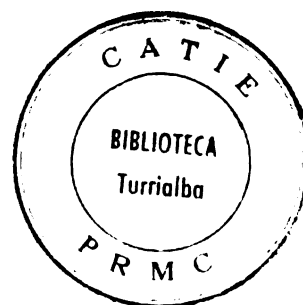




FORESTRY GENETIC RESOURCES PROJECT PROPOSAL

1988-1992

DRNR 2-87



CENTRO AGRONOMOICO TROPICAL DE INVESTIGACION Y ENSEÑANZA, CATIE
Renewable Natural Resources Department
Turrialba, Costa Rica, 1987

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1. PROJECT SUMMARY

Each year in the Central American region there is an increase in the number of reforestation projects and experience shows that one of the principal reasons for the failures or low yields observed is inappropriate source of seed or propagative material. On the other hand, several species native to the region are of worldwide importance while others have great potential. The increasing levels of deforestation, however, endanger the genetic resources of the region for forestry.

The project will try to help solve these problems and its general objective will be to contribute to regional forestry development through conservation and utilization of the genetic diversity, as well as strengthening institutions in the area of forest genetic resources. Its specific objectives are:

- a) Provision of seed of autochthonous and exotic tree species chosen for their commercial or research value within and outside the region.
- b) To increase the production of certain autochthonous and exotic tree species of regional interest through genetic improvement techniques.
- c) To stimulate the supply of high quality seed or vegetative material for use in the region.
- d) To develop vegetative propagation techniques for a range of autochthonous and exotic tree species chosen for their importance in the region.
- e) To collect and research seed storage and germination requirements of seeds from select tree species of the region to allow their conservation and utilization.
- f) To strengthen, through training, the institutions' of the region ability to carry out coordinated long term work related to forest genetic resources.
- g) To stimulate the supply and exchange of materials and information on forest genetic resources within the region.

To achieve these objectives, the proposal has been organized in the form of five specific sub-projects which will work together in an interrelated manner. These sub-projects are:

- 1) The Latin American Forestry Seed Bank (BLSF).
- 2) Genetic improvement of timber and multi-purpose species.
- 3) Vegetative propagation of multi-purpose trees.
- 4) Ex-situ conservation of tropical rainforest tree species.
- 5) Genetic improvement of nitrogen fixing trees.

Each sub-project has the following components:

- a) Development of technology for utilizing forest genetic resources.
- b) Teaching and training in forest genetic resources.
- c) Cooperation and technical assistance.

This document gives details of the activities carried out by each sub-project and the costs for their respective implementation. It describes the expected products within the framework of a follow-up system, and presents lists of species to be worked with. Total project costs are given in the following table. They are based on current costs and include 20 per cent to cover CATIE's administrative support and 10 per cent for unforeseen expenses (including inflation).

Table 1. Details of expenditure for Forest Genetic Resources Project
(in thousands of \$US)

Sub-project	Total	Y e a r				
		1	2	3	4	5
1. BLSF	353,3	85,6	69,2	66,5	66,5	65,6
2. Improvement	728,4	172,8	136,6	135,7	134,6	148,7
3. Propagation	447,7	101,5	78,6	79,6	92,0	95,9
4. Conservation	269,3	118,4	87,4	31,2	32,3	--
T o t a l	1799,7	478,3	371,8	313,0	326,4	310,2
X1.3	2339,6	621,8	483,3	406,9	424,3	403,3

Note: The nitrogen fixing tree sub-project is already financed and in operation

The following will be the principal results at the end of the project:

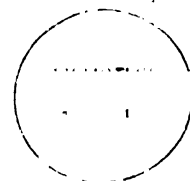
- 1) A self-financing seed bank (BLSF) to supply certified seed for use both within and outside the region. With its emphasis on broadleaf species, it will complement other forest seed banks in the region which specialize in conifers.
- 2) A forest germplasm bank storing material for long term availability.
- 3) Improved base populations adequate for an advanced long term genetic improvement program for the priority species.
- 4) Genetically improved seed of priority species, increasingly supplying the needs of forestry plantations within and outside the region.
- 5) Clones of proven high productivity of the priority species for use in plantations established by vegetative propagation.
- 6) A functional regional network of institutions for forest genetic improvement coordinating work carried out in the region and encouraging the exchange of ideas and information.
- 7) High level training of professional personnel within and outside the region in forest genetic resources.
- 8) A body of trained CATIE personnel to assist its work as a regional leader in research and training for forest genetic resources.

In continuation, a summary of each sub-project is given showing their specific approaches.

1. Latin American Forest Seed Bank (BLSF)

This will concentrate its efforts in exploration and collecting. It will follow the three lines of action which it has already be carrying out sporadically over the last 20 years.

- a) Collection and sale of seed for commercial scale reforestation.
- b) Collection and sale of seed for research purposes.



c) Research of storage and germination requirements in a variety of tree species.

With regard to commercial sale, species with a good market will be emphasised so that the BLSF can be self financing at the end of the project. Within a restricted number of species, individual trees will be selected from natural stands in conjunction with the Improvement Project and these will supply seed for carrying out research. The Bank will continue in its rôle as a regional importer of seed research.

The BLSF will promote the regional use of adequate seed sources through the establishment of seed stands, a network of national committees and a regional newsletter. The BLSF will also communicate the importance of adequate seed sources by participation in short courses, postgraduate programs, etc.

2. Genetic improvement of timber and multipurpose species

This sub-project will be based on the advances achieved in CATIE over the last few years, both by the improvement project and the firewood project. It will concentrate its efforts in the areas of evaluation and selection of germplasm sources. It will work with a limited number of species selected for their regional importance based on research carried out by the silviculture program at CATIE.

Work will be carried out in selecting individual trees, establishing provenance and progeny trials and seed orchards. Information and improved seed resulting from this will help increase the production of forestry plantations within and outside the region. The economic return from this kind of improvement program will be studied with regard to the feasibility of future programs or stages of the project being self financing in collaboration with forestry firms.

Along with the BLSF, a regional network for forest genetic resources will be established to reinforce the efforts in the region and the exchange of improved material. Short courses and courses at postgraduate level will be given to improve the capabilities of the region, and of Latin America, in the field of tree genetic improvement.

3. Vegetative propagation of multipurpose trees

Vegetative propagation techniques offer possibilities of very rapid gains in production. However, at the moment, the techniques and gains have only been made use of by large enterprises. This sub-project will develop practical vegetative propagation techniques for the priority species identified by the Improvement sub-project.

For certain species this will involve the rooting of cuttings to allow the establishment of clonal plantations. In other cases, the use of grafts will allow the propagation of trees selected by the Improvement sub-project for establishing seed orchards. The possibilities for developing vegetative propagation techniques for species in the Conservation sub-project, which cannot be easily propagated or preserved by conventional means, will be studied. A study will be made of the applicability of tissue culture techniques to priority species, specifically within the context of the region.

The profitability of the vegetative propagation program will be studied to assess the feasibility of private or governmental bodies setting it up in a commercial form. By way of training, short courses and postgraduate courses will be given by the sub-project to improve knowledge in the field generally and specifically regarding techniques developed by the sub-project. Practical manuals will be published which, along with the technical assistance, will allow the techniques to be used in the region.

