	12	9
Environmental Economics and Sociology	1	1	1
TOTAL	41	45	61

Chart 5. Master's Degree students by country (1998-2001)

Country	98-99	99-00	00-01
Argentina	2	0	1
Belize	0	1	1
Bolivia	2	0	1
Brazil	3	1	9
Colombia	4	4	3
Korea	0	1	0
Costa Rica	6	6	7
Ecuador	1	2	1
El Salvador	5	7	4
United States	0	1	1
Guatemala	3	3	7
Honduras	4	7	6
México	1	1	5
Nicaragua	4	5	6
Panamá	1	2	2
Paraguay	1	0	0
Dominican Republic	1	1	1
Venezuela	3	3	3
TOTAL	41	45	58

Doctorate Program

In the year 2000, the first three students graduated from the joint Doctorate Program with North American and European universities (Chart 6). From its inception in 1996, the Doctorate Program has made substantial progress. Its objective is to offer high-level education, comparable to that of renown universities in Europe and the United States of America.

During this period, the Doctoral Committee focused its efforts on the revision and coordination of the wording and scope of the agreement pertaining to the joint doctorate between CATIE and the University of Wales in the United Kingdom and the University of Idaho in the United States of America.

The joint endeavor between CATIE and the associate universities shall broaden the coverage of the existing demand for this program, and consequently, increase the possibility of selecting the top candidates. At the same time, we anticipate that students from allied institutions shall be attracted to CATIE to undertake research activities, thus opening new alternatives for the development of joint projects.

Thirty-two applications from 18 different countries were processed, 12 of which were admitted (Chart 7). For the year 2001, approximately nine new students are expected to enroll.

Chart 6. Country of origin of doctorate students graduated in December, 2000.

Country of origin	Students
Switzerland	1
Mozambique	1
British Guiana	1
TOTAL	3

Chart 7. Distribution of doctorate students by subject area.

Subject Area	Students
Tropical Agroforestry	9
Tropical Forestry Sciences	2
Environmental Socioeconomics	1
TOTAL	12

Research Program

The objectives of this program are: i) generate knowledge on the biophysical, ecological and socioeconomic processes of different production systems and their components, ii) generate sustainable management systems for agriculture and natural resources in an integrated manner, and, iii) generate data, scenarios, and options for development, based on agricultural and natural resources management at different levels (germ plasm, production systems, ecosystems).

Through the implementation of the research products and results, we seek to contribute towards the suppression of poverty and the conservation of the environment, promoting competition among the agricultural and natural resources sectors, in order to face the challenges of globalization.

The Program focuses its efforts on five lines of research, as follows:

Line 1: Improvement and conservation of germ plasm in selected agricultural and forestry species.
Line 2: Integrated pest management in agricultural, agroforestry, and forestry systems.
Line 3: Tropical agroforestry systems for slopes, agricultural frontiers, and degraded lands.
Line 4: Development of technologies for the sustainable development of forests and biodiversity.
Line 5: Socioeconomic analysis and appraisal of policies and of environmental goods and services in tropical ecosystems.

Each of the preceding lines is divided into sublines. The research activities undertaken within each line are carried out by means of interdisciplinary research projects. Chart 8 shows the projects in progress in each line of research for this two-year period.

Chart 8. Research projects in progress, by line of research (1999-2000).

Line of research	Projects in progress	
	1999	2000
1. Genetic Resources	11	15
2. Integrated Pest Management	19	18
3. Agroforestry	12	10
4. Forestry and Biodiversity	17	18
5. Economics, Sociology, and Policies	11	13
TOTAL	70	74

The Scientific Committee, responsible for the coordination of research activities, is made up of eight members: the General Director, the Research Director, the Education Director, and the Coordinators of the five lines of research.

During 1999 and 2000, priority was given to the preparation and dissemination of the technical and scientific data generated. CATIE technicians prepared 605 articles for regional and international publications (magazines, books, conventions, reports, presentations, etc.), as can be seen on Chart 9 and on the Appendix exhibiting the list of publications.

Chart 9. Publications and presentations made by CATIE (1999 - 2000).

Type of Publication	Number
Magazines	
International scientific	46
Regional technical	90
Other scientific publications	
Books	10
Chapters in books	39
Reports	44
Summaries / posters	37
In the media	2
Conferences	29
Technical	
Technical Series (CATIE)	24
Presentations at conventions	25
Articles in technical magazines	77
General	
Bulletins, general texts	88
Progress reports	5
Academic	
Academic texts	6
Master's Degree theses	83
TOTAL	605

Line 1: Improvement and conservation of germ plasm in selected agricultural and forestry species

CATIE has given priority to agricultural and forestry species which are of social and economic relevance to the Region, for the first case being coffee and banana, and for the second case, mahogany. Following are some of the most salient results and progress for the period 1999-2000.

Analysis of the genetic diversity of wild coffee (*Coffea arabica* L.) from the germ plasm collection of CATIE

We analyzed the genetic diversity available in the coffee germ plasm, using the RAPD ("Random Amplified Polymorphic DNA) molecular markers. The material under study consisted of 119 individuals, which stood for 88 accessions and six cultivars from Ethiopia and two individuals of the Typica and Bourbon genetic bases, introduced in the American continent during the XVIII and XIX centuries.

The results confirmed the low level of polymorphism of the C. *Arabica* species, detected in the wild accessions. The classification based on the similarity indices between pairs of individuals showed a distinct separation of the Bourbon base from the other accessions, which were separated into five groups: one with the Typica base and four with the Ethiopian accessions. Comparable to that of the rustic materials, the Ethiopian cultivars presented an ample genetic diversity.

The results of the study showed the importance of the rustic coffees to enhance the genetic base of the cultivated material. Based on the structure revealed by the RAPD markers and on the phenotypic evaluation performed on the germ plasm, the core collection (which forms part of the accessions from the coffee picked in the field) was determined. Likewise, a duplicate of this collection shall be kept in cryoconservation in CATIE's Biotechnology Laboratory.

Characterization of cultivated coffee varieties (*Coffea arabica* L.), kept in the germ plasm bank of CATIE.

The objectives of this research were to evaluate the capacity of the molecular markers for the characterization of coffee by variety, and to appraise the genetic diversity of the cultivated material (Typica, Bourbon, rustic, and introgressed) by means of molecular markers and agromorphological observations.

The agromorphological characterization based on the plant, fruit, and fertility characteristics, allowed for determining the genetic variability present in each group. The characteristic pertaining to the inside of the fruit was considered the most important one for classifying the varieties in each of the Typica and Bourbon groups.

The polymorphism found through the RAPD molecular markers was high, due to the presence of C. *Canephora* genotypes and to the group of introgressed varieties. However, the number of polymorphic markers was low. The different markers for each and the common markers shared by the groups were identified. Furthermore, the 10 specific markers for the progenitors of the Nemaya variety were identified. The genetic distance between the Typica and Bourbon is not significant, evidencing the narrow genetic base that characterizes these groups. Moreover, regarding these same groups, the genetic distance proved to be significantly greater as compared to the rustic varieties, thus presenting a more ample variability.

Evaluation of genetic diversity levels and dynamics of tropical forest species of economical and ecological relevance.

The description and comparison of the level and distribution of genetic diversity is critical in designing management policies for genetic improvement, as well as for the conservation of tree species, whether in situ or ex situ. The project has gathered collections of five important species in Mesoamerica: mahogany (*Swietenia macrophylla*) and white cedar (*Cedrela odorata*), and in Costa Rica: "mayo colorado" (*Vochysia ferruginea*), "pilón" (*Hyeronima alchorneoides*), and "chaperno" (*Lonchocarpus costaricensis*). The conservation status of the species was evaluated and their genetic diversity studied, using molecular markers. We gathered samples of mahogany and cedar from six countries and we have herbarium materials and live collections from CATIE's botanical garden. These species have great economic importance and the genetic diversity studies have demonstrated that they are undergoing a very strong genetic erosion and a vast number of populations are already extinct. We have pinpointed areas of great importance for the conservation of the species and actions which include the recuperation of natural areas where the a species has been decimated. "Mayo colorado" and "pilón" are two very important species for Costa Rica and salient genetic differences have been discovered; the studies identified the need to conserve the populations in southern Costa Rica as well as in the Atlantic area of the country, because of their genetic variability and their potential use by rural communities.

In the case of *Lonchocarpus costaricensis*, we have detected an important variation, despite being an endemic species of Costa Rica, of a very reduced distribution range (solely the Pacific of Costa Rica). This leguminosae is being researched for the production of a nematicide, and the differentiation amongst the Pacific populations, especially those in the Matapalo and Nosara, Costa Rica, regions is strong as compared to the Central Pacific populations. These differences may be used both in conservation as well as in the use of the species, carrying out conservation plantations and studies on the variation in nematicide production, which is a non-timber-yielding product which may acquire commercial significance in the country.

Molecular characterization of *Quassia amara* L. ex Blom in Central America.

Quassia amara is a shrub typical of the understory in the humid American tropics, considered a non-timber-yielding product of the forest of great interest because of its medicinal and insecticide properties. The molecular characterization seeks to obtain a further in-depth and detailed knowledge on 17 genotypes of *Q. Amara*, dispersed throughout Central America. This would enable us to determine conservation tactics for this species in a more efficient manner, and establish well-founded programs for genetic use and improvement.

This molecular characterization research on *Q. amara* denotes the coincidence of two simultaneous factors: a separation of same according to its Pacific or Atlantic origins; and in addition, the influence of the two possible genetic values within the population, one proceeding from the north represented mainly by the El Salado populations (Honduras), Chirilagua (El Salvador), and La Lupe (Nicaragua); and another conformed by populations typically represented by Barro Colorado, Soberanía, and Kéköldi (Costa Rica). Results have confirmed that many of the genotypes dispersed throughout Central America apparently were mobilized by man from other places, which was due to the traditional importance that *Q. amara* has had as a medicinal plant known from ancient times.

The use of somatic embryogenesis in bioreactor for the mass propagation of elite coffee materials in Central America and the Caribbean.

Twenty improved varieties of C. *arabica* F1 and one graft-bearing variety (C. *canephora*) have been propagated by means of somatic embryogenesis, and are grown in seven member countries of the PROMECAFE network. To guarantee the spread of this material, CIRAD and CATIE have jointly developed a somatic embryogenesis process, submitting several technical innovations to reduce production costs in coffee cultivation. The *in vitro* multiplication and embryo regeneration stages are carried out in a liquid media, in cellular suspension, in a bioreactor with temporary dipping, respectively. The use of the bioreactor with temporary dipping permits a faster mass production (4 months) of high-quality somatic embryos. This temporary dipping principle favors the elimination of the severe morphological and physiological problems found in embryos produced with traditional bioreactors.

For the very first time, the embryos produced in a bioreactor may be planted directly in horticultural soil and at the nursery, which means a reduction both in the duration of the in vitro cultivation and in the use of labor. The conversion rate of embryos in plant, in nursery is approximately 75%. To date, this process permitted the propagation of coffee genotypes introduced and it is currently in its pre-industrial validation stage. Agronomical assays have been established, on the one hand, to prove the genetic conformity of regenerated materials, and on the other, to create a multilocal producer network in Central America, aimed at selecting the very best F1 varieties of C. *Arabica* as of the year 2003. Concurrently, this process is in the course of being transferred to coffee research institutions in Central America and the Caribbean.

Regeneration and cryoconservation of cellular suspensions in edible cultivars of *Musa* spp.
The optimization of the cellular regeneration systems in *Musaceae* are the necessary foundation for genetic improvement by non-conventional means. The application of these systems to the majority of *Musa* cultivars has been one of the fundamental objectives of the research program, in addition to the establishment of cryogenic systems for the conservation and handling of these materials, with the least possible risk of genetic variability.

