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CATIE

TROPICAL AGRICULTURAL RESEARCH AND HIGHER EDUCATION CENTER

CATIE's Commitment with  
Agenda 21  
Into the XXI Century



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# **CATIE's COMMITMENT WITH AGENDA 21**

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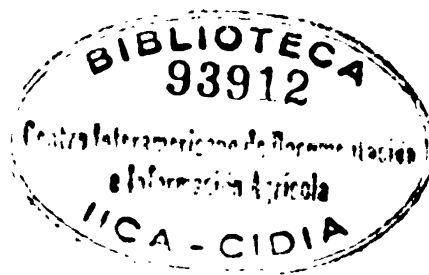
## **INTO THE XXI CENTURY**

by ✓  
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Director General  
and  
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**Document presented to the Rio+5 Forum, 'From Agenda to  
Action', Rio de Janeiro, Brazil, March 13-19, 1997**

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Tropical Agriculture Research and Higher Education Center  
Turrialba, Costa Rica**

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# ***I. Introduction***

The Rio de Janeiro 1992 United Nations Conference on Environment and Development (UNCED), widely known as 'The Earth Summit', sent a solemn 'Warning to Humanity' calling for action to reduce environmental damage, improve the management of natural resources, stabilize population growth, reduce poverty and work towards equality of the sexes.

UNCED was the largest gathering of world leaders in history. Several documents were promulgated, in particular an action plan called Agenda 21. This Agenda set forth strategies and measures aimed at halting and reversing the effects of environmental degradation and promoting environmentally sound and sustainable development throughout the world.

In UNCED's Guide to Agenda 21, The Global Partnership for Environment and Development, its Secretary General, Maurice Strong, wrote: *'Humanity is confronted with deepening disparities within and between nations. There is pervasive hunger, poverty, illiteracy, and ill health. The ecological consequences of ozone depletion, climate change, deforestation, loss of biodiversity and the increasing pollution of air, water and land threaten our common and sustainable future.'*

CATIE's mission, which is to improve the well-being of mankind through the application of scientific research and higher education to the development of tropical agriculture, and the management and conservation of natural resources, and the environment, is clearly in line with the objectives of Agenda 21.

Since 1992 CATIE has made significant advances in the areas of research, education and outreach which tackle most of the main issues of Agenda 21 which relate to conservation and management of resources for development. In addition, the Center has also made contributions in relation to social and economic dimensions, and to strengthening the role of major groups in the American tropics.

This paper presents a summary of CATIE's major contributions to the fulfillment of the objectives of Agenda 21 in the last four years, and the related compromises of the Rio Accords such as those related to Biodiversity, Global Climate Change, Ocean Waters, and the non-binding Forest Principles.



**- II -**

***Research and Validation Activities***

**“Resolving global problems through local solutions  
with regional impacts, and ample institutional and  
communal participation”**





# **Conservation and Management of Resources for Development**

## **Protecting the Atmosphere**

### ***Valuation of Tropical Rain Forest Services Sequestration of Carbon***

Scientists agree that global warming is related to anthropogenic emissions of greenhouse gasses. In particular, carbon dioxide (CO<sub>2</sub>) emissions are a major concern. Unprecedented warming of 1.5 to 4.5 °C is expected sometime in the latter half of the next century, if emissions of greenhouse gasses are not reduced (van Kooten et al., 1993).

The monitoring, sequestration and storage of carbon in forests plays a major role among the policies that have been proposed (Sedjo and Solomon, 1989).

Together with the United Nations Environmental Programme, CATIE has been actively collaborating in the total valuation of the tropical rain forest services, including CO<sub>2</sub> sequestration, as part of the integrated Environmental and Economic Accounting and Operating Manual. This effort began in 1994, and will continue for a few years.



# **Integrated Approach to Planning and Management of Land Resources**

## *Computerized Land Evaluation System*

Agricultural policies and economic incentives, designed to influence land use decisions of individual producers, are important tools to achieve a more sustainable use of natural resources. Tools for ex-ante assessment of effects of policies on agricultural land use could make a crucial contribution to facilitate the work of policy makers. They are useful for evaluating alternative land use policy options from various perspectives, taking into account socio-economic, edaphic and agronomic factors.

The Atlantic Zone Program, which is a cooperation effort between CATIE and Wageningen Agricultural University (WAU, The Netherlands), has been developing a methodology for land evaluation based on a modular approach which integrates different models and data bases.

The USTED system (USTED is an acronym from its spanish title: Uso Sostenible de Tierras en Desarrollo, i.e.-Sustainable Land Use in Development) is centered around a linear programming model which maximizes farm income subject to various resource and sustainability related constraints. The methodology also includes a Geographic Information System (GIS) which is used to store geo-referenced data and to visualize land use options through the generation of maps.

During 1994 work focused on the operationalization of the USTED system after several years of data collection. The methodology was first made operational for Asentamiento Neguev, a 5500 ha settlement in the Atlantic Zone of Costa Rica. Current work focuses on the scaling-up of the methodologies towards the regional level, and low-input data validation in Guanacaste, a much drier zone in Costa Rica.

Numerous demonstrations were conducted to familiarize various interested organizations, and a number of papers were presented in both national and international conferences.



## Combating Deforestation

### *Best Silvicultural Options - Research and Extension*

Generation of the best silvicultural options for the deforested areas of Central America was a main objective of CATIE's Multiple-Use Species Silviculture project (Madeleña). More than 300 multiple purpose tree species were included in a systematic series of trials covering the isthmus. More than 15,000 permanent plots were measured through a continuous effort involving more than fifteen years of research.

A database (MIRA-Management of Information about Multiple-Use Tree Resources) containing growth, social and economic data was developed. Site characteristics and indices, growth and volume data, market prices, together with growth models, make MIRA a powerful backstopping tool for silvicultural and agroforestry research.

A major effort was made to produce practical guides for extension purposes, thus ensuring that the results of these experiments, and other pertinent silvicultural experiences are placed at the disposition of extensionists. During 1995 alone, the number of extensionists trained rose to more than 850, up from 700 the year before.

A network composed of more than 50 community forest related organizations throughout Central America was organized. Via this network, more than 100,000 farmers received the assistance of extensionists and were trained and induced to plant trees. By 1995, an average 5 million multi-purpose species trees were planted annually in Central America, involving at least 25,000 families.