4. Ex-situ conservation of tropical rainforest tree species

One factor which limits the rational management of the region's natural forests is a lack of knowledge regarding species' basic requirements for seed germination and storage. The project will attempt to answer these questions while at the same time acting as a means of collection and storage for propagative material from primary and secondary forest species. These types of collections will give other groups the opportunity to study the material as part of searches for products of use to man.

The project will act as a case study in how to carry out this sort of project within the region. At the same time it will assist the BLSF in its

studies of the physiological problems of tree seed germination and storage and, through courses, increase the capabilities within the region.

5. Genetic improvement of nitrogen fixing trees

This sub-project will work in the fields of improvement, propagation and conservation restricting itself to certain Erythrina species and Gliricidia sepium. Work will be carried out on clonal material of Erythrina species standardizing vegetative propagation techniques for the rooting of stakes and biomass production allowing the distribution and use of the material to farms in the region. As such, simple techniques that are cheap to reproduce will be emphasised.

Collections of G. sepium already made will be studied to see the patterns of genetic variation and adaptability of the material to genetic improvement and use in farms of the region.

Techniques developed will be transferred in collaboration with government agencies and through courses.

2. THE PROBLEM AND JUSTIFICATION OF THE PROJECT

2.1 The problem

The number of reforestation projects in the region increases each year, and experience shows that inappropriate seed source is a major cause of the observed failures or low yields. Much of the seed collection in the region is carried out by farmers or other unqualified people without adequate knowledge of the best collection techniques nor the characteristics that the trees or stands should possess. As a result, the collections are generally made from badly formed trees and stands. For this reason, established plantations show poor growth and a lack of uniformity that makes management difficult and gives reforestation a poor image. These problems are also accentuated by the lack of knowledge about the importance of using appropriate sources of seed and a lack of information of the best sources among the region's scientific personnel and farmers.

2.2 Justification

Forestry plantation production increases achieved in the last thirty years in tropical and subtropical countries through genetic improvement techniques are well known. The selection and improvement programs of, for example, Brazil, Colombia and Zimbabwe have achieved production increases of up to 30 per cent in the first generation and a uniformity that makes management easier and guarantees high yields. The majority of these programs have however been developed by large businesses at a purely industrial level and the potential profits have not been made available to medium or small scale reforesters.

It has been estimated that for the period 1985-95 900,000 hectares need to be planted in the Central American region to supply the demands for forest products. If only a part were planted, the demand for seed would be very high, and it is expected that much of the reforestation would be small or medium scale.

Given these facts, there is a need to improve the quality of seed available within the area to establish plantations. At the same time it is necessary to increase the knowledge and awareness of people working in reforestation with regard to the importance of using appropriate seed sources. Along with this there has been a lack of communication between the groups involved in forest genetic resources in the region. This has led on occasions to an unnecessary duplication and division of efforts.

Many of the species native to the region have worldwide importance (e.g. Pinus caribaea, Calliandra calothyrsus and Leucaena leucocephala) whilst others have a potential for use both outside the region and within it (e.g. Alnus acuminata, Cordia alliodora and Gliricidia sepium). These priority species should be explored and collected to allow their validation in experiments worldwide.

It is hoped that in the future forest products from the region will be supplied not only from forestry plantations and through the destruction of natural forests, but also through a rational and sustained management of natural forests. One limiting factor to this type of management is the lack of knowledge concerning the physiology of seeds for the majority of species

involved in forest regeneration. Thus research into the requirements for germination, storage and conditions necessary for regeneration and growth in tree species of primary and secondary forest is needed.

3. ANTECEDENTS

3.1 The region

3.1.1 Geopolitical and socioeconomic situation

The work area of CATIE covers 7 countries: Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panamá and the Dominican Republic. These countries, with surface areas ranging from 21,000 km² (El Salvador) to 130,000 km² (Nicaragua), cover a total area of 549,000 km², including the island territory of the Dominican Republic with 49,000 km². The strategic position of the region, having access to both Pacific and Atlantic oceans and the Panama Canal connecting them, as well as the position of the Caribbean Watershed, affords these countries an advantageous location for international trade and a potentially large exportation of agricultural and natural produce.

The high annual rate of population growth has brought about a continual demand for land for agriculture, pasture and forest products. This has led to an indiscriminate felling of forest. It is estimated that 4,000 km² of the region's forest is felled annually whilst less than 50 km² are reforested. In other words, for each hectare of plantation newly established, 80 ha of mature forest are felled. There is no indication that this situation will change and it is estimated that the majority of forest area will be used up by the end of this century, for example, the fact that 73 per cent of the Central American population uses firewood as an energy source, implies that enormous quantities of forest products will need to be imported representing a great economic strain on the area. Furthermore, such deforestation will have extremely negative effects such as soil and fertility loss, changes in water levels and genetic erosion.

It is obvious that large scale reforestation is needed as part of the solution to this critical situation. To achieve this it will be vital to

encourage the exploration, conservation, evaluation, improvement and use of the region's forest genetic resources.

3.1.2 Ecological zones

The region has a wide range of rainfall distribution varying from 400 to 8,000 mm annually. Temperatures are so variable that locally they are classified according to altitude: hot, temperate and cool lands. Few areas of the tropics of a similar size to this region show such wide variations of topography, climate, soil and thus vegetation. According to Holdridge's life zone classification there are 17 major zones in Central America (see Table 2). A range from very dry forest to rainforest, depending on the amount of rainfall, can be found in the region and, depending on altitude, from basal to paramo.

3.1.3 Center of genetic diversity

FAO has identified Central America as one of the principal areas of the world for genetic diversity of plant life. This botanical wealth, shown as much in tree species as in shrubs and herbs, may have evolved due to Central America's position as a land bridge between the North and South American continents. In such a position, geologically speaking of recent establishment, Central America was occupied by plant migrations from both continents. Owing to the climatic diversity existent and the climatic changes of the Pleistocene epoch, a period of rapid evolution and expansion occurred. Thus families and species from South American low and intermediate lands can be found, such as Astonium, Aspidiospernum, Jacaranda and Prosopis. On the other hand, species of North American families can be found in the highlands e.g. Abies, Alnus, Juglans, Liquidambar, Pinus and Quercus. With a total number of more than 4,000 tree species, the region's forest genetic resources are enormous.

3.1.4 Native tree species of regional and world importance

Various tree species now planted on a large scale in many tropical countries of the world have their origin in Central America, e.g. Calliandra calothyrsus, Cupressus lusitanica, Leucaena, Pinus caribaea and Pinus oocarpa.