At present different cultivars of alimentary importance for the region may be regenerated through somatic embryogenesis. Furthermore, we have obtained embryogenic calluses of genotypes of great importance for genetic improvement, for which the initiation of suspensions is already in course. The cryoconservation of suspensions on plantains was attained by CATIE from 1998, initially by master's degree studies (Yah, 1998), and the subsequent adaptation of this protocol to banana cultivars, which during 1999 yielded the first results on survival of suspensions on the 'Big Dwarf' to their freezing in liquid nitrogen.

We observed, after 15 days' cultivation in a liquid medium, the recuperation of growth and proliferation of cellular aggregates. These are very significant results, since they allow for the management of embryogenic cultivations of great interest, both for the long-term storage of germ plasm and for the large-scale micropropagation of cultivars of interest.

Cryoconservation of coffee seeds.
The development of an alternative long-term conservation method (cryoconservation) has become a priority for coffee collection at CATIE, which has been subject to problems of genetic erosion, high management costs, adverse climatic conditions, and need for vast spaces. At CATIE, we evaluated the reproduction capacity of two procedures developed at the IRD, France. They used seeds from *Coffea arabica*, Typica var., which were desiccated and later disinfected. In procedure 1, the seeds were placed directly in liquid nitrogen, and later proceeded to the extraction of the embryos, which were set out to grow in a cultivation medium. One hundred percent of the embryos extracted developed healthy plants. For procedure 2, the seeds were frozen slowly and placed in a PEG "priming" solution during several weeks. In this case, depending on the PEG concentration, elevated percentages of seeds exhibited breakout of the hypocotyl and growth of the radicle. Currently all plants are completing their growth cycle at the nursery. Subsequent trials of rapid freezing and extraction of embryos from different varieties of coffee showed a wide variability of percentages of germination. The results have demonstrated the possibility of establishing a cryobank of coffee seeds, and we have recently collected seeds for this purpose.

Encapsulation-dehydration of mahogany (*Swetenia macrophylla*) apices *in vitro*.
Encapsulation-dehydration is a simplified cryoconservation technique. Only few works have been conducted on tropical ligneous species. The Japanese have employed this technique for the encapsulation of *Cedrela odorata* apices, and its subsequent *in vitro* storage; however, to date the recuperation of mahogany apices after freezing has yet to be published. At our laboratory, initial results with mahogany apices showed survival rates of 7% and 10%, using a 3-day preculture, with 0.5 M of sucrose and 6 hours of dehydration to the treamline flow. These values may be improved, evaluating the preculture and dehydration conditions.

Modernization of the germ plasm database.
The germ plasm database (in PcGRIN) was modernized with the traits of key plants and information on genetic variability within the collections. The renewal and inventory of the sapote collection was reinforced with the support of the Wallace Foundation. The germ plasm was regenerated as part of the

Project "Evaluation, Regeneration, and Updating of the Database of Unique Phytogenetic Resources in Mesoamerica," financed by the Department of Agriculture of the United States of America. In this Project the following is characterized: 100 accessions of chili (*Capsicum* spp.) and 300 accessions of pumpkin (*Cucurbita moschata*). In another order of things, we took care of 31 inquiries and 257 visitors from different countries of the world.

Maintenance and renewal of CATIE's international cacao collection.
We worked on the maintenance and renewal of our international cacao collection, the only one of its kind. Cultural and agronomic practices were applied with the purpose of maintaining the plants, and their hybrid vigor, in the best possible conditions. In addition, the efforts focused on curbing the propagation of *Rosellinia* spp. and *Ceratocystis fimbriata*, two fungi diseases that affect cacao.

The Honduran Foundation on Agricultural Research (FHIA) conducted a research in the year 2000, using CATIE's cacao germ plasm, with resistance to monilia (*Moniliophthora roreri*), a disease that devastated this Central American country in 1999. Another salient aspect in the research of this crop at CATIE is the selection and regeneration of cacao genotypes which are resistant to moniliasis.

Line 2. Integrated pest management in agricultural, agroforestry, and forestry systems.

The paradigm of the Integrated Pest Management (MIP, by its Spanish acronym) at present is widely recognized as a non-traditional alternative. The MIP practices provide advantages for preserving the environment and biodiversity, reducing risks for farmers, the rural population, and consumers, and contributing towards the sustainability of traditional farming and forestry production systems. Following we submit information on projects implemented in 1999-2000.

Viability of promissory strains of *Beauveria bassiana* against the coffee borer.
The viability of promissory strains of the entomopathogen fungus *Beauveria bassiana*, with potential against the coffee borer, may be preserved by formulation and storage methods. We evaluated the impact of four formulations on two strains of *B. bassiana* (RL-9 and 9205), and different storage methods, on the viability, growth, and sporulation of the fungus. The results indicate that the lyophilized formulation maintains 100% of the germination after 9 months and was not affected by the storage conditions. The formulations in oil and in dust reduced the viability of the conides in both strains; nonetheless,the conservation of the formulations with silica at 0°C improved the conservation of viability. These results indicate that the uselife of biological products in storage may be expanded.

Preventive management of the geminivirus–white fly in tomato.
Live coverages are effective in the management of geminivirus transmitted by the white fly in tomato. CATIE continues to search for preventive management approaches to face this problem that are appropriate for low-income farmers.

Recent findings have confirmed that several live coverages, such as "cinquillo" (*Drymaria cordata*), coriander (*Coriandrum sativum*), and "maní forrajero" (*Arachis pintoi*), significantly reduce the number of white flies and retard the propagation of the geminivirus, while maintaining sound crops. Moreover, due to the fact that the coriander produces an added bonus if sold, and it is easier to plant and harvest than the other crops, it is recommended for commercial use.

Antagonists for cacao diseases.
We established a collection of organisms (*Fusarium* sp., *Trichoderma* sp., and *Gliocladium* sp.) which are antagonists to the two main diseases attacking cacao. We selected antagonists against *Phytophthora palmivora* and *Moniliophthora roreri*, and the most promissory isolations were tested in Costa Rica and Panama. The experiments consisted of monthly applications of aqueous suspensions of spores to the floral cushions, flowers and fruit. A test was also conducted to evaluate the impact of several additives on the persistence of *Gliocladium* on cacao fruit in the field (data yet to be analyzed).

The use of *Bacillus popilliae* for the biocontrol of Phyllophaga spp.
Initial studies show that the "gallina ciega" (*Phyllophaga* spp.) is highly susceptible to the bacteria *Bacillus popilliae*. Experiments on application methods of *Bacillus popilliae* against first and second stade of *Phyllophaga elenans* produced mortality rates of up to 96%, identifying these as the best stades for attempting the reduction of populations of this important pest.

Biological control of *Mycena citricolor* in coffee.
The disease caused by "ojo de gallo" (*Mycena citricolor*) produces a strong defoliation of the plants, thus reducing coffee production, especially in coffee plantations with high relative humidity which promotes the development of this disease. The management of "ojo de gallo" is complex, even with the use of fungicides. The development of biological control agents for "ojo de gallo" could be an alternative, particularly in the production of organic coffee. Previous studies have revealed as an obstacle the wide diversity of biotypes of the pathogen. For this research we are working on obtaining biological control agents that have an impact on different biotypes of *M. citricolor* which are present in the region.

Biological control of coffee rust.
Given the high cost of the chemical control of rust (*Hemileia vastratix*), the biological control is a complementary alternative to other management practices for diminishing the severity of the disease. In previous research, organisms antagonist to *H. Vastratix* have been found, among which is *Verticillium lecantii*, an hyperparasite fungus commonly found in coffee plantations. However, a mass reproduction method has not been encountered, which would allow for the availability of large-scale concentrations of the fungus, both at the short term and at low cost, which would be needed for its applications in the field.

The objective of this research is to obtain strains of *Verticillium* sp. with potential as biological control agent, and a method that permits its mass production. To this end, we have established a collection of *Verticillium* sp.; in addition, we have selected strains of *Verticillium* sp., and its combinations in coffee plants grown in pots under greenhouse conditions.

Line 3. Tropical agroforestry systems for slopes, agricultural frontiers, and degraded lands.

CATIE has been awarded international recognition as a pioneer institution in the field of agroforestry systems research. These systems have an enormous potential for contributing to the sustainability of production and conservation of natural resources. This line of research is subdivided into three lines: agrosilvicultural systems for annual tropical crops, shade trees with perennial crops, and silvipastoral systems for degraded lands in the humid tropics. The following provides information on the projects implemented in 1999-2000.

Evaluation of the capacity of Tithonia diversifolia to accumulate and contribute nutrients.
We completed a collection of *T. diversifolia* proceeding from five sites in Costa Rica, Honduras, Nicaragua,

and Mexico, as part of a joint project with the University of Wales, CIAT, and ICRAF. We encountered some difficulties with reproduction of its seed, but a new more efficient method for vegetative reproduction has been developed, using small stem cuttings. We expect to receive new materials from Africa, Asia, and South America, to be able to compare these with the materials proceeding from Mesoamerica, in terms of its capacity to accumulate nutrients.

Evaluation of live barriers and organic rectifications for the production of vegetables on slopes.
We evaluated the use of chicken manure and foliages applied to the soil for bean (*Phaseolus vulgaris*) and string bean production, in an Acrudoxic Melanudand land in the slopes of the Irazú Volcano in Costa Rica. This soil has had a very low profile and a high phosphorus retention. With the addition of foliages such as *Erythina berteroana* and *Mucuna deeringiana*, the bean yield was incremented by over a ton per hectare, while the string bean yield, approximately two tons per hectare, as compared to their controls. Apparently, the calcium present in the chicken manure proves to be insufficient, so the foliages supply enough calcium to release the phosphorus available for bean production.

Evaluation of the vegetative communities of annual crops with *actris gasipaes*.
Participative techniques were used to pinpoint forestry alternatives for the producers who planted peach palm (or pejibaye) in the plains of the Atlantic Region of Costa Rica, prior to the plunge in prices of the heart of palm. Maize (*Zea mays*) produced over 13,000 ears per hectare, without negatively affecting the heart of palm production. The vegetative community with alate beans (*Vigna unguiculata*) increased the height and diameter of the heart of palm. Efforts have been made to ensure the use of improved varieties of alate beans and squash for other experiments in this field.

Participative evaluation and design of agroforestry technologies on slopes for Latin America.
After the positive results obtained with the production of string beans at the CATIE experimental station, a participative experiment was designed with the farmers from the Guayabo River settlement in Costa Rica. The objective of this research was to compare organic vs. traditional production of string beans, in some cases in vegetative community with coffee and other vegetables. The intense precipitation in the months of November and December 1999 generated better results, proving that slope farming may be more complex than previously anticipated.

Live props for the production of tomato (*Lycopersicon esculentum*).
We evaluated props from *E. poeppigiana*, *Gliricidia sepium*, and cuttings to evaluate the production of agrochemical-free tomatoes. Aerial biomass, fruit production, and nutrient accumulation were greater in tomato supported by cuttings of *E. poeppigiana*. *E. poeppigiana* has fine roots which are basically in the upper 20 cm of soil, while those of *G. sepium* are more uniformly distributed at a depth of 60 cm. By pruning the live props to diminish the competition for light, the magnitude of the associated loss of fine roots and nodules is thereby reduced, as compared to the total pruning of the crown (particularly *E. poeppigiana*). The nitrogen cycle in the aerial foliar biomass was greater on *E. poeppigiana* than on *G. sepium*. The greater foliar mass production in *E. poeppigiana* over *G. sepium* may have predisposed tomato to the attack of *Phytophtora infestans*. On the other hand, the presence of *G. sepium* favored the emergence of *Pseudomonas solanacearum*.

Contribution of agroforestry technologies to the economic performance of slope farms in El Salvador.
The inclusion of multipurpose trees (mainly *Eucalyptus spp.*) in annual crop systems (maize, sorghum/beans) in El Salvador improved economic benefits by 11% to 60%. And with the inclusion of *Tectona grandis*, even greater benefits were reaped.