### *Faster Growing Trees*

Clonal trials were implemented both for *Gmelina arborea*, one of the fastest growing trees in the world, as well as for *Cedrela odorata*, a close relative of *Swietenia macrophylla*, with many of the same attributes and problems. The ability to conduct such clonal trials will significantly enhance the ability to identify genotypes with optimal



growth characteristics and resistance to *Hypsipyla grandella*, a medium-sized moth which ruins the trees phenotype for commercial purposes.

A most important part of tree improvement work at CATIE is the first generation half-sib progeny tests that are being conducted for 17 of the most commonly planted tree species in Central America. In 1995, the results of these tests were evaluated, and seven of the tests were converted to forward selection seedling seed orchards by eliminating all but the best individuals of the best families. Trees grown from seed produced in these orchards will grow approximately 20 to 30% faster than trees grown from unimproved seed of the same species, and will also have better phenotype.

Fast growing trees of highly demanded species promote reforestation by small, resource poor farmers, and the rest of the population.

### ***Growth rate and leaf colour of Eucalyptus deglupta***

*Eucalyptus deglupta* is one of the tree species most commonly planted by Central American small-holder tree planters. Farmers and foresters in the region have long been aware of striking variation in leaf pigmentation of the species, ranging from intense green to deep purple. However the genetic basis of this phenomenon was for a long time unknown or misunderstood, as it was its relationship with growth rate.

Field trials carried out in different altitudes and soil types in Central America have shown that this variation is partially genetically controlled and, in addition, that is correlated with genetic variation in growth rate: plants derived from the same seed-tree tended to have similar leaf colour, whilst purple families tended to grow slower than green families.

Since leaf colour differences between individual plants can be distinguished soon after sowing in the nursery, the findings of the study permit a rapid and effective genetic improvement of the species, with concomitant increases in profitability of small-holder production systems (Cornelius, Corea and Mesen, 1995).





## *Silvicultural Treatment Doubles Growth Rate after Logging Rainforest Management*

Tropical rainforest management is increasingly required to seek multiple objectives of production, protection and conservation (Palmer and Synnott, 1992). From a technical point of view, sustainable timber production is feasible through the adaptation of good forestry practices. From a broader viewpoint, forest management for timber or non-timber products production may be seen as one of a range of measures for forest conservation (Sayer and Wegge, 1992).

A study (Finegan et al, 1995) was carried out at a site known as Tirimbina farm in Central America. Annual rainfall at this site is approximately 4,000 mm, with a mean temperature of 24 °C. Soils are dystropepts, derived from an ancient lava flow, and although deep and predominantly well-drained, are of very low fertility, and fairly acidic, with a pH of 3.9-4.5.

The management of a 30 ha plot was implemented in 1990 with a carefully planned and controlled harvest carried out by a local logger. Following the harvest (10 m<sup>3</sup> ha<sup>-1</sup> were taken, on the average, over the entire area). A silvicultural treatment was applied in 1991 as a refinement to eliminate all non-commercial trees (>40 cm dbh). A liberation of potential crop trees (> 10 cm dbh).

After the timber harvest, but before silvicultural treatment, mean stand density in the PSPs was similar to that of mature forests on comparable sites in northern Costa Rica.

Commercial diameter increments in the refinement + liberation treatment during the 1993-1994 period (9 mm/yr.) nearly doubled those in the control (log it and leave it) plots (5 mm/yr.).

The effect of these treatments on birds was positive. After the fifth year of the experiment, bird inventories showed more varieties and numbers present.

## *Damage Reduction Through Appropriate Timber Extraction Techniques High-Mountain Forest Management*

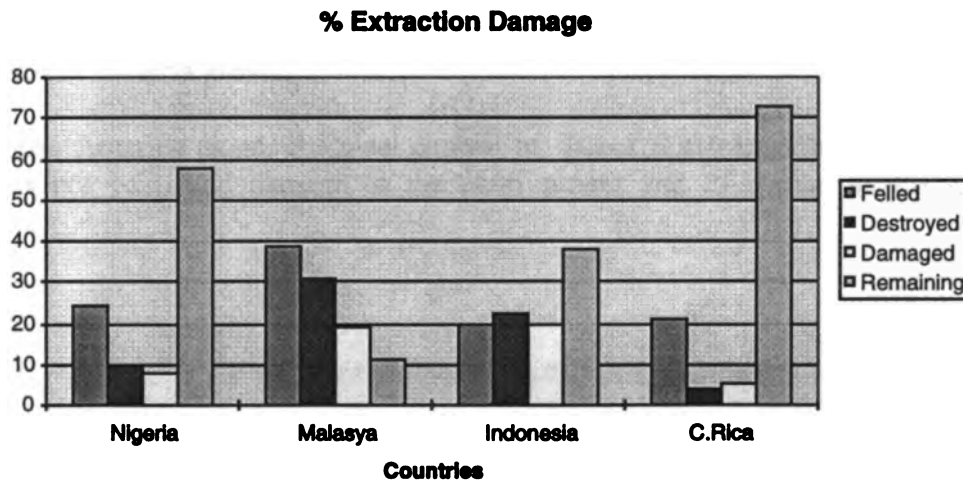
Detailed planning of extraction roads and the application of appropriate timber extraction techniques were implemented in a high-mountain Oak-Bamboo forest in Talamanca, Costa Rica. The experimental area comprises about 325 ha of primary natural forests, secondary forests and open fields. Soils belong to the Andepts group,



according to USDA, and might be classified as Dystrandep. Other characteristics of the site are altitudes ranging between 2650 and 2800 meters above sea level, average precipitation of 2.013 mm per year, and temperatures ranging from 0 to 20 °C.

Results obtained in terms of damage reduction are compared in the following graph with those obtained in other tropical countries. Data is taken from Whitemore (1990). The graph shows that only 4% and 5% of the trees of the Costa Rican forest belong to the destroyed and damaged categories, respectively, while percentages ranging from 10% to 32% (destroyed) to 8% to 20% (damaged), respectively, are observed in Whitemore data for the same categories.

**Percentage of Extraction Damage According to Four Categories in Four Tropical Countries**





## **Sustainable Agriculture and Rural Development**

### *Biological control of Black Sigatoka through microorganisms*

The main tactic to control Black Sigatoka in bananas and plantains is the use of fungicides. However, the appearance of fungicide resistance and the lack of new products have stimulated the search for alternatives. Biological control of pathogens through antagonistic microorganisms is considered a promising alternative. Field trials undertaken by CATIE researchers have shown that selected strains of *Bacillus cereus* and *Serratia marcescens* are effective control agents of this fungus. Nonetheless, no significant differences were found between the biological control treatment and the traditional fungicide treatment in field trials under severe disease pressure.