Table 2. Distribution of life zones (Holdridge) in Central America and the Dominican Republic, in km²

Life zone	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panamá	Rep. Dominicana
1. Tropical very dry forest	--	--	224	100	--	--	--
2. Tropical dry forest	148	2230	3026	5536	5263	5360	--
3. Tropical moist forest	--	2167	1345	31310	12366	24530	--
4. Tropical wet forest	2059	--	--	3771	11549	10900	--
5. Premontane	965	--	--	--	--	--	1001
6. Premontane dry forest	4282	--	3026	6606	--	2070	9962
7. Premontane moist forest	38982	15276	48758	22602	2402	2400	22794
8. Premontane wet forest	43355	1052	48085	47089	6950	15200	6834
9. Premontane rain forest	1197	--	--	508	5008	9975	56
10. Lower montane dry forest	--	--	112	--	--	--	--
11. Lower montane moist forest	9473	2	4371	420	102	9	3840
12. Lower montane wet forest	5880	295	3139	795	767	1378	36
13. Lower montane rain forest	934	--	--	--	3781	2370	--
14. Montane moist forest	104	--	--	--	--	--	--
15. Montane wet forest	1163	5	--	5	41	3	303
16. Montaje rain forest	--	--	--	--	2729	1185	--
17. Subalpine rain paramo	--	--	--	--	102	--	--

(Premontano = subtropical)

Others have been planted on a smaller scale but have great potential for development; Alnus acuminata, Bombacopsis quinatum, Cedrela odorata, Cordia alliodora, Gliricidia sepium, Juglans olanchana, Pinus tecunumanii and Prosopis juliflora. Furthermore, there are innumerable species in the region which need to be explored since they may have great potential for development.

3.2 Forest genetic resources activities in the region

3.2.1 National organizations

Guatemala has a seed bank (BANSEFOR) within INAFOR, equipped with 10°C storage, a laboratory and basic equipment. The main collection is of conifers for internal use. Seed exportation is mainly handled by private companies. Together with CAMCORE, INAFOR has set up some seed stands, conservation stands and progeny trials for Pinus species. Provenance trials of C. calothyrsus and G. sepium have also been set up in collaboration with CATIE's Firewood (now Tree Crop Production) Project.

El Salvador relies on a seed bank set up 10 years ago but not maintained for the past three years. It is hoped that a new facility at CENTA will help resolve the problem for forest seed species.

Honduras has a seed bank at ESNACIFOR/COHDEFOR which is one of the region's biggest and best equipped, with two 5°C storage rooms, laboratory and equipment. It specializes in collection of Pinus species for internal use and exportation. Broadleaf species are also collected on a smaller scale. Seed stands and progeny trials for P. caribaea and P. oocarpa have been set up on a limited scale. In conjunction with OFI/ODA, work on improvement will be increased over the next few years.

Nicaragua has set up a forestry seed bank at IRENA in cooperation with DANIDA. It has two 5°C storage rooms, laboratory and equipment. Its collections are mainly oriented towards Pinus spp., Eucalyptus camaldulensis and some broadleaf species.

Costa Rica is establishing a seed bank at the DGF although, at the moment, it has no equipment. Various broadleaf species are collected for internal use. Two seed orchards for Bombacopsis quinatum have been established (by the DGF

and CACH - Centro Agrícola Cantonal de Hojancha). Furthermore, seed stands of Gmelina arborea have been set up in collaboration with ITCR and CATIE. The DGF has provenance trials of Acacia mangium, Calliandra calothyrsus and Cordia alliodora set up in conjunction with CATIE.

Panama has a Seed Center at RENARE equipped with a 15°C storage room and basic collecting equipment. G. arborea and Tectona grandis are the main species collected.

3.2.2 International organizations

Only CAMCORE (Central America and Mexican Conifer Research Cooperative of North Carolina State U.) and OFI (Oxford Forestry Inst., England) are working intensively in the region on seed collection and genetic improvement.

CAMCORE was established in 1980 and has made collections of Pinus spp. and Abies guatemalensis in México, Guatemala and Honduras to start up ex-situ conservation plots and provenance/progeny trials in different countries of Latin America and other continents. It has started collecting broadleaf species and, starting in 1987, plans in conjunction with CATIE, selection and collection of 5 broadleaf species.

Since 1970, OFI has made collections in the entire region for provenance/progeny trials of various Pinus species, Cedrela odorata, Cordia alliodora, Bombacopsis quinatum, Gliricidia sepium and Liquidambar styraciflua. Collections of tropical broadleaves have also been made from arid and semi-arid zones (e.g. Parkinsonia aculeata and Prosopis juliflora). Over the next two years it will concentrate its efforts on species of Leucaena and Acacia. Seed from these collections are distributed free of charge to set up trials all over the world. The evaluation of such trials has already provided a great deal of information about genetic variation within these species. In the next three years, OFI/ODA in conjunction with the Honduran National Forestry School (ESNACIFOR) will work on various aspects of conservation and improvement of Pinus species in Honduras.

DANIDA - The Danish Seed Center has been involved in collecting species of Pinus throughout the region for ex-situ conservation since 1983, although it now concentrates more on assistance to the Seed Bank of Nicaragua.

The following organizations have also collaborated on forest genetic resource work within the region in one form or another: WWF, IUCN, CITES, UNEP, UNESCO, FAO, DDA, ODA, AID and BID.

3.2.3 CATIE

Within the Department of Renewable Natural Resources, CATIE has several projects that have been working in the area of forest genetic resources. These have included the three Programs of the Department (Silviculture, Agroforestry and Wildlands Management) to a greater or lesser extent and has covered work on seed supply, genetic improvement, vegetative propagation and conservation. There follows a brief outline of work that has been or is being carried out.

3.2.3.1 BLSF (Latin American Forest Seed Bank)

This was founded in 1967 and only had storage facilities until the establishment of the Phylogenetic Resources Unit in 1976, since when the BLSF has been able to use the good facilities of laboratory, dry room, storage room, etc. It concentrates on the collection and distribution of seed of some 100 species annually to approximately 35 countries for plantations and experimental purposes. It has suffered from poor finance and a lack chiefly of personnel and transport. However it is well recognized for its contribution to the region, where in 1985, for example, it distributed sufficient seed for 10 million plants. It has also carried out exploration and collection of G. sepium and C. calothyrsus and is promoting the establishment of seed stands of certain species within countries of the region in conjunction with the Tree Crop Production Project (CATIE/ROCAP Madeleña Project)

3.2.3.2 Projects for genetic improvement of trees

Financed by ODA and DDA within the Silviculture Program, work has been carried out since 1977 firstly with provenance trials (mainly P. caribaea, P. oocarpa, Cordia alliodora, G. arborea, E. grandis, E. urophylla and Acacia mangium). Progeny trials for the first three species and experimental seed orchards of P. tecunumanii have been established. Improved seed for

C. alliodora will be available for trials from 1986 and at a commercial level in 1987. A vegetative propagation technique for Araucaria hunsteinii has been developed. The Firewood Project, also in the Silviculture Program (1980-86), established provenance trials of C. calothyrsus and G. sepium. From 1987 onwards the Tree Crop Production (Madeleña) Project will set up more provenance trials (B. quinatum, E. camaldulensis and E. saligna), and with the BLSF will establish seed stands within the region.

Since 1984, work has also been done on selection, testing and vegetative propagation of some legume species (chiefly Erythrina and G. sepium) within the Agroforestry Program and financed by IDRC (Canada).

3.2.3.3 Wildlands Management Program

This Program assists in identifying and developing national parks and protected areas within Central America. It also acts as a regional liason for the international organizations, (IUCN, WWF, etc.), interested in conservation in the region. It gives training at various levels to personnel involved with conservation in Latin America. It thus makes a large contribution to in-situ conservation in the region.

4. CATIE RESOURCES AVAILABLE AND NECESSARY

4.1 General resources

CATIE has a staff of approximately 830, of whom 23 per cent are professional personnel. The number of professionals involved in scientific activities has increased significantly since 1973 (600%).