Evaluation of trees in the dairy production systems in La Fortuna, San Carlos, Costa Rica.
We studied the tree component in low tropical zones in mixed systems (crops and dairy production), dual purpose (beef and milk), and farms specialized in dairy products. The most abundant timber-yielding species was the laurel (*Cordia alliodora*) (70-88% were timber-yielding species). 85% of the farms have live fences, where the following prevailed: pore (*Erythrina spp.*), and "madero negro" (*Gliricidia sepium*). The Jersey cows in combined forest-pasture land systems produced more milk, as compared to those grazing in single-crop pasture lands. We began a study to determine the economic benefits of timber-yielding trees in the different dairy production systems.

Growth dynamics of the improved pastures in the humid tropic forest-pasture land systems of Guápiles, Costa Rica.
The *Panicum maximum* erect grass showed a significantly higher production of dry matter, metabolizable energy, and raw protein, in comparison to the semi-erect *Brachiaria brizantha* and bent grass *B. Decumbens*, when growing together with timber-yielding tree species, such as *Acacia mangium* or *Eucalyptus deglupta*. The efficiency in the use of radiation offered by *P. maximum* excelled that of *B. brizantha* and *B. decumbens*.

Use of foraging trees and crop residues for livestock feed during the dry season in Belize.
In the Cayo district in Belize, the CATIE/MAF agroforestry project promoted the use of foraging trees and crop residues for feeding dairy cattle during the dry season. After a three-year period, the results obtained evidence that production in dairy farms increased between 25% and 40%, with the use of foraging trees. A study is currently underway to determine the socioeconomic benefits and limitations for the adoption of this technology.

Initial growth of *Eucalytus deglupta* and *Terminalia ivorensis* associated to coffee in the southern region of Costa Rica.
A long-term experiment was developed aimed at studying above ground and underground interactions using different fertilization schemes, between *Coffea arabica* and timber-yielding species such as *E. deglupta* or *T. ivorensis*, or with the shade tree *Erythrina popeggigiana*, at a commercial farm in southern Costa Rica. Initially, the stem diameter and crown projection for *T. ivorensis* were greater than those of *E. deglupta*; however, no difference was noted as far as height was concerned. There was no clear response to the different fertilization schemes. However, the apices of *T. ivorensis* were infected by a fungi attack (*Nectria spp*), which may have affected the future shape of the stems.

Organic coffee in Costa Rica.
Despite higher production costs (5%) and lower yields (23%), the premium price paid for organic coffee resulted in a gross income that was 9 to 20% higher than that of traditional farms. The growth and vigor of organically produced nurseries fertilized with a 1:3 mixture of worm compost ("Lombri-compost") and soil, was similar to that obtained using agrochemical products, and the standard recommendations for production of nurseries in Birrisito, Paraíso, Costa Rica. Moderate shade (50%) improved the quality of the coffee (both acorn and cup) for elevations above 1000 m in Birrisito. The incidence of the disease *Cercospora coffeicola* in shaded plantations at this same place, was lower in organic plantations than in traditional ones; however, the incidence of *Mycena citricolor* was higher in organic plantations. No differences were detected with *Hemileia vastatrix*.

Inventory of tree resources outside the forest.
This project developed with counterpart agencies in Guatemala, Honduras, Austria, Germany and Holland, prepared a methodology for sampling, mapping, and monitoring the tree resources outside the forest.

The database is generated by satellite imagery, aerial photography, and field measurements. This project established work sites measuring 100 hectares each (five in Costa Rica, three in Guatemala, and two in Honduras), where the team proceeded to survey all existing trees. noting their main features. This information was used to undertake the different simulations, later used to prepare a methodology for taking an inventory of this resource.

Preliminarily, we conclude that the use of a sampling system by conglomerates, using plots located at a minimum distance of 150 m and a maximum distance of 300 to 400 m from each other, are considered efficient in conducting field sampling of this resource. Another preliminary conclusion reached is that prestratification, according to the use-of-the-land categories, vegetative communities, or life zones, is a difficult task, particularly because of the difficulties in obtaining adequate *a priori* data for large areas. A feasibility study is currently being conducted in each of the participating Central American countries, in an area of 2000 km^2, for the application and evaluation of the methodology developed, and at the same time, to generate information that serves to characterize this resource.

Information on forestry-pasture land systems.
The Livestock, Environment, and Development initiative–also known as LEAD, by its English acronym—is an interinstitutional project jointly carried out with FAO headquarters. LEAD's objective is to improve communications and provide relevancy to research and development aspects related to livestock-environment interactions, by means of the establishment of a Virtual Center for Research and Development. The Virtual Center operates globally (based in FAO, Rome) through English- and Spanish-speaking platforms (CIRAD and CATIE, respectively).

Line 4. Development of technologies for the sustainable development of forests and biodiversity

The main objective of this line of research is to develop strategies and technologies that contribute to the sustainable and diversified management of neotropical rain forests. With this in mind, research, validation, and transference activities are carried out with the purpose of reducing the conversion rate of natural forests to other land uses, as well as increasing the area under sustainable management in Tropical America.

This line has three research sublines: 1) development of technologies for the sustainable management of natural forests; 2) preservation of biodiversity in natural forests; and 3) forest plantations.

The results and progress of some of the most relevant research in this line of work are submitted below:

Sustainable management of secondary forests.
In the neotropical region, secondary forests are the object of attention as a source of timber, especially in Central America. CATIE researchers are typifying the flora structure and composition of secondary forests, and developing sustainable management guidelines in Costa Rica, Nicaragua, Brazil, and Peru.

CATIE is conducting research in Costa Rica on the impact of silvicultural practices, such as the liberation and elimination of the crown and techniques for the preparation of the substrate, on the dynamics of the forest stands and the regeneration of secondary forests, to provide guidelines for sustainable management at the regional level. Short-term responses on individuals from four commercial species (*Laetia procera*, *Simarouba amara*, *Tapirira guianensis*, and *Vochysia ferruginea*) were evaluated after their release. The growth in diameter of the future crop trees increased significantly as compared to the untreated controls.

This study concludes that young forest stands in the region may be attractive systems for simple silvicultural treatments, due to the rapid growth response, facilitated by a manageable size of the trees.

In Nicaragua, Brazil, and Peru the studies conducted on secondary forest management by small producers highlight socioeconomic and biophysical aspects. The coverage of secondary vegetation tends to increase, while that of residual growth tends to decline, while passing from the early pioneer stage to that of the boundary closing. Secondary vegetation is mainly fallow, consequently, it increases due to its value in agricultural production, while the forest reverts to farming after being exploited due to the extraction of valuable forestry products. The welfare of farmers and the ecological sustainability of anthropogenic landscapes may be improved if larger areas of secondary vegetation were handled in longer cycles for obtaining forestry products, and if a totally participative experimental system were to be implemented for the management of secondary forests.

The ecology of common tree species seeds of secondary forests in the northern region of Costa Rica: the implications of management based on natural regeneration.
The increasing importance of secondary forests as a source of timber at the local level has been amply recognized. Nonetheless, it is of the essence to refine silvicultural knowledge on many species, especially that of seeds and seedlings, with the purpose of offering guidelines that provide a solid technical foundation to interested parties in the management of this resource. This work describes the longevity patterns of the seeds in the soil and germination for nine common tree species in the Caribbean lowlands of Costa Rica and in other neotropical areas. The species under study were *Cordia alliodora*, *Hampea appendiculata*, *Jacaranda copaia*, *Laetia procera*, *Rollinia microsepala*, *Simarouba amara*, *Stryphnodendron microstachyum*, *Trichospermum grewiifolium*, and *Vochysia ferruginea*.

The longevity of the seed cohorts in the soil for the species under study varied from less than three months (*Cordia*, *Hampea*, *Simarouba* and *Vochysia*) to over one year (*Stryphnodendron*). Likewise, the percentage of germination in seeds dispersed under conditions of understory varied from 0% (*Laetia*) to over 75% (*Cordia* and *Vochysia*). The consequences derived from these results in the management of secondary forest stands are varied and depend on each species. In the first place, apparently all species require the removal of a greater part of the canopy to germinate or survive as seedlings, and be able to maintain levels of natural regeneration that are commercially attractive. Secondly, in the case of species whose seeds are able to germinate in the shade, it is possible to maximize the survival and growth of seedlings, by opening up the canopy after germination occurs. In the third place, in the case of species with low germination capacity under conditions of subforest, the canopy must be opened up to stimulate germination. However, it should be taken into consideration that all of these operations must take place within the first six months, since both survival of the seedlings and the viability of the seeds diminish rapidly for the species under study. Lastly, from the theoretical viewpoint, although the species under study may be grouped within the class of "long-life pioneers" or "durable heliophytes," the results obtained suggest that the regeneration requirements differ at seed level. In setting forth management guidelines for timber, these differences should be taken into account (in addition to the variations in the phenology of fructification), in order to guarantee adequate levels of commercial regeneration.

Characterization of ecosystems biodiversity and applications to forest management.
Among the practical methods that forest administrators use for identifying the types of forest, is the analysis of inventory data as related to types of soil or physiographic units. From a total of 54 species of trees inventoried in La Tirimbina, in northern Costa Rica, 25 showed significant differences in abundance, according to their topographic position, among which the most characteristic species of the

forest were found. *Pentaclethra macroloba* was the most abundant species throughout the three topographic sites surveyed. The distribution of many of the species, such as *Lonchocarpus oliganthus*, was clearly linked to the topographic gradient.

For the understory, 18 out of 47 species examined showed considerable differences in abundance according to their topographic positions, including many of the more abundant ones, such as the *Geonoma congesta* and *Prestoea decurrens* palm trees. It is evident that the production and conservation management in Central America would experience a marked improvement if the spatial distribution of the different types of woodlands at the regional or landscape levels is taken into account.

Biodiversity criteria and indicators in managed woodlands.
A phytosociological study and the mapping of types of woodlands were conducted in the northern and Atlantic zones of Costa Rica, evaluating the possibilities of characterizing the forests with Landsat TM imagery. A draft protocol was prepared for the evaluation of biodiversity in forest management units, through the use of Criteria and Indicators. In cooperation with IUFRO, CIFOR, and FAO, the "International Conference-Workshop on Criteria and Indicators for the Sustainable Management in the Neotropics" was held.

Development and integration of criteria and indicators for the evaluation of an ecologically-sustainable forest management in the Costa Rican and Nicaraguan rain forests.
The development of criteria and indicators (C&I) aimed at the conceptualization and evaluation of the sustainable management of forests, is one of the most active fields of the work in natural forests. Firstly, the project's objectives consisted in reviewing the C&Is as to the ecological sustainability aspects proposed by the National Committee for Forestry Certification (CNCF) of Costa Rica, with the joint efforts of CATIE and CIFOR, and should the need arise, adapt these to the regional ecological conditions.

In Costa Rica, the project adapted the C&Is to the country's situation, after having consulted with a multidisciplinary group of experts for the evaluation of forest management on production and conservation, seminars, and a field appraisal. Thanks to the active feedback in this process, manuals are being drawn up for the application of the C&Is, which are expected to be ready for publication in 2001.

This process shall be replicated in Nicaragua in the year 2001, taking into consideration the different conditions. We look forward to the completion of this phase, since it is expected to have a significant impact on the capacity of these two nations to sustainably manage their forests.

Silviculture of natural forests.
The network of long-term forestry research facilities is operating under excellent conditions in several Central American countries; and a new forestry research site is being established in Nicaragua. New information has been collected and analyzed for the network, with reference to:

- Response to the selective felling at varied intensities in an elevated mountain forest (oak-bamboo) in Costa Rica.
- Growth and productivity of a floodable forest in Panama.
- Growth and productivity in an unmanaged forest in Costa Rica.
- Demography of juvenile populations of commercial trees in response to silvicultural treatment in lowland and mountain forests.
- Silvicultural treatments in secondary juvenile forests.