Commercial surfactants have a lower attachment action than water or nutrient broth when sprayed on banana leaves. Substrates applied to the foliage showed positive effects on antagonistic bacteria growth.

In Central America alone, chemical control of Black Sigatoka costs more than US\$30 millions per year, and damage to the environment and to human health is a major concern.

### *Biological control of whitegrubs with fungi*

Larvae of the genus *Phyllophaga* (Coleoptera: Scarabaeidae) are whitegrubs that cause serious losses to a wide range of crops in most parts of the Americas. Damage is caused by third instar larvae feeding on the roots, weakening and frequently killing the plants. In maize alone, losses to whitegrubs in Latin America have been estimated at US\$135 million every year.

A highly virulent strain of the naturally occurring fungus, *Beauveria bassiana*, has been identified as a promising microbial control agent for one of the most important whitegrub species, *Phyllophaga menetriesi*, which is a serious problem from Mexico to South America.



## *Cultural practices reduce whitefly-borne geminivirus damage in tomatoes*

CATIE's researchers have succeeded in producing geminivirus-free and high-quality seedlings, in seedbeds covered with fine nets for the first 30 days after sowing, using inexpensive newspaper cups. This method is currently being validated and promoted by extension agents and NGO's in several Central American countries.

Moreover, they demonstrated that cover crops (such as *Drymaria cordata*), as well as silver plastic ones, reduced adult whitefly numbers and significantly delayed virus dissemination, giving good yields.

## *Ecological Management of coffee berry borers*

Applications of the entomopathogenic fungus *Beauveria bassiana* were used to control the berry borer. A comparison with conventional control practices, based on applications of the synthetic insecticide endosulfan, showed that ecological management practices are more efficient, and produce similar yields with better grain quality at a lower cost, and with higher economic returns, and do not contaminate the environment.

## *Timber trees as shade for cocoa plantations*

Observed total stem growth rates for *Tabebuia rosea*, *Terminalia ivorensis* and *Cordia alliodora* were between 9 and 18 m<sup>3</sup>/ha. Productivity of *T. ivorensis*, however, was reduced by high mortality rates. Cocoa production did not differ among shade species used.

The most commonly used shade, provided by the traditional *Inga edulis* species which only produces firewood, was the least successful in competing with the existing shade and in providing a new protective canopy for the cocoa in a short amount of time.





## ***Carbon and Nitrogen Dynamics in Erythrina poeppigiana***

Multi-purpose woody legumes are commonly used in tropical agroforestry systems, in which they are generally managed by periodic prunings. In the present study, carried out at CATIE's experimental farm, a functional analysis of the carbon and nitrogen dynamics in five genotypes of the Neotropical agroforestry tree species *Erythrina poeppigiana* (Walpers) O.F. Cook (Leguminosae: Phaseoleae) was carried out in order to gain understanding of the factors regulating the re-sprouting and growth of the species between prunings. The study (Nygren, P., 1995) was carried out under humid tropical field conditions on trees pruned twice a year.

The maximum leaf CO<sub>2</sub> assimilation rate was 17.9 - 20.5  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ , depending on genotype. A simulation model based on canopy development, penetration of photon flux to canopy and leaf CO<sub>2</sub> exchange was used to compute the whole canopy CO<sub>2</sub> exchange. According to the simulations, the canopy intercepted 26 - 36% of the potential photon exposure. The molar ratio of the whole canopy C assimilation to intercepted photon flux was 1.03 - 1.63%. The production of harvestable biomass (foliage and branches) was 2.79 - 6.19 Kg per tree per pruning, which was equivalent to 32 - 45% of the total C assimilation between two prunings. Following a complete pruning, the major proportion of C was allocated to the growing foliage. The trees depended partially on the reserve carbohydrates even at 15 weeks after pruning. This indicates that the reserve C pool is large but, on the other hand, its replenishment rate is low. All the nodules disappeared after pruning, and re-nodulation began roughly 10 weeks after pruning. Subsequently, nodulation was abundant, and seemed to be regulated by the N requirements of the foliage. The N concentration of mature leaves was 44.7 - 53.8 mg·g<sup>-1</sup>. The potential N supply to the soil was 135 - 268 g per tree per pruning interval. Pruning residues formed 70 - 80% of the total N supply.

The abundant production of N rich foliage makes *E. poeppigiana* a suitable species for green manure systems and forage production. It should not be pruned more frequently than every four months, because the initiation of nodulation and replenishment of the reserve C pool are slow processes. The genotypic variation in productivity was most probably caused by the differences in the size of the reserve C pool and canopy structure.



### *Forage trees produced superior silage*

Research on fodder trees covered eight woody species, previously selected as sources of fresh forage for goats and cattle. It was proven that they produce superior silage to that obtained from temperate gramineous and legume species. The best results were obtained with Morera (*Morus sp.*) and Chiscasquil (*Cnidoscolus aconitifolius*) with in-vitro digestibility of 68 and 73%, and crude protein of 17 and 23%, respectively (based on dry weights).

Milk production of grazing cows was not significantly affected when a commercial concentrate was replaced by Morera (13.6 and 13.2 kg/day/animal, respectively). However, partial net benefit (\$2.84 and \$3.29 per day/animal, respectively) favors the use of Morera as a supplement.

Mulches of leguminous trees overcame potassium and magnesium deficiencies in acid soils, and resulted in higher earthworm populations and higher bean (*Phaseolus vulgaris*) production. Combining ploughing with alley cropping reduced below-ground competition and labor requirements. These results, obtained in CATIE's farm experiments, were presented in the 1996 ASA Meeting, Indianapolis.

Alley farming with *Gliricidia sepium* resulted in higher bean (*Phaseolus vulgaris*) production and greater stability of yields. These results correspond to 10 years of research in four different sites in Costa Rica.

### *Timber shade for coffee*

A higher benefit/cost ratio, and return to labor, was obtained when 100 trees/ha of *Cordia alliodora*, a timber species, were introduced into traditional coffee plantations shaded with *Erythrina poeppigiana*.

Shaded coffee produced higher quality berries and reduced weed growth.



## **Environmentally Sound Management of Biotechnology**

### ***Somatic embryogenesis for mass propagation***

Mass propagation through somatic embryogenesis offers numerous advantages for the production of *in vitro* plantlets. These include a high multiplication rate and reduced production costs. CATIE has developed and improved the techniques of somatic embryogenesis for several tropical species. Most of the work has concentrated on *Musa* and *Coffea*.