To supply teaching services and carry out research, the Turrialba center has 1035 hectares of land, laboratories for soil science, plant physiology, phytopathology, animal nutrition, tissue culture, a germoplasm bank with over 10,000 accesions, a data processing center and a tropical agriculture and forestry library with over 80,000 specialized volumes.

CATIE's annual budget varies between 10 and 12 million dollars (US\$). Of this, 30 per cent is generated by the institute and the rest is made up of

project funds financed by external cooperation agencies. Funds generated by the institute comprise contributions from IICA, the member countries (Costa Rica, Guatemala, Honduras, Nicaragua, Panama and the Dominican Republic), the sale of commercial produce from CATIE's farms and administrative support financed by the projects.

4.2 Physical resources related to the proposal

By way of physical resources, CATIE has excellent facilities for studying, processing and storing seed. There is an air conditioned seed laboratory with three incubators, germination room, oven, "Copenhagen" tanks, etc. There are three cold rooms for short, medium and long term storage (20 m³ at +15°C, 55 m³ at +5°C and 105 m³ at -17°C,). To ensure the continued operation of the cold rooms during power cuts, they have their own generator. There is also a controlled humidity drying room which is one of the three in existence in Latin America. However, to carry out the Project, there is a need for greater drying, processing and short term seed storage facilities.

At the moment the BLSF does not have its own vehicle to carry out collection work and the Improvement Project has only one. Given the need for extensive travelling, collection trips, etc., an increase in transport facilities is required.

There is a forestry nursery with facilities for raising small plants for genetic improvement trials and two small greenhouses equipped for vegetative propagation trials. However, to carry out the propagation subproject, new greenhouses need to be constructed and/or old ones adapted. Similarly, tissue culture facilities need to be enlarged.

At the moment the Silviculture Program has three micro-computers. Given the amount of experimental analysis involved in the Project, the number of micros available must be increased.

4.3 Human resources related to the proposal

At the moment DRNR has scientific personnel (1 PhD, 3 MS) and 5 laboratory and field assistants specialized in the area of forest genetic

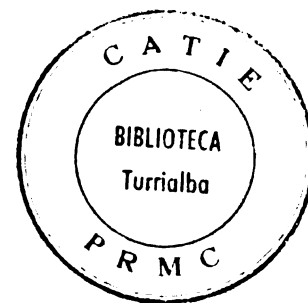
resources. They have been working for a number of years (see 3.2.3) and will form a good corps for the increased work foreseen in the Project.

The Firewood Project (1980-85) and the subsequent Tree Crop Production Project (1986-91) has worked in all the countries of the region in conjunction with each country's national institutions. The proposed project will make use of the regional network established and work together with the Tree Crop Production Project. The project will assist the Madeleña project in improvement of some of the multipurpose species it has identified as promising and of high priority.

4.4 Qualification of CATIE and DRNR for developing forestry genetic resources

CATIE already possesses the necessary basic infrastructure to give a decided support to the development of forest genetic resources and consequently forestry development in the countries of the region. Its regional mandate and agreements with national and international organizations allow the Center to develop and coordinate a network of actions in the countries of the region. Similarly, the Center's focus of activity in conservation and natural resource use along with accelerated development, as well as its general direction for scientific and technical action identify it with the needs and development priorities in the countries.

The Institute's stability, which assures continuity of work and an accumulation of experience, is an indispensable factor for coherence and persistence in the work carried out by the different programs and projects.



5. PROJECT DESCRIPTION

5.1 General objective

The Project aims, as a general objective, to contribute to the region's agricultural and forestry development through conservation and utilization of its genetic diversity, as well as strengthening institutions in the field of forest genetic resources.

5.2 Specific objectives

- a) To provide certified seed of autochthonous and exotic species chosen for their commercial or research value within and outside the region.
- b) To increase the production of certain autochthonous and exotic tree species of regional interest through genetic improvement techniques.
- c) To stimulate the supply of high quality seed or vegetative material for use in the region.
- d) To develop vegetative propagation techniques for a range of autochthonous and exotic tree species chosen for their importance in the region.
- e) To collect and research seed storage and germination requirements of seed from select tree species of the region to allow their conservation and utilization.
- f) To strengthen through training the institutions' of the region ability to carry out coordinated long term work related to forest genetic resources.
- g) To stimulate the supply and exchange of materials and information on forest genetic resources within the region.

5.3 Project subprojects and components

The Renewable Natural Resources Department, mainly through the Silviculture Program, has identified five subprojects specialized in accordance with the main focus of their component of technology development. The subprojects are interrelated and will work closely in their activities.

The five subprojects are:

- Subproject Latin American Forest Seed Bank (specializing in exploration and collection)
- Subproject Genetic Improvement of timber and multipurpose species (specializing in evaluation and selection)
- Subproject Vegetative propagation of multipurpose trees (specializing in propagation)
- Subproject Ex-situ conservation of humid tropical forest tree species (specializing in conservation)
- Subproject Genetic improvement of nitrogen fixing trees (specializing in evaluation, selection and propagation), this is being totally financed by IDRC, Canada.

The subproject components are:

- a) Development of technology for utilizing forest genetic resources.
- b) Training and teaching in forest genetic resources.
- c) Cooperation and technical assistance.

Within component a) Technology development, the work is divided into four areas of action: i) exploration and collection; ii) evaluation and selection; iii) propagation and iv) conservation.

Component b) Teaching and training, will be directed at three groups of people: i) scientific personnel; ii) producers and iii) CATIE postgraduate students.

Component c) Cooperation and technical assistance, is divided into: i) regional network; ii) production of propagative material; iii) introduction and distribution of propagative material and iv) documentation and dissemination.

5.4 Goals

The goals for each subproject are:

5.4.1 Subproject Latin American Forestry Seed Bank (BLSF)

1. To stimulate the collection and use of good quality seed in forestry projects within the region.
2. To satisfy, within and outside the region, the need for supplies of good quality seed from a wide range of autochthonous and exotic species for use in plantations and research.

5.4.2 Subproject Genetic improvement of timber and multipurpose species

1. To generate genetic information concerning certain forestry species of economic value to Central America.
2. To develop improved material suitable for use in Central American forestry plantations.
3. To develop base populations suitable for long term improvement.

5.4.3 Subproject Vegetative propagation of multipurpose trees

1. To develop vegetative propagation techniques that will allow certain species in the subproject genetic improvement of timber and multipurpose tree species to be established in multiclonal plantations (this will allow the optimization of genetic gains in each generation of selection).
2. To develop vegetative propagation techniques for those species which have been shown to be unsuitable for reproduction by seed in the subproject conservation of tropical rain forest species.

5.4.4 Subproject Ex-situ conservation of tropical rain forest tree species

1. To identify possibilities for long term conservation of seed from a wide range of species selected from certain families under normal (orthodox) conditions.

2. To collect and store seed from a wide range of orthodox species from tropical rainforest in Costa Rica.
3. To create a collection of valuable genetic material and a model for future collection groups in tropical rainforest.

5.4.5 Subproject Genetic improvement of nitrogen fixing trees

1. To develop and evaluate clones of Erythrina spp. To refine and standardise rooting techniques and biomass production by technique and clones.
2. To validate, demonstrate and disseminate improved material and cultural techniques previously developed under controlled farm conditions.
3. To study cultural practices, germplasm collections already made of G. sepium and the occurrence of varieties in Costa Rica.
4. To establish and evaluate living collections of G. sepium.