In 1999 a manual was published for the installation of permanent plots to be used at the ecoregional level, and technical support was offered to members of the CATIE network, for data management and the study and dissemination of results.

Environmental services provided by forests.
In this project intended to measure the capability and risks of forestry activities as regards carbon storage and conservation in privately-owned farms in the central region of Costa Rica, we selected a system of principles, criteria, and indicators of the biophysical, social, and economic dimensions.

The biophysical evaluation graded the protection and management of natural forests as 0.79, in a 0 to 1 scale; while plantations were graded as 0.44, and pastures only as 0.07. Protection is favored due to its capacity for preserving the ecosystems. Forest management is an activity that promotes the continuous fixation of stored carbon and allows for the storage, both in standing timber as well as in durable goods; on the other hand, the protected forest only contains stored carbon, and fixation only takes place in terms of the ecosystem's maintenance.

In the economic dimension, we had values of 0.67 for protection; 0.76 for forest management; 0.66 for plantations; and 0.61 for pastures, according to the experts; and 0.64; 0.46; 0.6; and 0.6, respectively, according to the evaluation by farm owners. The parameters evaluated pointed to problems in the activities of forest management and forestry plantations, basically due to ignorance and difficult access to markets. This weakness leaves the pasture activity as the most profitable option due to its immediate benefits, and the farm owner prefers to leave the forest management and plantations in the marginal areas of his farm.

Growth, productivity, and socioeconomic feasibility of mixed and pure plantations of native species in the humid tropics.
In the reforestation of small farms, diversification is desirable because of the uncertainty concerning the growth of the species, dearth of saplings, and potential pest damages. Moreover, mixed plantations generate more diverse products than single-crop plantations, thus contributing to reducing risks that farmers usually have in unstable marketplaces. From the year 1990, studies have analyzed the growth, productivity, and biomass accumulation as well as the financial aspects in three experimental plantations, with twelve native species in mixed and pure plots, at La Selva Biological Station in the tropical rain forest region of Costa Rica. This study aims to demonstrate the following hypotheses: 1) The growth, productivity, and total biomass accumulation are greater in mixed plots than in pure plots. 2) For the slowest-growing species in each plantation, total productivity is less, but the shape of the woodpole is better in adult trees. 3) With the anticipated felling turns and available subsidies, mixed plantations are financially more attractive than pure plantations.

In the year 1999 silvicultural measurements were completed on these plantations, and the data were entered in the Data Management System on Tree Resources (MIRA). These data include growth parameters on 12 species ranging from 1 to 8 years of age in pure and mixed plantations. A total of 4 publications were made in international magazines, besides 2 collections of articles on the results of the project, for local and regional dissemination.

Growth models for teak (*Tectona grandis*).
Traditional forest growth and productivity models are empirical, i.e., these are based on statistical ratios between growth and other variables on the trees, the forest, and the environment. Ecophysiological models, on the other hand, describe the growth of a tree as a function of the environment and

interactions amongst trees. In cooperation with the University of Helsinki, Finland, technicians from the Plantation Silviculture Unit of CATIE put to use, for the very first time, an ecophysiological tree growth model (modified SIMFORG) applied to teak (*Tectona grandis*), on seven permanent plots with trees ranging from 5 to 11 years in Guanacaste, Costa Rica. These growth simulations yielded results similar to those measured in permanent plots.

Management and storage of recalcitrant and intermediate seeds.
In cooperation with the International Plant Genetic Research Institute (IPGRI), in 1999 CATIE's Seed Bank identified forest stand seed plots, collected seeds, and conducted drying and storage trials for the species *Calophyllum brasiliensis* (María) and *Astronium graveolens* (ron ron), with the Center of Forestry Seeds of Danida as collaborator for the replication of assays. "María" showed a recalcitrant behavior, with sprouting decreased from 68% to 4%, and humidity contents (HC) ranging from 40% to 4.8%. On the other hand, "ron ron" showed an orthodox behavior: its seeds may be desiccated up to 1.4% HC, and germination be as high as 89%, with a 6.6% HC in sealed plastic bags and a –17ºC temperature, during a six-month period. The seeds of *Genipa americana* and *Hancornia speciosa* were sent to CATIE by EMBRAPA, Brazil for germination assays. In the desiccation of G. *Americana*, sprouting decreased from 96% to 89%, with the HC from 46.9% to 9.8 %; and with *H. Speciosa*, germination decreased from 85.5% to 38%, with the HC from 38.6% to 16.3%, respectively.

Forestry data management.
The Data Management System on Forestry Resources (MIRA) developed by CATIE includes data on climate, soil, species, seed bed sources, tree measurements, and production of several forestry products. Based on an agreement between CATIE and CIFOR, the MIRA system was converted into a bilingual package operated with Windows '95. At the same time, the MIRA user network was expanded to include organizations outside Central America. The system was distributed to organizations in several countries and to private companies.

Strategies for the recuperation of degraded ecosystems: natural regeneration in mixed and pure plantations of native species.
One strategy with the potential to facilitate the maintenance or recuperation of biodiversity in agricultural landscapes is the establishment of forestry plantations with native species. Besides providing a variety of economic and environmental services, these plantations may contribute to local biodiversity by promoting tree regeneration and providing habitats for forest animals. Natural regeneration in mixed and pure plantations was studied with native species at La Selva Biological Station in Costa Rica's humid tropical region, aimed at determining its role in the recuperation of local biodiversity, and in 1999 the project added the study of a plantation.

The greater number of tree individuals was found in the understory of the mixed plantation, followed by pure plantations of *Hieronyma alchorneoides*, *Vochysia ferruginea* and *Pithecellobium elegans*. Very few tree individuals were found in the plantation of *Genipa americana* and in the control of natural regeneration. The diversity indices followed a similar trend to that of the abundance of tree individuals. The most frequently found families of tree individuals regenerated in the understory of plantations are *Melastomataceae* and *Rubiaceae*, both important families in the natural forest understory in La Selva, and both are dispersed by birds.

The genetic impact of forest fragmentation.
Deforestation frequently results in the formation of forest fragments located in a matrix with a higher or lower degree of deforestation. The Forestry Fragmentation Project (CATIE/CIFOR/IPGRI/SWGRP)

endeavors to contribute to the management and conservation of such forest fragments, by generating data on the genetic impact that spatial isolation has over small populations. The project quantifies the impact of this fragmentation on the genetic traits of the populations, with emphasis placed on the influence exerted on the reproductive characteristics of the species. It focuses on two main species: *Anacardium excelsum* and *Plumeria rubra*. The main objective of the project lies in designing a model to predict the genetic impact of various scenarios of forest fragmentation, particularly as regards the biological traits of the species and the spatial characteristics of the fragments.

Forestry monitoring and administration in concessions in Guatemala and Costa Rica.
This study was conducted to evaluate and improve the efficiency and efficacy of the official standards (criteria and indicators) proposed by CONAP, in order to monitor the compliance of the environmental, social, and economic conditions at the forestry concessions in Petén, Guatemala. The methodology was developed based on the proposals submitted by TROPENBOS and CIFOR, and the experience of CATIE. The methodology involved four filters: analysis of consistency by the experts; evaluation and appraisal of the four attributes used; field tests in four concessions; and the appraisal of relative importance (rank and percentage) for each parameter. At the conclusion the group of official standards were consulted with the concessionaires, NGOs, and governmental institutions.

The C&Is for ecological sustainability constitute a proposal by the National Committee for Forestry Certification (CNCF) of Costa Rica, in collaboration with CATIE and CIFOR. Secondly, the set of C&Is required to produce an integrated set of C&Is for Costa Rica, based on the two aforementioned, would generate an appropriate balance between inputs, process indicators (used to define and evaluate the application of "best practices"), and results indicators (used to evaluate the impact of forest management, which furnish the essential adaptive components for sustainability).

Departing from this study, the recommended standards take into consideration 96 parameters, of which 24 are criteria and 67 are indicators. Four community concessions were evaluated to validate the biophysical parameters of the standard. All concessions obtained satisfactory results.

The resulting standard is being officially applied by CONAP to evaluate, for the very first time, the environmental, social, and economic performance of 13 concessions in the Mayan Biosphere Reserve (over 500,000 hectares of forest).

Rescue, propagation, conservation, and use of threatened species and populations of forest trees in Central America and the Caribbean.
In recent years an increasing interest has been witnessed in Central America and the Caribbean to work jointly with regional institutions, aimed at rescuing and propagating threatened species, with the objective of contributing to their conservation through its use. Under such premises, the first phase of this project began in June 2000, with actions adopted in Costa Rica and Panama. In cooperation with ANAM in Panama, a second-generation progeny assay on *Bombacopsis quinata* was conducted at the Río Hato Experimental Station. In Costa Rica, in collaboration with ITCR, we obtained germ plasm selected from plus trees of the *Dipterix panamensis* species for the establishment of a progeny assay. Also, parent plants of *Cedrela odorata*, *Dipterix panamensis*, and *Swietenia macrophylla* are growing at the CATIE nursery to develop *in vitro* propagation protocols. In addition, a macropropagation assay was conducted with *D. panamensis*, which yielded the initial results on the technical improvements of root generation by using juvenile stem cuttings.

Domestication of mahogany (*Swietenia macrophylla*) and oak (*Cedrela odorata*).
The research undertaken on the domestication of these two species, which have economic importance due to its timber, have yielded relevant results in three areas: genetic variation; nursery techniques; and silvicultural techniques (pruning and shade).

As regards the clonal variation, the study on the attack of *Hypsipyla* on *Cedrela odorata* reveals that a severe change has taken place in the growth levels and quality of the three-year-old trees. For instance, the mean height at the first embranchment for the best clone was 50% of the total clone average. The results confirm the potential of the clonal selection as a tool for the integrated combat of *Hypsipyla*.

On the other hand, this project has conducted a research on progenies and source in the Yucatan Peninsula in Mexico, having established six assays on mahogany and oak between the years of 1997 and 1999. The results of two years on mahogany show significant differences in the growth in height according to sources and level of families, ranging from 15% to 115%, respectively. The selection for the resistance to *Hypsipyla* may be possible, since some families were not attacked; while 90% of its progeny was affected. After an intensive selection using multiple traits, the assays shall be converted to nursery seedbeds for use in State reforestation programs.

Sustainable management of *Smilax* in natural forests and agroforestry ecosystems.

Smilax is a non-timber-yielding product from the forests of tropical America. It is a genus that groups several native medicinal plants, with ample traditional applications by the communities, as well as by the phytopharmaceutical industry throughout the world. This research project was launched in June 2000 with the financial support of the Interamerican Development Bank (FONTAGRO), and the object of fostering sustainable exploitation and marketing of a native medicinal plant from tropical America, which has ample traditional use by the communities and by the phytopharmaceutical industry around the globe.

In order to surmount the confusions between marketable species of this genus, but with different chemical properties, we have collected botanical samples from the main varieties of medicinal use and market in Guatemala, Nicaragua, and Costa Rica, as well as a taxonomical analysis of materials from the national herbarium in Costa Rica. The intention of this current work is to complete the botanical samples with flowers of both sexes, in addition to underground organs, in an attempt to clarify these confusions.

The appropriate identification of species, conducted with the support of the National Autonomous University of Nicaragua at León (UNAN), jointly with the University of Costa Rica, will allow us to determine those that are the safest for use, conservation, and promotion in rural productive systems. Jointly with the Technological Institute of Costa Rica, we are researching the different forms of propagation, aimed at promoting the production of the most promising species for the industry and rural communities.