Conventional methods for banana (*Musa* sp.) micropropagation use the *in vitro* budding method. CATIE has developed a system of regeneration through somatic embryogenesis. Male flowers are used to initiate the culture. The embryogenetic tissue obtained goes through a temporary culture immersion system (Rita R) which encourages multiplication and regeneration of adventitious embryos. This technique allows regeneration of the main group of banana (AAA, AAB). Field experiments are presently in progress to determine the agronomic traits of plants obtained through this procedure. The method will be used for the mass propagation of existing cultivars, or for the multiplication and distribution of new hybrids.

A regional breeding program (network) has been set up to enlarge and improve the genetic basis of cultivated varieties. Ten selected hybrids were introduced *in vitro*, and are presently multiplied through somatic embryogenesis. The multiplication and regeneration steps are performed in liquid medium (cell suspensions and temporary immersion systems). Large scale production and field experiments are in progress.

### ***Transformation of Banana Embryogenic Cultures Through Biolistic Techniques***

The conventional improvement of bananas is long and complex, due to the sterility of the triploid cultivars currently grown. Genetic engineering and gene transfer are opening up new prospects for banana improvement. Mastering embryogenic cell suspension and somatic embryogenesis for the genus *Musa* is an important tool for the development of non-conventional breeding programs.



One study considered *Musa* AAA cv. 'Grand Naine' and cv. 'Gross Michel'. Genetic transformation was done using Biolistic<sup>(R)</sup> techniques (helium-driven particle gun and micro-projectiles). The target consisted of the adventitious somatic embryos obtained from male flowers in embryogenic cultures in a temporary immersion system.

The best transient expression of the  $\beta$ -glucuronidase gene (GUS) was obtained using the enhanced 35S promoter (pCaMV2) in comparison with ubiquitin and actin. Scores of 400 to 800 blue spots per shooting were recorded.

A stable expression was obtained five weeks after transformation using the GUS gene with the cultivars 'Grande Naine' and 'Gross Michel'.

To select transformed cells, the pBar gene and the selective herbicide agent Glufosinate or 'BASTA', were used. Fifteen days after transformation, somatic embryos were subjected to selection in BASTA 5 mg/l for two months in the SIT system. Subsequently they were regenerated on a semi-solid germination medium containing BASTA at 5 mg/l. Only 0.25% of the embryos resulted in the formation of plants.

### ***Construction of a genetic linkage map for Theobroma cacao***

A genetic map is similar to a road map, where DNA is the road, and towns and villages on the road are analogous to loci on the DNA. Each road can be thought of as a chromosome; in cocoa there are 20 chromosomes ( $2n=2x=20$ ).

A cocoa genetic linkage map was constructed from a Catongo crossbreed population. DNA was first isolated from the Catongo and Pound 12 parents, then later from the F1 hybrid tree (Tree 33) used as a pollen parent for the Catongo cross, and finally from the leaves of 137 crossbreed trees.

Over 1200 primers consisting of random sequences of 10 base-pairs each, were tested in the polymerase chain reaction for polymorphisms between Pound 12, Tree 33 and Catongo DNA.

Data were inserted into the MAPMAKER (Lander et al, 1987) computer package for linkage analysis. Ten linkage groups were identified, which is equal to the haploid number of cocoa chromosomes.

In addition to the 81 RAPD markers, the map includes 12 RFLP markers and phenotypic markers from two apparently single gene traits. These are anthocyanin





production and autocompatibility, both found on chromosome 4. Total map distance is 887 centimorgans with an average distance of 10.5cM. This is considered a medium density map, which is useful, but not as useful as a high density map where average distance between loci would be in the range of 5 cM.

The study was financed by USDA, ACRI, the ACRI-Pennsylvania State University Program and the Government of Holland.



**- III -**

***Graduate Education and Training  
Activities***

**“Development and promotion of technological options and practices suitable for tropical ecosystem use faces the serious problem of lack of human resources trained in this field ”**



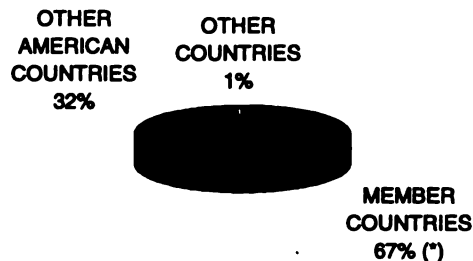
## Graduate Education

### *Graduate Programs (M.Sc. and Ph.D. ) in Natural Resource Management and Sustainable Tropical Agriculture*

Since 1946, CATIE's Graduate School, the oldest of its kind in Latin America and the Caribbean, has offered graduate programs in Tropical Agriculture and Natural Resource Management. Since its inception the School has maintained top academic standards, equaling those of the world's most prestigious universities. An international full time academic staff with more than 100 scientists devotes a high percentage of its time to teaching and research activities.

Hundreds of CATIE's graduates, in fact more than 1200, are now working in different countries of the Americas and the Caribbean, and all around the world, in relevant academic, research, administrative and policy making positions.

### **CATIE's graduates according to geographic area (1945-1996)**

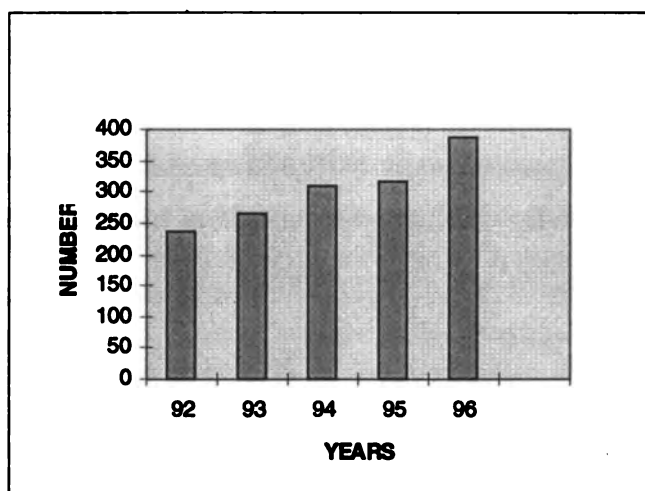


(\*) México, Guatemala, Honduras, El Salvador, Belice, Nicaragua, Costa Rica, Panamá, Venezuela, República Dominicana



The number of applicants to the M.Sc. has continuously increased reaching almost 400 candidates last year. The prestige of the School, the quality of its academic staff, and its innovative programs makes its education package a very attractive one. Although a high percentage of CATIE's students are Latin American citizens, the School also receives applicants from other nationalities.