5.5 Activities and subactivities

Activities and subactivities for the five subprojects are:

5.5.1 Subproject Latin American Forest Seed Bank (BLSF)

A. Technology development

A-1 Exploration and collection

A.1.1 To explore a large number of forest tree species (see Appendix 1) over their whole range within the region according to priorities including species in danger of extinction.

A.1.2 To establish a timetable for collections in Central America and the Dominican Republic according to priorities.

A.1.3 To stimulate and support the countries of the region through the Forest Germplasm Regional Network (see C.1.2), in the exploration and collection of material of tree species of priority to each country.

A.1.4 Based on A.1.1 and in conjunction with subproject improvement, carry out seed collection and intensive selection of individual trees within natural stands for select broadleaf species of economic importance within the region.

A.1.5 To collect botanical samples from each batch of seed collected for the purpose of control and study of identification.

A-2 Evaluation and selection

A.2.1 In conjunction with subproject improvement, to promote, coordinate and support the establishment of seed stands within each country for priority species determined in collaboration with the national institutions.

A.2.2 To promote the use of better sources of seed or propagative material by means of selection of stands, plots, individual trees, etc.

A.2.3 To evaluate the material (seed) through germination and storage trials.

A-3 Conservation

A.3.1 Medium term ex-situ conservation in the form of seed will take place through collections. Furthermore, studies will be made to allow long term conservation in a frozen state.

A.3.2 In conjunction with the Wildlands Program, in-situ conservation of species/provenances in danger of extinction in danger will be stimulated through national parks and forestry reserves.

B. Teaching and training

B-1 Scientific personnel in the region

B.1.1 To carry out in-service training on seed management techniques (collection, conservation, analysis, etc.) according to requests made by the national institutions and availability of time.

B.1.2 Support of forestry short courses given by the DRNR and other institutions in the region on collection, management and analysis techniques and improvement of seed quality.

B-2 Producers

B.2.1 Support of forestry short courses given by the DRNR and other institutions in the region on collection, management and analysis techniques and improvement of seed quality.

B-3 CATIE postgraduate students

B.3.1 Offer opportunities for carrying out research (special studies, theses, etc.) within the areas of collection, storage and seed treatment.

B.3.2 Along with the vegetative propagation and conservation subprojects, offer a new, optional course on tree species propagation, to increase possibilities of specialization in the program.

C. Cooperation and technical assistance

C.1 Regional network FGR

C.1.1 Establish a National Commission for Forest Germplasm in each country. These commissions will later be united to form a regional network (C.4.1).

C.1.2 Along with the improvement subproject, stimulate collaboration and coordination in forest genetic resources at a regional level. This will be achieved mainly through twice yearly meetings and a newsletter (see C.4.1)

C.2 Seed production

C.2.1 Give support to the countries to produce improved seed by means of the establishment and management of seed stands.

C-3 Introduction and distribution

C.3.1 Supply of seed collected in A-1 on request to groups within and outside the region.

C.3.3 Introduction of seed from other regions to continue testing new species of importance to regional forestry development.

C.3.3 Distribution of seed and improved material from individual trees, stands or orchards and from other subprojects.

C.3.4 Charges will be made for material supplied in C.3.1 and C.3.3 according to the international market price. Thus, at the end of the five years, there is a possibility of self-financing, ensuring a continuation of the work at the end of the Project.

C-4 Documentation and information transfer

C.4.1 Together with the improvement subproject and INFORAT, a twice yearly newsletter covering the region's activities in forest genetic resources will be produced.

C.4.2 A computerized data base covering information on available material will be set up.

C.4.3 An information service covering all aspects concerned with tree seed in the region will be offered.

5.5.2 Subproject genetic improvement of timber and multipurpose species

A. Technology development

A-1 Exploration and collection

A.1.1 Based on explorations of subproject BLSF, an intensive selection of individual trees from natural stands will be made for certain broadleaf species of economic importance or potential. Seed collection will be carried out in conjunction with subproject BLSF (see 4.6.1 - A.1.1)

A-2 Evaluation and selection

A.2.1 On the basis of collections (A.1.1), provenance/progeny trials will be set up for five of the species. These trials will provide genetic information for the species studied and also improved seed and/or base populations for future improvement. This will be carried out within the CAMCORE Program with which CATIE is joining as an active member.

A.2.2 Evaluation of material already evaluated in formal provenance/progeny trials will be continued. Many of these trials are part of an international network. As in A.2.1, these trials will provide genetic information, improved seed and/or base populations for future improvement.

A.2.3 The best provenances, families and individual trees for use as base populations in improvement programs will be selected on the basis of results from A.2.1 and A.2.2.

A.2.4 Progeny trials will be set up to test the selections made in A.2.3 and provide material for the next phase of selection.

A.2.5 Cost benefit studies will be made to determine the economic gains achieved in the improvement process.-

A-3 Propagation

A.3.1 On the basis of material selected in A.2.3, seed or cutting orchards depending on species, will be set up to provide improved seed or vegetative material.

A-4 Conservation

A.4.1 By means of the trials set up, the collected material will be conserved ex-situ. This has been shown to be one of the most effective ways of conserving species/provenances of commercial interest.

A.4.2 Material selected in A.1.1 and A.2.3 will be conserved in seed orchards or clone banks depending on the needs of each species.

B. Teaching and training

B-1 Project scientific personnel

B.1.1 Given that knowledge about tree improvement is poor within the region, national personnel contracted would probably have little experience in this field. Therefore they will receive in service training as part of their work.

B-2 Regional scientific personnel

B.2.1 Intensive short courses will be organized around the post graduate course "Tree improvement and forest genetics" allowing, at the same time, training of regional scientific personnel. It is anticipated that 15 people per year can be trained starting from 1988. This will be carried out in conjunction with CAMCORE.

B-3 CATIE postgraduate students

B.3.1 The already existing course "Tree improvement and forest genetics" will be given each year.

B.3.2 Postgraduate students will be given the opportunity to carry out research topics within the subproject's experiments.

C. Cooperation and technical assistance

C-1 Regional network FGR

C.1.1 Along with subproject BLSF it will stimulate collaboration and cooperation in forest genetic resources at a regional level. It will be carried out mainly through biannual meetings and a newsletter (see C.4.1).

C-2 Seed production

C.2.1 It will produce improved seed or vegetative propagules for use within and outside the region. This material will be distributed through the BLSF subproject.

C.2.2 Technical assistance will be given to projects within the region where necessary and to others where there is a demand for establishing advance genetic improvement programs or for improving existing programs.

C-4 Documentation and information transfer

C.4.1 A twice yearly newsletter concerning forest genetic resource activities within the region will be edited in conjunction with subprojects BLSF and INFORAT.

C.4.2 Research results will be published in scientific journals. Articles will also be prepared for spreading information through more popular means to be understandable to non-technical personnel.

5.5.3 Subproject vegetative propagation of multipurpose trees

A Technology development

A-3 Propagation

A.3.1 Research the needs for vegetative propagation through rooting of cuttings at an experimental level for certain species of great regional importance (those of A.2.1 and A.2.2 in the improvement subproject and those of priority in the Tree Crop Production (Madeleña) project).