Line 5. Socioeconomic analysis and appraisal of policies and of environmental goods and services in tropical ecosystems

This line addresses three topics, namely: 1) Economic appraisal and analysis of environmental goods and services in tropical ecosystems; 2) Socioeconomic evaluation of policies that have an impact on the use and management of tropical ecosystems; and 3) Socioeconomic analyses of the technological change processes that occur in tropical ecosystems.

Following are the results on some of the projects developed in 1999-2000.

Forestry Certification in Central America.
The forestry certification process continues to make progress worldwide, and Central America is no exception. Nonetheless, the success attained on this topic shall depend on the position and attitude adopted by national governments. With the purpose of inquiring what may be expected from the governments of the Central American region on this topic, research was conducted by means of surveys and consultations to a diversity of authorities from the governments of Costa Rica, Nicaragua, Honduras, Guatemala, and El Salvador (Carrillo Martínez, S.A., 1999). The outcome of this investigation lead to the following conclusions:

- The governments of the countries under study are fully aware of the importance of certifying timber, as a fundamental tool for sustainable forests and forest plantations.
- These governments are not interested in playing the direct role of certifiers nor becoming the "certifiers of certifiers." However, they expressed the need to continue playing a role in the subject of legislation, permanent evaluation of the certification processes, and contributing to criteria and standards. The governments of the countries surveyed coincided in the convenience that criteria and standards be developed by their national experts, with the support of foreign experts. They all deemed it essential to lend credibility and trustworthiness to the process.

Secondary forests and their relationship to the Costa Rican industry and politics.
It has been calculated that there are approximately 425,000 hectares of secondary forests in Costa Rica, hence constituting the most plentiful forest resource in the country. A study was conducted in northern Costa Rica, in the Huetar and Chorotega regions (Berti, Carlo G., 1999) to pinpoint the expectations of the various sectors on the permanency and benefits of the forest cover. The most important conclusions of this study reveal the following:

- The payments of environmental services are exerting a direct and positive influence on the decision of owners to conserve this resource.
- Drawing up criteria and indicators for the management of secondary forests, contemplated in "Principle 11," represents an important step toward the conservation of this resource.
- Traditional sawmills do not have the appropriate technology for processing small diameter timber. Thus, any potential processing of this type of timber is focused on the new industrial sawmills specialized in cutting plantation timber.

Appraisal of the service of carbon fixation and storage in private forests.
The capacity of forests as mechanisms to fix and store carbon is already subject to worldwide recognition. As such, the knowledge of the capacity that the various types of natural ecosystems have to fix and conserve atmospheric carbon, is a topic of increasing interest. Likewise, we need to estimate the economic value of the service of carbon fixation and storage by these ecosystems, as the basis for the application of policies that foster this activity.

To obtain additional information on the matters referred to, a research project was implemented which addressed the economic appraisal of the carbon fixation and storage service in natural forests located in private farms in Costa Rica (Tirimbina in Sarapiquí and Corinto in Guápiles). A few of the research's conclusions are as follows (Segura, M. 1999):

- Total biomass and carbon stored in a group of permanent sampling parcels used for comparative purposes, exceeded by more than 100% the results found in the farm parcels under study. This reflects the high rate of timber extraction potential in the farms.

- The cost of opportunity of the payment of environmental services, as compared to other agricultural uses in these farms, ranged from US$ 234 to US$ 555 ha-1year-1 in sustainable management areas, and from US$ 255 to US$ 288 ha-1year-1 in areas with absolute protection.

Factors that have a bearing on ecotourism, as an economic alternative.
Tropical America is a region endowed with ecosystems which offer ample potential for ecotourism, which may contribute significantly to the development of rural communities. A study conducted in the lake region of Inbabura, Ecuador, has revealed new breakthroughs concerning the aforementioned issue. Among the conclusions reached in this research, the following may be highlighted (Landázuri, X. 1999):

- There is a clear trend to visit these lakes, which have an outstanding scenic beauty, and are endowed with adequate lodging services and good access roads.
- According to an econometric study undertaken to analyze the pattern of the total expenditures by tourists, the environmental variables were insignificant. These results suggest that tourists are unaware of the environmental situation of the lakes, or else, have a limited perception thereof.
- The communities face processes whereby their traditional knowledge is being lost as regards the degradation of their resources. Their perception of "goods and services" is related to their surroundings in general, and not solely to those furnished by the lake itself.

Socioeconomic appraisal of communities located in the area of influence of commercial reforestation projects.
In 1998, the international firm Ecoforest S.A. domiciled in Panama promoted, with international support, the establishment of a teak (*Tectona grandis*) forest plantation covering over 3,000 hectares in the Panama Canal watershed. In this area, rural communities have traditionally lived in situations of extreme disadvantage, with the resulting lack of roads, schools, medical services, drainages, drinking water, and other basic services. During the first year of operation, the inhabitants from these local communities were hired to work at nurseries, hot houses, seed treatment areas, and other facilities; recently created by the company. Other persons were contracted to work in the construction and maintenance of roads and tree planting tasks.

This research, which is currently in progress, aims to establish the social and economic impact of the Ecoforest operation and of the forestry plantation activity in neighboring communities. In 1999, CATIE became a member of the Consulting Committee of Ecoforest S.A., a pivotal figure in this new model of cooperation between private and public sectors, which is being developed within the project financed by the AVINA Foundation.

Economic and environmental appraisal of "white straw" (*Saccharum spontaneum*) in the Panama Canal watershed.

White straw is the name of an aggressive weed that grows near sugarcane plantations, amply disseminated in the Panama Canal watershed. This weed was originally introduced to fix the soil and diminish erosion in the canal; however, at present, due to its aggressive behavior, white straw has invaded neighboring farming fields, limiting their production. The research undertaken by the Sociological Section pinpointed the distribution of the week in the canal, the conditions for dissemination, the alternatives for its elimination, and the analysis of future problems and preventive measures on the part of the government, the rural population, and society in general, to restrict the expansion of this weed.

Outreach Activities Program

From the year 1998, the Outreach Activities Program has been organized in four lines: 1) Promotion, Cooperation, and Technical Assistance; 2) Participative Validation of Technologies; 3) Human Resources Education (skills, training, and conferences); and 4) Data Management and Publication.

Line 1. Promotion, Cooperation, and Technical Assistance

During the years 1999 and 2000, the main assistance demand to CATIE on the part of the member countries, focused on the design of development projects and technical assistance proposals to alleviate the consequences of natural catastrophes, particularly those caused by Hurricane Mitch. With this in mind, CATIE developed a series of actions aimed at responding to short-, medium-, and long-term needs in the issues of vulnerability, management of watersheds, and prediction of environmental and productive impacts. To this end, international cooperation was offered, among which the aid received from the Swedish Agency for International Development (ASDI) is highlighted. Through the joint endeavor of governmental and private institutions in each of the nations affected, this support allowed us to assess and design watershed management projects.

The participation of the National Technical Offices of CATIE in Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica was clearly determinant to achieve success in these ventures. Some of the most relevant attainments are described below:

In Honduras, CATIE provided decisive support to the Secretariats of Natural Resources and Environment, and Agriculture and Livestock, in the planning of six projects for the management of watersheds which formed part of the National Reconstruction Program, presented at a gathering of the Consulting Group in Stockholm, Sweden. These projects consist of the sustainable management of the watersheds for the Choluteca, Ulúa, Chamelecón, Nacaome, León, and Aguán rivers. In addition, a project was prepared to reduce the environmental vulnerability of the Sula Valley, by incorporating community management and actions for the development of communities in the upper area of the Ulúa river watershed, in the Lempira e Intibucá departments.

In Nicaragua, we provided support to the Ministry of Agriculture, Livestock, and Forestry by planning projects aimed at strengthening the agricultural and natural resource sectors of this country. The proposals drawn up consisted of:

- Unit for the Follow Up, Evaluation, Training, and Technical Assistance (USECAT) in support of sustainable forestry.
- Coordinating Unit Manual for Administration of Watersheds in Nicaragua.
- Ministerial Agreement for the creation of the Coordinating Unit for the Administration of Watersheds in Nicaragua.
- Rehabilitation of Agricultural Farms and Prevention of Natural Disasters through Agroforestry Technologies.
- The use of SIG as a support tool in the management of natural resources.

The MAG-FOR/CATIE Accord was expanded to include the execution of the MIP-AF Program in Nicaragua, and was awarded the bid to conduct the feasibility study for preparing the Watershed Management Plan for the El Zapote River watershed in Nueva Guinea, Nicaragua. This study has the financial backing of the Interamerican Development Bank (IDB).

In Costa Rica we supported the organization of an entity in charge of managing the Río Parrita watershed, in the central Pacific region of the country, wherein several governmental and private institutions participate, as well as local governments. Concurrently, a new proposal was drawn up for the management of that watershed, to be submitted to the World Bank for its possible financing.

In Mexico, the Economics and Environmental Sociology sector collaborated with the University of Colima, in the study for the creation of a Master's Degree in Geomathics Applied to Natural Resources. Concurrently, other extension activities have been developed jointly with the National Institute for Forestry and Agricultural Research (INIFAP). Procedures were initiated to cooperate in research on *Meliaceae* (mahogany and cedar), with funding from USDA. INIFAP, in turn, gave its support to REDCA and CATIE.

We continued to maintain contact with CINVESTAV, and expect to strengthen joint efforts in research and genetic transformation of *Musaceae*.

Finally, it should be emphasized that in December 1999 we backed the negotiation with the CCAD aimed at obtaining the consulting services for cartographical-thematic database generation and processing of geographic information systems, as well as watershed management, with the financing of USAID, USGS, and NOAA. These endeavors have been developed during the year 2000 for the trinational watershed of the Lempa River in El Salvador.

In Belize, a special workshop was designed to identify the priorities and opportunities for aid and technical assistance from CATIE, on the topic of development and training in sustainable management of natural resources. This workshop was attended by 65 public officers from several institutions, and by CATIE officers.

After the formal incorporation of Colombia as a member state in 1998, CATIE and the Colombian Corporation on Agricultural Research (CORPOICA) began designing a joint portfolio of projects, which shall be submitted for financing before European and American donors.

In Dominican Republic, the II Symposium on "Progress in the Production of Forestry Seeds," an international event where 80 scientists from 17 countries participated, presenting over 50 scientific papers. The Group of Forestry Support was also created, with the participation of professionals from universities and diverse institutions. At the same time, support was given to the National Technical Forestry Commission (CONATEF), which declared the year 2000 as the "Year of Forestry Seeds."

In Venezuela, a series of contacts were initiated with the company MANPA, with the intention of providing consulting services on the issue of carbon sequestering evaluation in the company's pine forests. Likewise, research work began aimed at studying the process of change in the use of land and its relationship, the vulnerability of the region affected by flooding in the northern strip of the country in 1999.

Line 2. Participative Validation of Technologies

This line is executed through the different research and development projects. These are validation and field-demonstration projects of the best available technologies, whether generated by CATIE or by other external actors. With the support provided by national counterpart institutions, and with the active participation of communities, efforts were combined for activities of extension, demonstration, validation in pilot areas, dissemination of information, and exchange of experiences.

CATIE/CONAP

This project has as its main objective to reinforce the CONAP (National Council on Protected Areas) in Petén, and it focused its efforts in supporting community concessions located in the Mayan Biosphere Reserve (or RBM). Thanks to the joint action by CATIE, CONAP, NGOs, and communities, this project contributed to creating job opportunities (some 20,000 wages) in the communities, and to the export of 69% of the timber production to U.S., Mexican, and European marketplaces; generating around US$ 50 million in gross income for the concessionary communities. The management guidelines that were promoted allowed for the incorporation of some 17 timber-yielding species, as compared to the five which traditionally are exploited in this area, thus spurring diversification in forest exploitation.