### **Applicants to CATIE's M.Sc. Program ( 1992-1996 )**



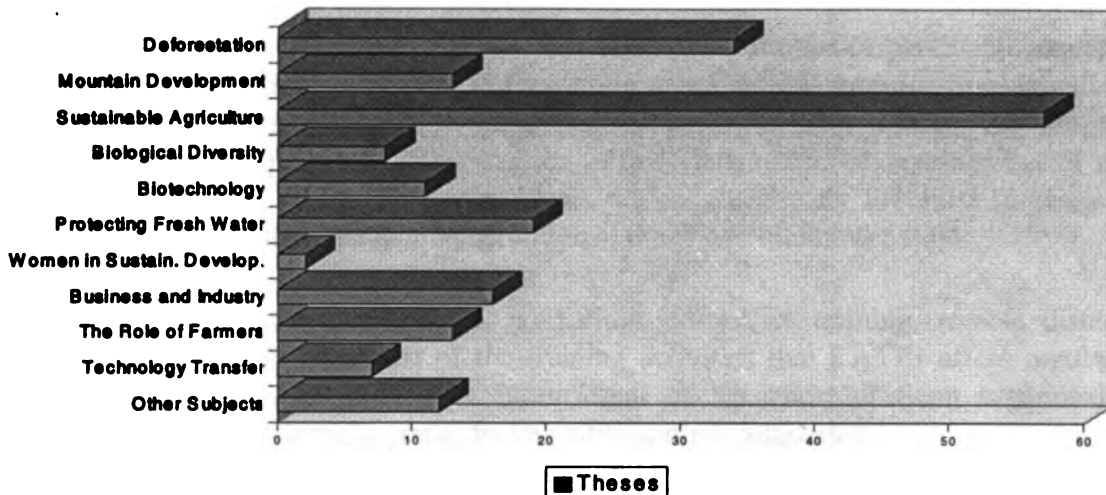
The School is recognized for the strong link which exists between the research activities of the Center and its graduate education programs, which ensures the highest quality and relevance of these' research.

Since 1992, the year of the Summit, the Graduate School offers Master's degrees in the following Agenda 21 related subjects: tropical forest management , tropical biodiversity management and conservation, watershed and soil management, integrated pest management and biocontrol, socioeconomics of conservation, ecological agriculture and tropical agroforestry systems. There are over 180 graduates from over 20 countries in the five years since UNCED 1992.





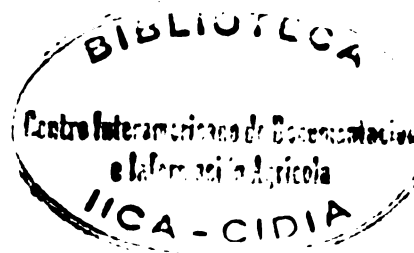
## Master's degree theses by Agenda 21 subjects (1992-1996)



A Doctoral Program was created in March 1996, and now offers four possible emphases: tropical forestry, tropical agroforestry, ecological agriculture and environmental socioeconomics. The Ph.D. Program in tropical forestry is offered in conjunction with Colorado State University, Fort Collins, and the Ph.D. Program in tropical agroforestry is similarly organized with the cooperation of the University of Florida, at Gainesville. Other agreements with European and American universities are also available. In particular, CATIE participates in joint graduate program with the University of Wageningen, at a Ph.D. level, and with the Universities of Alberta and Laval at a Master's level. Demand for the doctoral program surpassed one hundred candidates during the first year.

Since 1992, the Graduate School has shared cooperative ties with NATURA (a network of European universities and scientific institutions working in the field of agricultural development, with a focus on tropical and sub-tropical production), and with other academic networks such as AUIP (Ibero-American Association of Universities), OUI (Inter-American Association of Universities), REDCA (Latin American Network of Universities and Research Institutes in the fields of Agriculture and Natural Resources), etc.





## Training

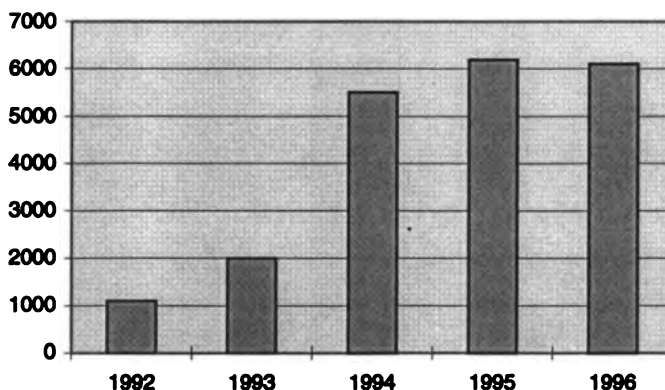
### *Continuous Education Graduate Programs Short Courses, Seminars, Workshops, Conferences, In-Service Training*

The general objective of training at CATIE is offer opportunities of continued education to professionals working in the fields of agriculture and natural resource management in the American tropics. Through a variety of different training events, the program promotes and makes possible the acquisition of knowledge and the development of new abilities. The target group are professionals which are already involved in research, teaching, development or production activities in the above mentioned fields.

Short courses, seminars, conferences, workshops, in-service training, remote distance courses, field days, etc., are part of the training activities that CATIE offers regularly. More than 6000 persons participate in different events, most of them organized in different member countries, i.e. outside the institution's headquarters.