A.3.2 Develop, on the basis of results from A.3.1, techniques for rooting of cuttings to allow commercial scale plantation establishment.

A.3.3 Develop adequate techniques of vegetative propagation by grafting for species established in the seed orchards in the improvement subproject.

A.3.4 Research the vegetative propagation needs of species which the Conservation subproject has established to be inappropriate for propagation or conservation through seed.

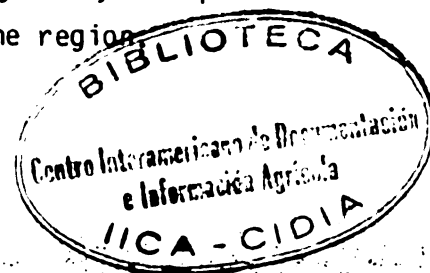
A.3.5 From the third year, develop basic techniques for the vegetative propagation of some of the species in A.3.1 through tissue culture.

A.3.6 Carry out cost benefit studies to find the economic gain from using the techniques developed at a commercial level.

B. Teaching and training

B-2 Regional scientific personnel

B.2.1 Two short courses will be given in the second and fourth years to train 15 scientific personnel in the use of vegetative propagation, the practices and the advances of the project and how they relate to the region.



B-4 CATIE postgraduate students

B.4.1 Postgraduate students will be given the opportunity to carry out research topics within the subproject's experiments.

B.4.2 A new optional course on forest species propagation will be offered in conjunction with the BLSF and Conservation subprojects.

C. Cooperation and technical assistance

C-1 Regional network

C.1.1 Technical assistance on vegetative propagation and use of the Project's research results will be given to the region's national bodies and others who require it according to their needs.

C-4 Documentation and information transfer

C.4.1 Research results will be published in scientific journals.

C.4.2 A manual will be published for each species based on the technologies developed in A.3.2. These will give steps for plantation establishment by vegetative propagation.

5.5.4 Subproject ex-situ conservation of tropical rain forest species

A. Technology development

A-1 Exploration and collection

A.1.1 Important taxa (in ecological, economic and experimental terms) within the Costa Rican tropical rainforest will be identified.

A.1.2 The phenology of selected species will be studied and the results used for collecting sufficient quantities of seed to accomplish the research in subactivity A.3.1.

A.1.3 On the basis of the results of research in A.3.1 and A.4.1, quantities of seed will be collected from species that can be stored long term in an orthodox form (in conjunction with BLSF).

A-3 Propagation

A.3.1 Within certain chosen families, study groups of species under laboratory conditions necessary for germination to determine if certain families contain large numbers of species with orthodox seed.

A-4 Conservation

A.4.1 Together with subactivity A.3.1, the conditions necessary for long term storage will be studied in conjunction with subproject BLSF.

A.4.2 On the basis of the results of A.3.1 and A.4.1 and the collections in A.1.3, collected seed will be conserved in the following way: 1/3 DGF Seed Bank, 1/3 BLSF/CATIE, 1/3 Kew Royal Botanical Gardens, England.

B. Teaching and training

B-1 Project scientific personnel

B.1.1 National personnel will receive in service training in seed physiology.

B-4 Postgraduate students

B.4.1 A new postgraduate course "Propagation of trees species" will be offered in conjunction with the BLSF and propagation subprojects.

B.4.2 Research (as thesis or special work) will be carried out within the Project's research program.

C. Coordination and technical assistance

C-3 Introduction and distribution

C.3.1 Seeds conserved in A.4.2 will be available to individual institutions on request, for research.

C-4 Documentation and information transfer

C.4.1 Research results will be published in scientific journals. Emphasis will be given to communicating results to other institutions working in tropical rain forests.

5.5.5 Subproject improvement of nitrogen fixing trees

This project has been financed entirely by IDRC Canada and is already in operation.

A. Technology development

A-1 Exploration and collection

A.1.1 Planting methods already in existence in Costa Rica for G. sepium will be studied along with identification of the range of varieties used, evaluating their possible future use in establishing living collections.

A-2 Evaluation and selection

A.2.1 Clonal trials for Erythrina will be set up at three sites and evaluation of living collections already established will be continued.

A.2.2 Clonal variation in terms of biomass, production in association with pasture and utilization as fodder will be studied.

A.2.3 Existing germplasm collections of G. sepium (CATIE and OFI) will be evaluated for possible use in establishing living collections.

A.2.4 A total of 100 G. sepium plus trees will be selected from the best provenances.

A.2.5 Progeny trials will be set up based on the selections made in A.2.4.

A-3 Propagation

A.3.1 Various aspects of the rooting of E. poeppigiana stakes will be studied for developing consistent rooting techniques.

A.3.2 Direct sowing methods for G. sepium will be studied.

A.3.3 Methods will be developed for vegetative propagation of G. sepium by rooting of stakes both in greenhouse and field.

A-4 Conservation

A.4.1 Living collections of Erythrina already set up in CATIE will be maintained and brought up to date.

A.4.2 A living collection of G. sepium will be set up at CATIE.

B. Teaching and training

B-4 CATIE postgraduate students

B.4.1 Participation in postgraduate courses in Agroforestry Systems and Tree Species Propagation.

B.4.2 It will be possible for students to carry out research (thesis topics or special projects) within the research plan.

C. Cooperation and technical assistance

C-3 Introduction and distribution

C.3.1 Certified material for propagation and a tech-pack will be offered to government agencies for distribution to farmers. These agencies will set up propagation plots at various sites for extensive multiplication of the clonal material.

C-4 Documentation and information transfer

C.4.1 Operational support will be given to governmental extension agencies for disseminating improved Erythrina cultivation practices by means of field days, farm visits and pamphlets.