This project received an international award for sound forest management, pursuant to the October 2000 report by the World Forest Management Council (FSC, by its English acronym). The standards were drawn up for the monitoring and evaluation of concessions, based on principles, criteria, and indicators. It is worth noting that there are only a few countries worldwide that have this mechanism. The proposal was validated by CONAP, with the monitoring of 10 community concessions and two industrial concessions, during the evaluation of the Annual Operating Plan for 2000. This Project, which began work in October 1995, plans to terminate in March 2001.

Conservation project for sustainable development in Central America (OLAFO)

The participation of the communities has been the key of success of the Conservation Project for Sustainable Development in Central America (OLAFO), which concluded its activities in September 2000. Due to its efforts, farmers from five demonstrative areas in agricultural frontiers located in Petén, Guatemala; Pacific Coast, Nicaragua; Talamanca, Costa Rica; and Bocas del Toro, Panama, which experimented major and positive changes, not only in productive areas, but also allowed for a strong community organization.

During the year 2000, the efforts of the project that concluded its activities in the majority of areas –except for Honduras—focused on the preparation of publications to document the experiences and results generated (participative territorial disposition, forest management by communities in mangrove swamps, diversified forest management–timber-yielding and non-timber-yielding products—among others).

At present, the project is carrying out training, technical assistance, and technology transfer activities in San Ramón, Nueva Granada, and Brisas del Norte in Honduras, with the intention of improving the farmers' production systems, by promoting the sustainable use of local resources.

Slope Farmers' Fund

In Honduras, CATIE participated in the bid for the management of the Project Administration Unit (UAP) of the Slope Farmers' Fund, a project promoted by the Ministry of Agriculture and Livestock of Honduras, with World Bank funding. This project was secured for an amount of US$ 939,477, paid to manage the Fund's US$ 7,5 million.

The objectives of the Slope Farmers' Fund Project is aimed at combating poverty in rural areas, by the generation and transfer of technology, a greater stability in land holding, forest management, and biodiversity conservation. This project is a subcomponent of the Rural Areas Management Program (PARA), of the Secretariat of Agriculture and Livestock (SAG) of Honduras. The responsibility for the supervision and certification of execution activities of the Fund was assigned to CATIE.

The Fund has established four strategic areas for investment, namely: generation of agricultural and forestry technology, agricultural and forestry technology transfer, training of trainer technicians, and management of priority municipal catchments. Its area of influence includes eight municipalities in the north of Francisco Morazán, five municipalities in eastern Olancho, and 11 municipalities in Yoró, totaling 24 municipalities in these three departments.

In the year 2000, 34 technology transfer subprojects were approved, benefiting 5,983 families organized in 268 groups, and allotting 21,757,931 Lps. In addition, management plans were prepared for the region's catchments, and consulting services were provided to 12 municipalities. Soil conservation practices were implemented, aimed at contributing, at the middle term, to blocking the advance of the agricultural frontier.

PROSELVA

In Guatemala, specifically in Petén, the execution of the PROSELVA program was launched, with financing by Germany's KFW and Guatemala's CONAP, and a budget of US$ 4,5 million. This project is being implemented with the participation of a consortium composed of the Institute for Interamerican Cooperation on Agricultural (IICA) and CATIE.

PROSELVA is a project aimed at attaining the enforcement of standards in protected areas (Mayan Biosphere Reserve and Chiquibul Reserve, Pre-Columbian Archeological Reserves in Machaquilá, and Wildlife Refuges of Xutilhá), in order to improve the use of the resources in accordance with preestablished zones in southern Petén, Guatemala. Promotes the sustainability in the use of resources in the buffer zones, on the part of communities settled there.

PROSELVA's achievements have been attained by creating awareness and providing environmental education to the area's population. Some of the achievements of the year 2000 are: a greater level of organization in the communities and improved leadership amongst local authorities, implementation of the evaluation model in the protected areas, and the fulfillment of the first international course in planning and management of protected areas.

El Salvador Environmental Program (PAES)

By using participative methods and processes with community extension workers, the El Salvador Environmental Program (PAES) is currently working in the regions of Tenancingo and Guazapa. Its objective is to reduce the sedimentation rate in the El Cerrón Grande Reservoir, by the application of practices and works for soil conservation and agroforestry, in sloping lands cultivated in basic grains. PAES' subcomponent on soil conservation is executed by the Consortium formed by IICA-CATIE-Catholic Relief Service (CRS) and Catholic University (UCA).

To date, the following was achieved: 28 organizations with five-year community development plans, grouping 1,555 inhabitants; 20 annual operating plans benefiting 657 persons, 3,471 families serviced in 65 communities, and 3,1831 organizations in process of consolidation in 35 communities. The population involved in the project covers some 43,000 persons, of whom 17,200 are women.

Furthermore, 738 farm plans were prepared and follow-up was given to 2,733 plans benefiting 3,471 persons in an area of 7,650.64 hectares. In the period January-June 2000, 4,438 persons were trained on agroforestry and soil conservation topics.

Sustainable Development Program in Petén, Guatemala.
In Guatemala we cooperated in the execution of the Sustainable Development Program in Petén, which has an allotted budget of US$ 22.0 million. CATIE acts as the Central Executing Unit for the Project, with a budget of US$ 2.0 million for a four-year period.

The Sustainable Development Program in Petén, Guatemala seeks to contribute towards the solution of deforestation and environmental degradation problems in the municipalities of Flores, La Libertad, Melchor de Mencos, Dolores, Poptún, and Sayaxche. In recognizing that these problems stem from the lack of viable economic options as well as lack of definition in the farmers' land holdings, the Project shall generate job opportunities through the promotion, restoration, and development of tourism, emphasizing the cultural wealth found in the region surrounding these communities.

The Project's main achievements are: International call for bids for the legalization of 45,000 hectares; award of the legalization work on 45,000 hectares; international call for bids for the excavation and restoration of the archeological sites of Yaxcha and Aguateca; call for bids and award for the design of tourist infrastructure.

On the other hand, we executed a Regional Environmental Education Strategy, and a Strategy for Strengthening Municipalities and Coexecuting Institutions. An Agreement was also signed between MAGA and the Ministry of Culture and Sports.

FOCUENCAS
The severe damages caused by Hurricane Mitch in Central America in October 1998 served to promote the initial meetings among governments, institutions, and donors, with the purpose of pinpointing actions that would contribute to reconstruction programs of the countries--especially Honduras and Nicaragua—which were the most severely affected.

CATIE, at the request of these two governments, submitted before ASDI a Regional Watershed Program. Therefore, in March 2000 two projects were launched: The "Program for the strengthening of local capability in management of watersheds and prevention of natural disasters," and "Education of human resources, with a Master's Degree, in the planning and management of natural resources, with emphasis in an integrated management of watersheds."

This program is known as FOCUENCAS and it shall function during a four-year period, developing its actions in 11 Honduran municipalities and three Nicaraguan municipalities. The area of each watershed varies from 50 to 500 square kilometers.

During the year 2000, a program was established covering technical, administrative, and financial aspects. Also, we identified and initiated negotiations with counterpart organizations: SAG-PRONADERS, SERNA, and AFE-COHDEFOR in Honduras; and MAG-FOR, MARENA, INTA, and INIFOM in Nicaragua. The areas of intervention and requirements were identified, as far as strengthening organizations in watershed management is concerned.

PROMA
In view of the tremendous losses in natural resources and the environmental impact, USAID provided financial support to CATIE to implement the Environmental Monitoring Project in the watersheds of the Motagua and Polochic rivers (PROMA) in Guatemala. This project is carried out in the framework of the Mitch Program: Recuperation of rural economy after the impact of the Hurricane and reduction of vulnerability to disasters.

During 2000, several evaluations took place covering physical works for stabilizing lands and watersheds, restoration of agricultural and forestry use, public infrastructure, house water supply, and environmental sanitation, among others. Furthermore, a characterization of the generic impact of Hurricane Mitch was performed, and the practices and physical works for the control of torrents were identified. We conducted a study on the coverage and current use of the land for the Motagua and Polochic watersheds; we drew up a base line on the conditions of the water for all uses in the subwatersheds for both rivers. Besides, we designed and initiated the application of a simple system for the follow-up and evaluation of impacts.

On the other hand, research was conducted on the economic cost of the damages caused by Hurricane Mitch and its consequences on local populations, concerning health, productivity, and environmental quality in the Río Motagua watershed.

Secondary Forests Project
This project was jointly executed by the Central American University (UCA) in Nicaragua, and CATIE, and its first stage was financed by CIFOR-FAO-FPPP, which concluded at the end of the year 2000. We signed an agreement with PROFOR to implement the subproject Sustainable Management of Secondary Forests for the San Juan River Rural Communities, also executed by CATIE/UCA.

This project seeks to validate alternatives for the communities of the San Juan River, for the sustainable management of secondary forests, in such a way that it generates both environmental and financial-economic benefits by managing and marketing the secondary forest products, especially non-traditional timber-yielding species.

MIP-AF
The project on Integrated Pest Management / Agroforestry (MIP-AF) is a regional project for the participative implementation of management practices on coffee for Nicaragua and Central America.

In the year 2000, the project expanded its coverage as far as the number of participating farmer families is concerned, as well as the participation of experts and extension workers from around 71 agencies (governmental, education, and national and regional NGOs).

This project financed and coexecuted 228 small projects, with the participation of 3,750 farmer families. And the 228 extension workers, program experts and experts from counterpart institutions worked in 16 training projects, 10 planning groups, and also in six research projects.

TRANSFORMA
This project operates with the purpose of training qualified personnel in the design and implementation of systems for the sustainable management of natural forests. To this end, it also works on product marketing aspects, with communities in Honduras (northern area) and Nicaragua (RAAN).

With the support of these training and technology transfer actions, CATIE intends to promote the integration of the sustainable management of tropical latifoliate forests to the economics of peasant and indigenous communities, as well as to commercial concerns. TRANSFORMA cooperates with a wide array of actors, including decision-making politics, university professors, students, professionals, extension workers, businessmen, farmers, and indigenous people.

In order to comply with its mission, TRANSFORMA undertakes its work with the cooperation of partners by means of three operating networks: Management Network of Humid Latifoliate Forests in

Honduras (REMBLAH), Natural Forests Management Network in the North Atlantic Autonomous Region of Nicaragua (REMAB-RAAN), and Horizontal Cooperation Network for the Management and Conservation of Natural Forests in the San Juan River (REMARIO, all by their Spanish acronyms).

Through these networks, and in collaboration with other liaison organizations, a furniture exhibition was carried out, using non-traditional wood species, by the COATLAHL Cooperative in Honduras. The REMAB-RAAN organized the second Forestry Fair in Bilwi, Puerto Cabezas, with the participation of 17 craftsmen. On its part, REMARIO celebrated its third anniversary under the auspices of the Sustainable Development Council of the San Juan River.

Also, the Project is working on the development and consolidation of the Operating Management Areas (AMO) at the community level, as a means to demonstrate and disseminate to other communities. In Honduras, the greatest achievements during the years 1999 and 2000 were the preparation and publication of the general forest management plan in Toncontín. We also built the footpath "Participative Forest Management," which permits us to show the forest in all its management stages, and a visitors' guide was also published.

Also in Honduras, but in the Mosquitia region, efforts to consolidate the indigenous cooperative by the name of CODA-PUCIML have given fruits: by the last quarter of 2000, the Cooperative obtained its corporate registration. This Cooperative gathers over 300 associates from four communities from the area of Mocorón. With the support of the PROBAP Project (GEF/COHDEFOR), we are continuing with the training process in topics such as: directed selective logging, chainsaw mechanics, business administration, foundations in ecology, and forest inventories.

In the Atlantic region of Nicaragua, the activities at AMO Awastingni were suspended, located at the RAAN, due to difficulties between the indigenous community of the Mayagna-Sumo ethnic group, and the central government, since the boundaries of their community lands have not been set, nor their legal titling enforced. Nonetheless, TRANSFORMA has supported training activities in Layasiksa, and at present it closely follows a new opportunity at another community that has made greater progress in the titling of their lands.