### Number of participants in training events

1992-1996

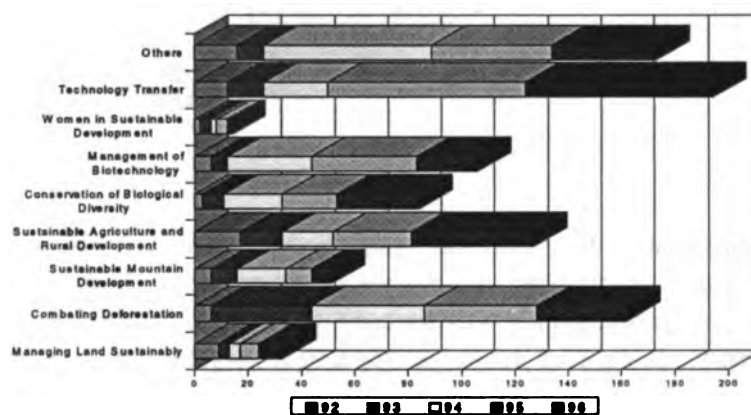


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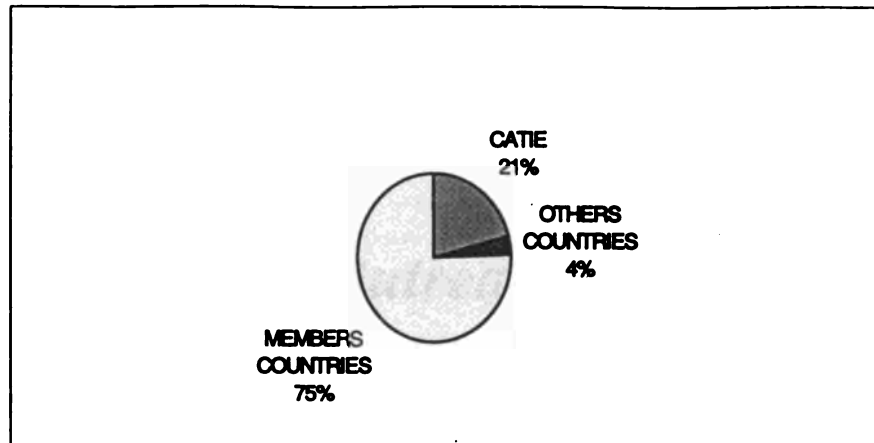
# Training activities by Agenda 21 subjects

1992-1996





## Training Events by Host Country 1996



The subjects which are offered include silviculture, natural forest management, watershed management, application of geographic information systems to natural resources management, protected areas management, biodiversity management, genetic resources management & biotechnology, integrated pest management, biological control, etc.

A number of 'strategic' courses are regularly organized to attend strategic needs of the region, aiming to strengthen national organizations in member countries. Other courses are 'tailor made' and respond to specific requests received from national institutions or respond to specific plans of development, research or extension projects which are being executed in the region.

The tendencies in the near future are: (a) to further increase alliances with other institutes to perform joint training activities, (b) prioritize distance learning and the use of modern communication media, including electronic networks and devices, (c) to strengthen modular training courses leading to graduate certificates and (d) to continue strengthening the production of training materials (books, pamphlets, CD Roms, etc.).





**- IV -**

***Outreach:  
Communications, Extension and  
Networking***

**“Outreach to national program partners is an integral part of CATIE’s overall activities. Without outreach the Center’s presence and impact in the member countries will be minimal.”**



### ***Research and Extension Network on Multiple-Use Trees***

The Central American Research and Extension Network on Multiple-Use Trees, organized by CATIE and called 'Madeleña', represents one of the most successful efforts and a pioneer example on a worldwide level in the tropics. This network, coordinated and implemented through agreements between CATIE and national institutions in charge of forestry research and extension in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama has been in operation now for fifteen years, working in the areas of forestry and agroforestry research and extension.

Since 1980, CATIE, with the financial support of USAID's Regional Office for Central America and Panama (ROCAP), and since 1990 with the financial support of PROCAFOR-FINNIDA, as well as counterpart funds from the Central American countries, the Madeleña Network was instrumental to facilitate testing of individual forest species and tree species useful for agroforestry purposes, under different environmental and socio-economic conditions in a variety of ecological zones. The network has also made socio-economic information collection possible, as well as that concerning to extension, technical assistance and training, input costs and yields and reforestation activities.

Presently the network is formed by 31 institutions which conduct forestry research and extension, and through their transfer structures they offer training and technical assistance to producers and/or organized groups interested in incorporating and managing forest production systems on their farms. Nearly 600 extensionists, who directly assist 20,000 producers who incorporate and manage trees on their farms, participate in training, research and extension activities.

### ***Validation and Extension of Sustainable Production Systems in the Maya Biosphere Reserve, Peten, Guatemala***

Since 1989, with financial support provided by the Swedish Government, CATIE has been involved in research and development activities aiming to improve the well being of community groups through the implementation of sustainable production systems in the Maya Biosphere Reserve in the north of Guatemala, Central America.



The activities were undertaken under the leadership of the so called 'OLAFO' project. A participative strategy was used to improve and validate new production systems based on the sustainable use of forest biodiversity and including new agricultural practices.

Diversified forest management, non-timber forest products (*Desmoncus spp.*, *Chamaedorea spp.*, *Zamia Skinneri*, *Reinhardtia gracilis*, *Quassia amara*, *Ryania speciosa*, *Carludovica palmata*, etc.), new agroforestry systems, forage trees used to feed goats (*Leucaena spp.*, *Cnedosculus spp.*, *Aegiphila montrosa*, etc.), honey production, green manure intercropped with corn, improved marketing of non-traditional products, promotion of community organization, etc., led to significant increases in family income (which almost doubled) and a 30% reduction in the advance of the agricultural frontier.

Work was concentrated in the areas of San Miguel (7,039 ha of forests and agricultural areas, and La Pasadita, with 18,817 ha). More than 100 families actively participated and directly benefited from the activities of the project. The contributions of the Committee of San Miguel to sustainable development were recognized by the President of Guatemala in a formal ceremony.

***Regional Cooperation Network in Agricultural and Natural Resource Management  
Research and Higher Education - REDCA***

Created in 1986, under the leadership of CATIE, to strengthen and coordinate regional efforts for the improvement of higher education and research in the areas of tropical agriculture and natural resource management, REDCA is at present a fundamental tool for regional academic interchange and cooperation.

With more than 200 member institutions, including universities, research institutes, NGO's, development institutes, and having a strong decentralized structure composed of autonomous National Committees, REDCA organizes more than 20 regional meetings per year, including workshops, seminars, courses, etc. In addition, it organizes and finances scientific interchanges among the member institutions and with well known European and American universities.

Financial support is being provided by the Government of The Netherlands, the European Community, CATIE and through contributions of member institutes.



## ***Renewable Natural Resources Bibliographic Information Network-RIBRENAC***

The RIBRENAC Network is a bibliographic information system on renewable natural resources, specifically forestry and agroforestry sciences, for Central America. It was developed by CATIE beginning in 1992 with the objective of organizing and strengthening a series of documentation services in renewable natural resources. Information is offered and transferred to producers, technicians, extensionists, reforesters, planners and decision makers.

The network is composed of a central node (INFORAT) located at CATIE and a series of national nodes, one in each Central American country. National nodes organizes its activities in coordination with a number of information units within each country.

An ample range of specialized documentation services are offered, including data base searches, inter-library loans, reference services, short specialized bibliographies, research directories, directories of libraries, short term bibliographic training, etc.