5.6 Expenditure

5.6.1 Subproject BLSF

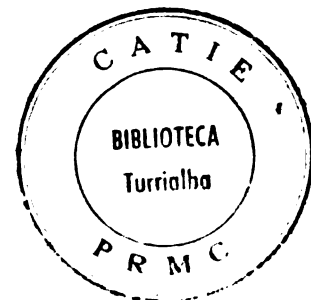
Personnel	Total	Year				
		1	2	3	4	5
B C1 6 Coördinator-seed specialist (PPN MS)	70.00	14.00	14.00	14.00	14.00	14.00
B A1 6 Specialist in exploration and collection (PPN BSc)	46.80	9.36	9.36	9.36	9.36	9.36
B A1 6 Field assistant (PA)	23.25	4.65	4.65	4.65	4.65	4.65
B A1 6 Laboratory analyst (PA)	23.25	4.65	4.65	4.65	4.65	4.65
B C1 6 Documentation/information assistant (PA)	23.25	4.65	4.65	4.65	4.65	4.65
B C1 6 Secretary (part time)	12.65	2.33	2.33	2.33	2.33	2.33
B A1 6 Laborers (3)	37.50	7.50	7.50	7.50	7.50	7.50
B A1 6 Incidental personnel	6.00	1.20	1.20	1.20	1.20	1.20
Sub-total	242.70					
Investments						
B A1 3 Partial contribution to set up herbarium	3.0	3.0				
B A1 3 Partial contribution to set up 16°C room	3.0 (50 m ²)	3.0				
B C1 3 Partial contribution for office installation	3.0 (200 m)	3.0				
B A1 4 Pick-up (double cabin, 1/2 (shared with propagation))	6.0	6.0				
B A1 4 Seed collection equipment	3.0	2.0	1.0			
B A1 4 Camera	0.4	0.4				
B A1 4 Seed depulper	1.2		1.2			
B A1 4 Small lab equipment	1.5	0.3	0.3	0.3	0.3	0.3
B C1 4 Typewriter (1)	1.4	1.4				
B C1 4 Office equipment	2.6	1.0	0.9	0.2	0.2	0.2
B C4 4 Microcomputer	5.0	5.0				
B C4 4 Micro accessories	1.0	1.0				
Sub-total	31.1					
Travel						
B A1 7 Expenses (Natl.)	19.0	4.0	4.0	4.0	4.0	3.0
B A1 7 Special collections (5 x 4 years) (Regl.)	19.0		5.0	5.0	5.0	4.0
B C1 7 Trips/expenses (Intl.)	5.0	1.0	1.0	1.0	1.0	1.0
Sub-total	43.0					
Running costs						
B A1 7 Diesel/oil	9.0	1.8	1.8	1.8	1.8	1.8
B A1 7 Vehicle maintenance (1/2)	4.5	0.5	1.0	1.0	1.0	1.0
B C1 7 Computing service	2.5	0.5	0.5	0.5	0.5	0.5
B C1 7 Telex/telecommunications	5.8	0.8	1.0	1.2	1.4	1.4
B C1 7 Office supplies (paper, etc.)	5.5	1.1	1.1	1.1	1.1	1.1
B C1 7 Micro maintenance	1.0	0.2	0.2	0.2	0.2	0.2
B C4 8 Publications	4.5	0.5	1.0	1.0	1.0	1.0
B A1 5 Insecticide/fungicide/fertilizer	0.7	0.1	0.2	0.2	0.1	0.1
B A1 5 Glassware/small lab equipment	1.5	0.3	0.3	0.3	0.3	0.3
B A1 5 Reagents/lab chemicals	1.5	0.3	0.3	0.3	0.3	0.3
Sub-total	36.5					
T O T A L	353.3	85.54	69.16	66.44	66.54	65.54

5.6.2 Subproject improvement

Personnel	Total	Year				
		1	2	3	4	5
M A2 6 Coordinator-tree improvement specialist (PPI 1)	230.0	55.0	40.0	40.0	40.0	55.0
M A2 6 Tree improvement specialist (PPN 1) M.S.	68.0	14.0	14.0	14.0	14.0	14.0
M A2 6 Research assistant (PPN 1) B.Sc.	40.0	8.0	8.0	8.0	8.0	8.0
M A1 6 Field assistants (PA 2)	46.5	9.3	0.3	0.3	0.3	0.3
M C1 6 Secretary 1/2	11.65	2.33	2.33	2.33	2.33	2.33
M A3 6 Nurseryman (PA 1)	23.25	4.65	4.65	4.65	4.65	4.65
M A1 6 Laborers (8)	100.0	20.0	20.0	20.0	20.0	20.0
M A2 6 Incidental personnel	10.0	2.0	2.0	2.0	2.0	2.0
Sub-total	529.4					
Investments						
M C1 3 Partial contribution to office installation	3.0 (200 m ²)	3.0				
M A1 4 Pick-up (double cabine) 1	12.0	12.0				
M A1 4 Field equipment	2.0	0.4	0.4	0.4	0.4	0.4
M A3 4 Nursery tools	2.5	0.5	0.5	0.5	0.5	0.5
M C1 4 Typewriter (1)	1.4	1.4				
M C4 4 Office equipment	2.6	1.4	0.6	0.2	0.2	0.2
M C4 4 Microcomputer	5.0	5.0				
M C4 4 Micro accessories	1.0	1.0				
Sub-total	29.5					
Travel						
M A1 7 Expenses (Natl.)	24.0	5.0	5.0	5.0	5.0	4.0
M C1 7 Trips/expenses (Intl. and regl.)	13.0	2.0	3.0	2.0	3.0	3.0
Sub-total	37.0					
Running costs						
M A3 5 Insecticide/fungicide/fertilizer	0.5	0.1	0.1	0.1	0.1	0.1
M A1 7 Diesel/oil	15.0	3.0	3.0	3.0	3.0	3.0
M A1 7 Vehicle maintenance	9.0	1.0	2.0	2.0	2.0	2.0
M C1 7 Computing service	20.0	4.0	4.0	4.0	4.0	4.0
M C1 7 Telex/telecommunications	3.4	0.6	0.6	0.6	0.6	0.6
M C2 7 Office supplies (paper, etc.)	5.5	1.1	1.1	1.1	1.1	1.1
M C4 7 Soil analysis	4.0	0.8	0.8	0.8	0.8	0.8
M C4 7 Micro maintenance	1.0	0.2	0.2	0.2	0.2	0.2
M C4 8 Publications	6.5	1.0	1.0	1.0	1.0	1.0
Sub-total	64.5					
Other						
M C4 8 CAMCORE membership	70.0	14.0	14.0	14.0	14.0	14.0
T O T A L	728.4	172.78	136.58	135.68	134.68	148.68

5.6.3 Subproject Propagation

Personnel	Total	Year				
		1	2	3	4	5
P A3 6 Coordinator/propagation specialist (PPI Ph.D 1)	230.00	55.0	40.0	40.0	40.0	55.0
P A3 6 Tissue culture specialist (PPN 1)	28.08			9.36	9.36	9.36
P A1 6 Field assistant (PA 2)	23.25	4.65	4.65	4.65	4.65	4.65
P A2 6 Secretary (PA 1/2)	11.65	2.33	2.33	2.33	2.33	2.33
P A3 6 Tissue culture assistant (PA 1)	13.95			4.65	4.65	4.65
P A3 6 Nurseryman (PA 1)	23.25	4.65	4.65	4.65	4.65	4.65
P A3 6 Laborers (1)	12.25	2.5	2.5	2.5	2.5	2.5
Sub-total	324.68					
Investments						
P A3 3 Partial contribution for greenhouse installation (2)	8.0 (100 m ²)	8.0				
P A3 3 Partial contribution to tissue culture lab. improvements	2.0		2.0			
P C1 3 Partial contribution for office installation	3.0 (200 m ²)	3.0				
P A1 4 Pick-up (double cabin) 1/2 with BLSF	6.0	6.0				
P A1 4 Field equipment	1.5	0.3	0.3	0.3	0.3	0.3
P A2 4 Camera	0.3	0.3				
P A3 4 Nursery tools	0.8	0.3	0.3	0.2		
P A4 4 Small lab equipment	0.9			0.3	0.3	0.3
P C1 4 Typewriter (1/2)	0.7	0.7				
P C4 4 Office equipment	4.3	2.8	0.8	0.3	0.2	0.2
P C4 4 Microcomputer (1/2) shared with conservation	2.5	2.5				
P C4 4 Micro accessories	1.0	1.0				
Sub-total	31.0					
Travel						
P A1 7 Expenses (Natl.)	10.0	2.0	2.0	2.0	2.0	2.0
P C1 7 Trips/expenses (Intl. and regl.)	8.0	1.0	2.0	1.0	2.0	2.0
Sub-total	18.0					
Running costs						
P A3 5 Insecticide/fungicide/fertilizer	1.5	0.3	0.3	0.3	0.3	0.3
P A3 5 Reagents/chemicals for veg. prop.	1.5	0.3	0.3	0.3	0.3	0.3
P A3 5 Reagents/chemicals for tissue culture	3.6			1.2	1.2	1.2
P A4 5 Glassware/small lab. supplies	1.5			0.5	0.5	0.5
P A1 7 Diesel/oil	3.0	0.6	0.6	0.6	0.6	0.6
P A1 7 Vehicle maintenance (1/2)	4.5	0.5	1.0	1.0	1.0	1.0
P C1 7 Computing service	2.5	0.5	0.5	0.5	0.5	0.5
P C1 7 Telex/telecommunications	3.4	0.5	0.6	0.7	0.8	0.8
P C1 7 Office supplies (paper, etc.)	5.5	1.1	1.1	1.1	1.1	1.1
P C4 7 Micro maintenance	1.0	0.2	0.2	0.2	0.2	0.2
P C4 7 Publications	5.0	0.5	0.5	1.0	1.5	1.5
Sub-total	33.0					
Other						
P C4 8 Short courses	24.0		12.0		12.0	
TOTAL	447.78	101.53	78.63	79.64	92.04	95.94