At the San Juan River (southern Nicaragua), the work is the result of a cooperative effort of the company SOSMADERA, the IPADE Project, TRANSFORMA, and the communities there. As part of the endeavor to improve the marketing of their products, SOSMADERA was successfully supported in its steps to secure funding for building an all-weather access road at AMO Las Quesadas.

Promotion of non-synthetic phytosanitary products in Central America.
This project initiated activities at the beginning of 2000 with financing from GTZ Germany. It is planned in three phases and shall conclude in the year 2008. The objective of this project–of a Mesoamerican scope—is to support small- and mid-size companies in Central America, for the development and/or marketing of alternative phytosanitary processes and products, in order to increment their availability to consumers.

Aimed at promoting the Project's integration to the counterpart institution (CATIE), we are searching for a strong cooperation with other projects of this Institution. A case in point is the creation of a cooperation with CATIE's Agroforestry Project (Nicaragua, Panama, El Salvador, and Honduras), and with the CATIE/NORAD Project for integrated plant health in Nicaragua. In 2000 a Planning Workshop also took place.

In Costa Rica, we identified the private companies involved in the production and marketing of non-synthetic phytosanitary products, and these were informed on the goals and services offered by the Project.

In Nicaragua, we began cooperating with the CATIE/NORAD project and with the University of León. Regarding IICA's REDCAHOR Project, we agreed to carry out joint training and support activities in benefit of farmers.

In Honduras, support was given to the Plant Health Project (SAVE-GTZ) in its final phase, and this project was submitted to the consideration of the Ministry of Agriculture and the Honduran Foundation on Agricultural Research (FHIA), as a possible cooperation counterpart.

One of the Project's achievements, in its initial stage, has been the preparation of guidelines for non-synthetic phytosanitary products. To this end, an interdisciplinary group was created made up by the private sector, the Ministry of Agriculture, the Ministry of Health, the Chamber of Farmers, and OIRSA.'

We created an electronic information system at the Internet web site www.catie.ac.cr/noq, basically addressing the private industry and the state sector, containing data on products, companies, and regulations, as well as questions and answers in this new field.

CATIE/DANIDA Agroforestry Project.
Jointly with the National Agroforestry Network, State Agencies, NGOs, CATIE's technical team, and the National Technical Office of CATIE in Nicaragua, we conducted two outreach activities (financial analysis in SAF, and planning and research in agroforestry systems, with a total of 34 participants (10 women and 24 men).

Together with the National Agroforestry Network of Nicaragua, we developed a National Workshop on Agroforestry Research and Extension. Over 100 technicians and university students (Nicaragua, El Salvador, Costa Rica, and Colombia) attended.

Within the framework of the reinforcement actions of national capabilities on agroforestry research, four research mini-projects have been implemented, with the participation of five university professors and 10 pregraduate students from the National Agrarian University and the National Autonomous University of Nicaragua. Also, technical assistance was provided on agroforestry systems, such as strip cropping, live fences, disperse trees in pasture land, foraging banks, and data analysis in agroforestry systems.

Project in support of the institutional management and outreach activities of CATIE.
With the purpose of increasing the presence, relevance, and impact of CATIE in Guatemala, El Salvador, Honduras, and Nicaragua, in March 2000 we launched the Project in support of the institutional management and outreach activities of CATIE (SIMO, by its English acronym), which was financed by Danida. With this in mind, we appointed coordinators-liaisons in each of these countries. The SIMO activities have focused on four specific areas: Institutional Management; Systematization and Cooperation; Supply and Demand; and Planning, Monitoring, and Evaluation.

During 2000, in addition to performing several institutional diagnoses to support decision-making strategies, especially on the outreach activities mechanisms, the Project strongly supported the Technical Cooperation Area, specifically as follows:

i) In coordination with the National Advisory Councils of Honduras and Guatemala.
ii) In support of the development projects in the different countries (Transforma, Focuencas, PDS, for example).
iii) In the planning and follow up of REDCA's actions.
iv) In drawing up proposals of projects and initiatives, such as the PRONAMICH project, the Agroforestry School, and the Protected Areas in Petén, Guatemala, which involves the Guacamaya Foundation and the BASIC Company.
v) In technical assistance and training on projects and institutions in the countries.

Line 3. Education of Human Resources through Training and Conferences.

Between 1999 and 2000, there were 568 training sessions which benefited 12,262 participants. Most of these events took place in the Member Countries (82% in 1999 and 73% in 2000), as compared to the events that took place at its Headquarters in Costa Rica (16% in 1999 and 25% in 2000). Of this total, 172 events represent short courses (strategic and special courses), with the attendance of 2,635 participants. The 396 remaining events correspond to workshops, seminars, fora, lectures, in-service trainings, symposia, field trips, work meetings and technical assistance, with a total participation of 9,627 personas. Chart 10 lists the number of activities and participants, classified per type.

Chart 10. Training activities undertaken in 1999-2000 (Countries and Headquarter)

Type of event	Events	Participants
Strategic Courses	26	249
Special Courses	146	2,386
Service Training	26	178
Excursions, Field Trips	29	369
Workshops, Demos	105	2,859
Conferences	1	18
Seminars	10	454
Fora	2	67
Symposia	3	217
Lectures	97	4,327
Work Meetings	90	719
Technical Assistance	33	419
TOTAL	568	12,262

Line 4. Data Management and Dissemination

We edited and distributed 24 issues of the three CATIE magazines: Integrated Pest Management (MIP), Agroforestry in the Americas (RAFA), and Central American Forestry (RFCA). Also, as of the first semester of 1999 these three magazines are available in the electronic version of the corporate web site. Likewise, the MIP and RAFA magazines are found in Internet in their complete version.

In an effort to secure additional funding (US$ 19,000) for RFCA, an agreement was signed with the Central American Forestry Program (PROCAFOR). We also negotiated the financial support of the USDA National Agroforestry Center, in the amount of US$ 15,000 for RAFA.

Institutional web page

In the period under study, a new web page was launched, incorporating the benefits of automatic, dynamic pages, with a totally new approach. In terms of computer safety, new software was installed to provide improved safety to our resources and information.

The inauguration of the Virtual Room should be emphasized, which is endowed with videoconference equipment, audiovisual projection, and computer technology, with a capacity for 32 persons. The first multimedia training courses were held, as well as several videoconference transmissions, which served to test the equipment.

Orton Memorial Library (IICA/CATIE)

The changes in technology and communications have had a positive impact on services and products generated by the library. Orton Memorial Library was designated as coordinator of the Agricultural Information and Documentation System of the Americas (SIDALC), accessible through www.sidalc.net. Among the main products generated is the mega database Agri2000, which gathers over 50 bibliographical databases in one single electronic address. The Revis database was updated, and 8,500 periodical publication titles were entered, there is also a daily update available on line (40% without indexing).

We held the very first videoconference in the field of documentary information on agriculture. We also inaugurated the Virtual Library on Agriculture, with emphasis on Latin America and the Caribbean.

Information Systems

In the period under study we were able to translate 70% of the information systems to a graphic version and developed new modules for the SIIF and Management/Administrative Systems. With the latter, we achieved an important degree of automatization in the management of administrative, accounting, and financial data. Amongst the systems implanted and updated, the following should be highlighted: receipts, work orders, assets, graduate degrees, and the institutional relations database.

With the purpose of improving and allowing for an adequate technological development, in January 1999, the Internet band width went from 64 Kbps to 256 Kbps. This improvement made it possible for CATIE services, such as the www, become more expedite and visits multiplied, thus attaining a wider dissemination of the activities and products of the Institution. For the internal network, we set up a high-capacity processing switch to accelerate communications throughout the local computer network.

Geographic Information Systems.

CATIE's SIG Laboratory, besides developing research and educational activities, provides support to the different technical areas, and has turned into a key tool at the service of the entire Region.

In the area of research, the Laboratory provided services in various fields:
- Mapping ecoregions for Latin America, for the Regional WWF office.
- Mapping biodiversity within the socioeconomic context in Honduras, Nicaragua, and El Salvador for the Olafo Project.
- Creation of SIG for CATIE as a guide of researchers.
- Creation of Production SIG (precision farming) for CATIE.
- Pinpointing of degraded lands in Central America.
- Module for the measurement and modeling of carbon flows in the Region.
- Support to the validation of biological control technologies, by means of mapping the domains of recommendation and the mapping of research sites.

In addition, we worked on various research studies such as: Analysis of the use of land in the Turrialba River watershed in Costa Rica: development of techniques to improve the precision of digital classification in the tropics, particularly for deforestation research, the use of remote sensors (AVHRR) for detection of forest fires and prevention planning, research on the impact of El Niño in 1997-1998, mapping of biodiversity in a protected area in Nicaragua, analysis of flooding in the Turrialba River watershed, and the mapping of the change of the use of land at the regional extent.

In the direct support to the Region, we should emphasize the following: The creation of a SIG for the diminishment of vulnerability for the Lempa River (jointly with CCAD/SICA); the construction of a SIG Laboratory and an information system for the Ministry of Agriculture of Guatemala; the consolidation of the Ecosystems Map for Central America; and the creation of an information system on coffee for the Costa Rican Coffee Institute (ICAFE).

The adoption and implementation of new technologies allow CATIE to make inroads in work areas that convey leadership to the Institution. Thus, during 2000 we were able to improve the area of communications and networks, both at Headquarters and at the National Representative's Offices in Central America.

CONCLUSIONS

During the two-year period 1999-2000, CATIE was able to consolidate its actions and widely project itself toward the member countries, thanks to the joint efforts of its research, education, and outreach activities, and as a result of the launching of a series of projects linked to environmental development and management of agriculture and natural resources, in the countries.

In 2000 we began the creation of a portfolio of Affiliated Members aimed at strengthening the basic budget and actions at the regional level.

The Research Program has generated knowledge and products for its five priority lines that contribute to the technological innovation processes which, in turn, contribute to the technological innovation processes for the Region. At the same time, it has begun to apply a policy of a greater regional cooperation through research networks. CATIE's Master's Degree Program has responded positively to the increase in the demand for professionals and the Doctorate Program, with its first three graduates, and is reaping positive results since it is promoting CATIE abroad. Thanks to the strategic alliances established with European and U.S. universities, we are preparing a sound platform for the education of human resources at the highest level. The enunciation between the Research and the Graduate Programs, has doubtlessly been decisive in consolidating the education processes of the Region's human resources, as well as an element that allows us to conduct research studies directly, which are of interest to Latin American countries.

The modernization of CATIE's communications system has allowed us to gradually adjust the dissemination mechanisms to the needs of the Region, preparing the Institution to face the challenges of the 21st Century.

During the two-year period 1999-2000, CATIE has developed great efforts not only to contribute to the mid-term development of the rural sector of the Region, but also to efficiently respond to the compelling needs that arose as a result of the natural disasters that affected many of its member states.

Parallel to the above, CATIE has been concerned in improving its institutional development, supported by its top directive bodies, through the Council of Ministries, its Board of Directors, and the decisive support of international cooperation agencies.

With this input, the Center is now in readiness to prepare its new Institutional Strategic Plan for the period 2003-2012.

ANNEX

Annex 1. Other research conducted (1999-2000)

Line 1

- Crioconservation of pathogenic fungi isolates
- Crioconservation of *Musa* spp. cell suspensions
- Valorization of genetic resources for coffee (*Coffea arabica*) production
- Genetic structure of populations of the fungus *Mycosphaerella fijiensis* in Latin America.
- Cacao genetic diversity for the *Moniliophthora roreri* (Cif. & Par.) pathogen
- Identification of masculine sterility genes in coffee.
- Research in crioconservation (coffee seeds)
- Tissue culture research in Musa, coffee and forestry species (*Cedrela odorata*, *Dipterix panamensis* and *Swietenia macrophylla*).
- Use of SSR markers to characterize coffee
- Crioconservation protocols for the crio bank and development of norms for its management.