## ***National Forestry and Agroforestry Research and Extension Commissions in Central American Countries***

Since 1992, professionals from diverse disciplines have collaborated to form and consolidate national research and extension commissions in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama. The purpose of these commissions has been to provide a forum where researchers and professionals involved in forestry extension activities can present the results of their work and exchange experiences with others. In most of the aforementioned countries, annual workshops have been carried out during the last four years where selected research results have been presented and important experiences and relevant topics in forestry and agroforestry extension have been discussed, including participatory extension methodologies and gender issues.

In several countries the existence of the commissions has encouraged research among Universities, NGO's, public and private entities. The close contact between researchers and extensionists has favored both research planning and the application of research results. Participatory approaches to forestry and agroforestry research have been promoted and in 1996 farmers with important experiences in agroforestry were invited to share their perspectives in an annual workshop.





The effectiveness of the national commissions has depended on the interest and active participation of persons from different institutions and organizations. Many donors have contributed to cover costs of the annual workshops in the countries. During the first four years CATIE's Madeleña project (USAID-FINNIDA) contributed to the formation of the commissions and the planning and organization of the annual workshops.

Gradually the legal nature and status of the commissions in each country is being defined. It is hoped that with time, the commissions will become an important and permanent part of forestry and agroforestry development in each country.

### *Forestry and Agroforestry Journals*

The "Revista Forestal Centroamericana" (RFCA) and "Agroforestería en Las Americas" (RAFA) are technical journals. They constitute practical communication means, which cover subjects related not only to forestry and agroforestry, but also to conservation, management and utilization of natural resources, environmental management and rural development.

Through explicit language, they encourage the exchange of technical information, act as a forum of discussion of forestry, agroforestry and environmental problems in the Region, and publish experiences about renewable natural resources.

Both Journals have a Central American coverage, but also contain relevant information from other parts of the world and are directed to persons, institutions and enterprises dealing with production, education, administration, research, communication and planning.

Periodicity: Quarterly .

### *IPM Journal and Regional Information and Communications Center*

The Regional Integrated Pest Management Information and Communications Center provides the following services: databases of IPM professionals, specialists and institutions in Central America and the Caribbean which are continuously updated, as well as the Plant



Protection bibliographic data base. The *IPM Journal*, including the *IPM Technical Sheet* is issued on a quarterly basis. Promotional material about Plant Protection information services, as well as on the different publications edited by this Area, are included in CATIE's Gopher, which can be accessed through Internet.

The Pesticide Information Service includes the distribution of the *Pesticide Bulletin*, addressed to non-traditional export crops. Questions from producers referred mostly to pesticide registration and use allowances, current status of pesticides, tolerances, and general regulations of crop-importing countries. A continuous service provided updated information on pesticide regulations to relevant agrochemical companies. Updates of the Pest Bank database were received as part of the support provided by the U.S. Environmental Protection Agency (EPA) to the pesticide information services.

The Regional Plant Protection Network involves five countries. CATIE is a member institution in all of the National Chapters that it has helped to organize so far. The number of institutional members presently exceeds 50.

The Regional Action Plan for Whitefly Management in Latin America and the Caribbean, which is led by CATIE, involves 18 countries. It includes diagnosis, training, research, validation, and technology transfer activities carried out by specific countries. The newsletter *Whitefly Update*, edited by CATIE, is published quarterly.

### ***IPM Training and Support to Non-Traditional Exports***

Most of the beneficiaries from CATIE's Plant Protection educational/training, research and outreach activities are reached indirectly through the improved knowledge and capacities for IPM experimentation and training /extension of the para-technical, technical and decision-making personnel of collaborating/beneficiary institutions or organizations in the member countries. They are mostly small and medium-sized farmers, in numbers conservatively estimated at several hundred thousand. Direct beneficiaries from 1989-1995 included over 5,000 university professors, students, researchers, extension agents and other categories of technical and para-technical personnel who were reached through CATIE's M.Sc. program, as well as through non-degree Training Programs and the IPM Information and Communication and Technical Assistance Programs. Nearly 20,000 end-users benefited directly from the Center's involvement in cooperative pilot extension programs covering six different crops in 15 important agricultural areas throughout Central America. Those included the tomato-producing department of Zacapa and the non-traditional export crop producing Altiplano in Guatemala; several zones in the west ("Occidente") and east ("Oriente") of El Salvador; the coffee-producing departments of Jinotega, Matagalpa y



**Carazo in Nicaragua; and the vegetable crop producing areas of Grecia, Sarchí and Tierra Blanca in Costa Rica.**

**An example of these training efforts is the following one related to non-traditional exports: broccoli and snow peas are two important non-traditional export commodities for Guatemala. However, these crops must be free of pesticide residues to be accepted in the US. The MIP/ICTA/CATIE/ARF Project has dealt with this challenge through the training of 3235 growers. Pamphlets have been addressed to extension agents and farmers to keep them well informed about IPM and pesticide restrictions.**



- V -

***Funding:  
Governmental, Private, and Member  
Countries Contributions***

-

***Partnerships for Development  
Counterpart Contributions***

**“Attracting greater resources for the core budget guarantees continuity  
of the excellent pool of human resources needed for research and  
graduate education”**





**GOVERNMENTAL DONOR CONTRIBUTIONS PER YEAR**  
In US\$ thousands

**1992-1997**

<b>Donor-Govt.</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997*</b>	<b>Total</b>
<b>Germany</b>							
<b>DAAD</b>							
<b>BMZ/GTZ</b>	521	641	545	327	291	335	2660
<b>BMZ/CIM</b>	-----	-----	-----	-----	100	100	200
<b>Sweden</b>	1323	1111	990	1306	1474	1474	7678
<b>SIDA</b>	613	837	821	1306	1474	1474	6525
<b>SAREC</b>	710	274	169	-----	-----	-----	1153
<b>Denmark</b>	592	1188	1209	2347	2348	2348	10,032
<b>DANIDA</b>	592	1188	1209	2347	2348	2348	10,032
<b>Switzerland</b>	168	231	275	232	489	871	2266
<b>COSUDE</b>	168	231	275	232	489	871	2266
<b>United States</b>	5321	4626	4355	3852	811	652	19,617
<b>USAID</b>	5321	4626	4296	3817	659	448	19,167
<b>USDA</b>	-----	-----	59	35	152	204	450
<b>Norway</b>	1201	1635	1485	1361	798	611	7091
<b>NORAD</b>	1201	1635	1485	1361	798	611	7091
<b>Finland</b>	332	446	506	488	134	109	2015
<b>FINNIDA</b>	332	446	506	488	134	109	2015
<b>Canada</b>	1230	642	401	70	22	17	2382
<b>CIDA</b>	772	566	216	-----	-----	-----	1554
<b>IDRC</b>	458	76	185	70	22	17	828
<b>The Netherlands</b>	-----	-----	440	520	463	375	1798
<b>Embassy</b>	-----	-----	440	520	463	375	1798
<b>Guatemala</b>							
<b>MAGA</b>							
<b>France</b>	45	23	-----	-----	-----	-----	68
<b>MAE</b>	45	23	-----	-----	-----	-----	68
<b>Japan</b>	97	84	94	101	-----	-----	376
<b>JICA</b>	97	84	94	101	-----	-----	376
<b>Italy</b>	113	53	-----	-----	-----	-----	166
<b>INFORAT</b>	113	53	-----	-----	-----	-----	166
<b>EEC</b>	54	140	91	116	97	77	575
<b>TOTAL</b>							