Line 2

- Analysis of preferences for organic vegetables in Costa Rica.
- Biological control of cacao diseases in Chicago, USA.
- Biological control of "Ojo de gallo" (*Mycena citricolor*) in coffee
- Biological control of *Radopholus similis*
- Validation of low impact technologies for sustainable tomato production
- Development of diseases in conventional and organic coffee under perennial shade.
- Whitefly Network
- Survival strategies of small coffee producers in the Pacific region of Nicaragua
- Forages and fruits of wood species in livestock production systems in Boaco, Nicaragua. (UNA/FORESTAN).
- Identification and selection of biological products with antifungal potential to control Black Sigatoka in banana plantations.
- Participative and interdisciplinary research in agriculture
- Pest management in Musa: control of Sigatoka
- Whitefly management and prevention in tomatoes
- Use of *Bacillus popilliae* (Bp) for biocontrol of *Phyllophaga* spp

Line 3

- An evaluation of the present status of windbreaks in León, Nicaragua (UNAN/Espino Blanco)
- Contribution of *Acacia pennatula* for sustainable agroforestry production in Estelí, Nicaragua.
- Economic contribution of trees dispersed in pastures on cattle farms in Costa Rica

- Development of improved fallow in Chiriquí, Panama
- Biodiversity in cacao and bananas in agroforestry systems in Talamanca, Costa Rica.
- Development of minimum costs based on incentives for a centralized coffee processing plan in Honduras.
- Development of coffee associated with *Eucalyptus deglupta* or *Terminalia ivorensis* during its establishment phase.
- Design and management of coffee plantations in western El Salvador.
- Effects of competition in coffee through the use of fast-growing timber trees and pasture areas as barriers to control erosion in the Costa Rican Atlantic zone
- Root interaction between *Eucalyptus deglupta* and competition with pastures.
- Carbon production from *Eucalyptus camaldulensis* planted in agroforestry systems in El Salvador (UES/PAES/CENTA).
- Production and recycling of phosphorous in *Arachis pintoi* accessions associated with *Acacia mangium* in Guápiles, Costa Rica.
- Productivity in traditional silvopastoral systems in Estelí, Nicaragua.
- Silvopastoral systems for dairy cattle production in Cayo, Belize: economic viability and limitations for adoption.
- Typology of coffee systems with shade in Central America
- Use of native trees to restore pastures in regions in the wet tropics.
- Carbon sequestration in agroforestry systems in Costa Rica.

Line 4

- Nutrient accumulation in biomass on soils in young plantations of native species in tropical wet lowlands.
- Analysis of user preferences for protected areas management for Petén, Guatemala
- Sustainable production, rehabilitation and conservation of the Miraflor Protected Area, Estelí, Nicaragua (CATIE/PANIF)
- Plant propagation of threatened native species in the Costa Rican dry forest
- Information Management System for Tree Resources as support to research in forest plantations and technology transfer.
- Forestry Seeds Project (PROSEFOR) and Forest Seed Bank (BSF)

Line 5

- Analysis of external costs based in water contamination in the Las Cañas River, El Salvador
- Analysis of tourists´ preference for ecotourism development in Costa Rica
- Analysis of preferences for nature conservation and scenic beauty as a priority payment for environmental services in Costa Rica.
- Analysis of benefits from procedures to prevent forest fires in Honduras.
- Estimation of water quality value in the Acelhate Watershed, El Salvador
- Analysis of adoption and innovation forces and processes in rural areas of Central America, with particular attention to technologies promoted by CATIE

- Preferences shown in entrance rates, guides and good park management.
- Results of willingness to pay for residual water treatment

Annex 2. List of Publications

1999

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Annex 3. Governing Authorities

GOVERNING COUNCIL

As of January 20, 2001

Dr. Alberto Dent, Minister of Agriculture and Livestock, Costa Rica. Chairman.
Ing. Guillermo Alvarado, Secretary of Agriculture and Livestock, Honduras
Ing. Augusto Navarro, Minister of Agriculture, Livestock and Forestry, Nicaragua
Hon. Daniel Silva, Minister of Agriculture, Fisheries and Cooperatives, Belize
Mr. Javier Usabiaga, Secretary of Agriculture, Livestock and Rural Development, Mexico
Dr. Luisa Romero, Minister of Comerse and Production, Venezuela
M.B.A. Salvador Urrutia, Minister of Agriculture and Livestock, El Salvador
Ing. Eligio Mejía, Secretary of Agriculture, Dominican Republic
Ing. Pedro A. Gordón, Minister of Agricultural Development, Panama
Ing. Jorge Escoto, Minister of Agriculture, Livestock and Food, Guatemala
Dr. Rodrigo Villalba, Minister of Agriculture and Rural Development, Colombia
Hon. Roger Clarke, Minister of Agriculture, Jamaica (IABA representative)
Carlos Aquino, Director General, IICA
Dr. Pedro Ferreira Rossi, Director General, CATIE. *Ex Officio* Secretariy

BOARD OF DIRECTORS

Dr. Victor Villalobos, (Mexico) Chairman (also Chairman of the Executive Committee) (1998-2004)
Dr. Cristian Samper (Colombia) (Scientific Committee) (1999-2002)
Mr. Iain MacGillivray (Canada) (Executive Committee) (until May 2001)
Lic. Roberto Ortiz, (El Salvador) (Executive Committee) (1997-2003)
Dr. Larry Boone (USA) (IICA delegate, serves on both Committees) (indefinite)
M.Sc. Lorena San Román (Costa Rica) (Scientific Committee) (1999-2002)
Dr. Jochen Heuveldop (Germany) (Scientific Committee) (1998-2004)
Dr. Richard Rortvedt (USA) (Executive Committee) (1999-2002)
Dr. Floyd Horn (USA) (Scientific Committee) (2000-2003)
Dr. Fiona Wilson (Denmark) (Scientific Committee) (2000-2003)
Dr. Marcelino Avila (Belize) (Scientific Committee). Dr. Avila represents CATIE's Governing Council, according to the new versión of the Contract. (1999-2002)
Dr. Alberto Dent (Costa Rican Minister of Agriculture) (indefinite)
Dr. Pedro Ferreira, Ex Officio Secretary

Annex 4. Foundations

FUNDATROPICOS

Michael Stimpert, Chairman
Eugene Younts, Vice Chairman
Víctor Villalobos, Secretary
Orlando Rojas, Treasurer
Willy Loría, Member

TROPICS FOUNDATION

Harlan Davis, Chairman.
Rafael Leonardo Callejas, Vice Chairman
Susan A. Davis, Treasurer.
Pedro Ferreira Rossi, Secretary
Thomas Miller.
Whetten Reed
Benjamin White

Annex 5. List of International Personnel (as of 12-31-2000)

Name	Country of Origin
Ammour, Tania S.	France
Arze, Jose Agustin	Peru
Beer, John William	England
Bustamante, Rojas Elkin	Colombia
Caballero Deloya, Miguel	Mexico
Camero Rey, Luis Alberto	Venezuela
Carrera Gambetta, Fernando	Peru
Contreras Denton, Doris Anahi	El Salvador
Cornelius, Jonathan	England
Ellenbroek, Willem Emmanuel	The Netherlands
Faustino Manco, Jorge	Peru
Ferreira Rossi, Pedro	Uruguay
Finegan, Bryan Gerald	England
Galloway, Glenn	USA
Gonzalez Figueroa, Alan	Guatemala
Guariguata Urbano, Manuel	Venezuela
Guharay, Falguny	India
Haggar, Jeremy Philip	England
Harvey, Celia	England
Hearne, Robert R.	USA
Ibrahim, Muhammad	Guyana
Jimenez Burgos, Jorge	Costa Rica
Jones, Jeffrey R.	USA
Kanninen, Markku	Finland
Kass, Donald	Brazil
Montagnini, Florencia	Argentina
Monterroso Salvatierra, David	Guatemala
Muschler, Reinhold G.	Germany

Otarola Toscano, Augusto	Peru
Paez Bogarin, Gilberto	Paraguay
Ramakrishna, Bommat	Venezuela
Saunders, Joseph	USA
Somarriba Ch., Eduardo	Nicaragua
Staver, Charles Paul	USA
Stock, Tim	USA
Velasquez Mazariegos, Sergio	Guatemala

ACRONYMS

ACRI	American Cocoa Research Institute
AID	US Agency for International Development
ARS	Agricultural Research Service (USA).
SIDA	Swedish International Development Agency
IDB	Interamerican Development Bank.
BMZ	German Federal Ministry for Economic Cooperation and Development
CIAT	International Tropical Agriculture Center.
CIDA	Canadian International Development Agency
CIFOR	Center for Forestry Research.
CINVESTAV	Center for Research and Advanced Studies (Mexico)
CONAP	National Protected Areas Advisory (Guatemala)
COHDEFOR	Honduran Corporation for Forestry Development.
CIRAD	International Center for Agricultural Research (France)
COSUDE	Swiss Development Cooperation Agency.
CCAD	Central American Comission for Environmental Development.
DANIDA	Danish International Development Agency.
EMBRAPA	Brazilian Center for Agricultural and Livestock Research.
FAO	Food and Agriculture Organization of the United Nations
FIDA	International Fund for Agricultural Development.
FINNIDA	Finnish Agency for International Development.
FHIA	Honduran Foundation for Agricultural Research
FOCUENCAS	Local Capacity Strengthening in Watershed Management and Prevention of Natural Disasters.
FONTAGRO	Regional Fund for Agricultural Technology of the IDB.
FTPP	Forest/Trees and Rural Communities Program (FAO)
GEF	Global Environmental Facility.
GTZ	German Society for Technical Cooperation.
IICA	Interamerican Institute for Cooperation on Agriculture.
ICAFE	Costa Rican Coffee Institute

ICE	Costa Rican Electricity Institute.
ICRAF	International Center for Research on Agroforestry.
INCO	International Cooperation with Developing Countries of the European Union
IDIAP	Agriculture and Livestock Research Institute (Panama).
INAFOR	National Forestry Institute (Nicaragua).
INIFOM	National Institute for Municipal Strengthening (Nicaragua).
INTA	Agriculture and Livestock Technology Institute (Nicaragua).
IPGRI	International Institute for Plant Genetic Resources.
IUFRO	International Union of Forestry Research Organizations
KfW	Kreditanstalt F_r Wiederaufbau.
LEAD	Livestock, Environment and Development / FAO.
MAFC	Ministry of Agriculture, Fisheries and Cooperatives (Belize).
MAGA	Ministry of Agriculture, Livestock and Food (Guatemala).
MAGFOR	Ministry of Agriculture, Livestock and Forestry (Nicaragua).
MINAE	Ministry of the Environment and Development (Costa Rica).
MARENA	Ministry of Natural Resources and the Environment (Nicaragua).
NORAD	Norwegian International Development Authority.
NRI	Natural Resources Institute (United Kingdom).
OIRSA	International Regional Organism for Plant and Animal Health.
PAES	Environmental Program of El Salvador.
PROMECAFE	Coffee Improvement Program of Central America and the Caribbean.
POSAF	Socio-environmental and Forestry Development Program (Nicaragua).
PROSEFOR	Forest Seeds Project.
REDCAHOR	Regional Network for Vegetable Production.
RUTA	Regional Unit for Technical Assistance.
SAG	Secretariat for Agriculture and Livestock (Honduras)
PRONADERS	National Program for Sustainable Rural Development (Honduras).
SERNA	Secretariat for Natural Resources and the Environment (Honduras).
SICA	Central American Integration System.
SIDA	Swedish Agency for International Development.
IUCN	International Union for the Conservation of Nature.
USDA	US Department of Agriculture.
USGS	United States Geological Survey.
UAW	Wageningen Agriculture University, The Netherlands.
WWF	World Wildlife Fund