**PRIVATE DONOR CONTRIBUTIONS PER YEAR**  
**In US\$ thousands**

**1992-1997**

<b>Donor</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997*</b>	<b>Total</b>
<b>ACRI</b>	-----	-----	-----	30	30	97	<b>157</b>
<b>BID</b>	-----	-----	-----	135	354	471	<b>960</b>
<b>CIAT</b>	-----	-----	-----	143	183	-----	<b>326</b>
<b>CIFOR</b>	-----	-----	-----	2	111	97	<b>210</b>
<b>CIRAD</b>	20	-----	18	37	19	6	<b>100</b>
<b>Falcon Brice</b>	18	-----	-----	-----	-----	-----	<b>18</b>
<b>FUNDATROPICOS</b>	-----	132	407	505	614	860	<b>2518</b>
<b>INIBAP</b>	-----	-----	-----	-----	-----	10	<b>10</b>
<b>IPGRI</b>	44	39	5	40	29	21	<b>178</b>
<b>IUCN</b>	-----	-----	-----	13	6	-----	<b>19</b>
<b>ODA/NRI</b>	213	273	370	361	249	210	<b>1676</b>
<b>UA Wageningen</b>	62	58	53	49	70	46	<b>338</b>
<b>U. of Florida</b>	9	20	-----	-----	-----	-----	<b>29</b>
<b>World Bank</b>	229	125	-----	-----	-----	-----	<b>354</b>
<b>WWF</b>	22	22	34	60	32	26	<b>196</b>
<b>World Relief</b>	-----	31	-----	-----	-----	-----	<b>31</b>
<b>TOTAL</b>	<b>617</b>	<b>700</b>	<b>887</b>	<b>1375</b>	<b>1697</b>	<b>1844</b>	<b>7120</b>



**DONOR CONTRIBUTIONS  
MEMBER COUNTRIES**

**1992-1996**

<b>Country</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>Total</b>
<b>Belize</b>	-----	-----	50,000	50,000	50,000	<b>150,000</b>
<b>Costa Rica</b>	32,815	43,487	45,331	34,469	36,494	<b>192,596</b>
<b>Dominican Republic</b>	-----	-----	-----	-----	-----	<b>0</b>
<b>El Salvador</b>	100,000	50,000	50,000	50,000	50,000	<b>300,000</b>
<b>Guatemala</b>	25,763	-----	-----	-----	100,000	<b>150,000</b>
<b>Honduras</b>	50,000	50,000	32,335	50,000	58,817	<b>241,152</b>
<b>Mexico</b>	25,000	75,000	50,000	50,000	50,000	<b>250,000</b>
<b>Nicaragua</b>	50,000	-----	-----	-----	-----	<b>50,000</b>
<b>Panama</b>	25,000	50,000	50,000	-----	-----	<b>125,000</b>
<b>IICA</b>	1,222,300	1,271,200	1,347,400	1,361,700	1,361,700	<b>6,564,300</b>
<b>TOTAL</b>	<b>1,530,878</b>	<b>1,539,687</b>	<b>1,625,066</b>	<b>1,596,169</b>	<b>1,707,011</b>	<b>8,023,048</b>



**Partnerships for Development  
Counterpart Contributions  
In US\$ thousands  
1992-1996**

Institution 1996	1992	1993	1994	1995	1996
CIRAD-France	600	850	850	850	1000
IPGRI/INIBAP	150	150	150	150	200
NRI-United Kingdom	250	300	250	250	180
COSUDE-Switzerland	495	495	495	495	300
GTZ-Germany	500	400	400	400	250
ODA-United Kingdom	200	200	200	200	50
UA Wageningen-The Netherlands	45	45	70	70	70
DGIS-The Netherlands	150	150	150	150	150
MAE-France	90	90	90	90	100
WWF-United States	140	140	200	250	250
ORSTOM-France	150	150	250	300	250
FINNIDA-Finland	---	180	300	300	100
Penn State Univ./ACRI	---	125	125	75	20
ICRAF	---	---	25	30	30
ISNAR	---	---	20	50	---
CIPOR	---	---	30	125	200
UICN	---	---	25	25	40
CIAT	---	---	---	75	75
U.Laval/U. Alberta-CIID	---	---	---	35	40
Univ. Vet. Medicine-Denmark	---	---	---	50	75
DANIDA-Denmark	---	---	---	---	200
CIM	---	---	---	---	100
<b>TOTALS</b>	<b>2770</b>	<b>3275</b>	<b>3630</b>	<b>3970</b>	<b>3670</b>





# **VI.**

## ***The Future***

**“Inducing behavior, and finding answers that lead people to produce while conserving and conserve while producing”**



## **The Future**

**CATIE is in a very favorable strategic position compared to other international centers of research and development with respect to current world tendencies.**

**The Center is currently strong in areas of world interest such as tropical forest management, biodiversity conservation, integrated pest management, agroforestry/agrosylvopastoral production systems, water and watershed management and multiple use land, aimed at protecting the environment, and reducing poverty.**

**These topics are clearly in line with the commitments for action which emerged from the Earth Summit meeting in Rio de Janeiro, 1992.**

**Five years after the Summit the center can proudly show a significant record of accomplishments, and a high level of credibility among the countries of the region because of the relevance and success of its projects. Furthermore, the commitments of increased support of the international community continues to strengthen the core budget and projects of the Institute. This is an expression of acceptance of its policies towards improving sustainable agriculture in the region by methods that are economically viable, culturally acceptable, environmentally sound, socially feasible, with wide participation of the populace, equity and continuity.**

**If we continue to do our part, with the international community's support, we can have a safer, better world. Inducing behavior, and finding answers that lead people to produce while conserving and conserve while producing. This is our commitment to the future.**



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Fecha	21: into the XXI century...		
Derolución	Nombre del solicitante		

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