5.6.4 Subproject Conservation

Personnel	Total	Year			
		1	2	3	4
C A4 6 Coordinator-seed physiologist (PPI Ph.D 1)	110.0	55.0	55.0		
C A4 6 Seed physiologist (PPN 1)	37.44	9.36	9.36	9.36	9.36
C A2 6 Lab. assistant (PA)	18.6	4.65	4.65	4.65	4.65
C A2 6 Secretary (PA 1/2)	9.32	2.33	2.33	2.33	2.33
C A1 6 Laborers (2)	20.0	5.0	5.0	5.0	5.0
Sub-total	195.36				
Investments					
C A2 3 Partial contribution to seed processing installation	3.0 (100 m ²)	3.0			
C C1 3 Partial contribution for office installation	3.0 (200 m ²)	3.0			
C A1 4 Pick-up (double cabin) 1	12.0	12.0			
C A1 4 Field equipment	1.2	0.3	0.3	0.3	0.3
C A4 4 Small lab. equipment	1.2	0.3	0.3	0.3	0.3
C A4 4 Dryer/oven	4.5	4.5			
C C1 4 Typewriter (1/2)	0.7	0.7			
C C4 4 Analytical balance	2.0	2.0			
C C4 4 Office equipment	3.0	2.0	0.5	0.3	0.2
C C4 4 Microcomputer (1/2) shared with propagation	2.5	2.5			
C C4 4 Micro accessories	1.0	1.0			
C C4 4 Refrigerators	3.0	3.0			
Sub-total	37.1				
Travel					
C A1 7 Expenses (Natl.)	8.0	2.0	2.0	2.0	2.0
C C1 7 Trips/expenses (Intl. and Regl.)	6.0	1.0	2.0	1.0	2.0
Sub-total	14.0				
Running costs					
C C4 5 Insecticide/fungicide/fertilizer	0.6	0.2	0.1	0.2	0.1
C A4 5 Reagents/lab. chemicals	1.2	0.3	0.3	0.3	0.3
C A1 7 Diesel/oil	3.2	0.8	0.8	0.8	0.8
C A1 7 Vehicle maintenance	7.0	1.0	2.0	2.0	2.0
C C1 7 Computing service	2.0	0.5	0.5	0.5	0.5
C C1 7 Telex/telecommunications	2.0	0.5	0.5	0.5	0.5
C C1 7 Office supplies (paper, etc.)	4.0	1.0	1.0	1.0	1.0
C C4 7 Micro maintenance	0.8	0.2	0.2	0.2	0.2
C C1 8 Publications	2.0	0.3	0.5	0.5	0.5
Sub-total	22.8				
T O T A L	269.26	118.44	87.34	31.24	32.24

5.7 Indicators for follow-up

Subactivity	Control	Indicators
5.7.1 Subproject Latin American Forest Seed Bank		
A.1.1	In the first and second years maps will be made showing distribution and collection sites of the principal autochthonous and exotic species as well as species in danger of extinction. Potential species will be covered in the last two years (Appendix 1).	Map making in the second and fourth year
A.1.2	Establishment of priorities for forest seed collection according to A.1.1 results, state of genetic erosion and needs of the countries in the region.	Collection timetable
A.1.3	Seed collection and stimulation of collection according to the indications of A.1.2.	Seed or propagative material in stock
A.1.4	Selection of trees and seed collection.	Seed
A.1.5	Collection of botanical samples.	200 samples/yr
A.2.1	In the first three years, the countries will have set up seed stands with technical support from CATIE.	4-5 stands/country
A.3	Completion of routine trials to test physiological quality of conserved seed.	Routine information
A.3.1	All storable seed collected (A.1.1 and A.1.2) will have sufficient samples kept in the +5°C room (medium term) and reliable information will be obtained for forestry species which can be preserved long term as seed by freezing (-17°C)	Stored seed and a special report
A.3.2	Within 3 years, creation of a list of species/provenances in danger of extinction or severe genetic erosion within the region and recommendations for their conservation (in conjunction with the Wildlands Management Program)	Publication of catalogue on the present situation with recommendations for conservation

Subactivity	Control	Indicators
B.1.1	Periods of training requested by the countries in the region will be accomplished	Trained personnel
B.1.2	Support will be given to silviculture courses for the benefit of the region's scientific professionals.	Informed scientific
B.2.1	Support will be given to silviculture short courses for the benefit of producers.	
B.3.1	Research topics for postgraduate theses and special projects will be offered to CATIE students	Theses and reports
B.3.2	A course on propagation at post-graduate level will be offered in conjunction with "propagation" and "conservation" subprojects.	One per year
C.1.1	In the first year a national commission will be set up in each country. Specific objectives will be defined for each one.	Functional commissions in each country
C.1.2	Biannual meetings of the regional network will be held to plan strategies and actions in the region and exchange experiences.	Meetings once every two years
C.2.1	Support will be given to the countries for producing improved seed in the managed stands (in conjunction with Improvement Subproject.	Countries will be self-sufficient in propagative material for their reforestation needs
C.3.1	Provision of seed to interested groups.	Availability of seed
C.3.2	Introduction of seed from species of exotic origin with potential for the region.	20 lots/yr
C.3.3	Distribution of improved seed in conjunction with other subprojects	
C.4.1	Newsletter	2 editions/yr

Subactivity	Control	Indicators
C.4.2	A data base will be formed in the first year	
C.4.3	Information service will be provided	Number of requests for service
5.7.2 Subproject: Genetic improvement of timber and multipurpose trees		
A.1.1	Selection and collection of selected individual trees (in conjunction with BLSF).	10 species (see Appendix)
A.2.1	Setting up provenance/progeny trials and seed production.	5 species (see Appendix)
A.2.2	Evaluation of provenance/progeny trials already established	Periodic reports and publications
A.2.3	Selection of improved material and trials of species of regional interest	Reports and publications
A.2.4	Setting up advanced phase improvement trials	Reports and publications
A.3.1	Setting up seed orchards (in coordination with Propagation Subproject)	Availability of propagation material
A.4.1	Establishment and maintenance of trials (A.2.1, A.2.2 and A.2.4)	Special reports
A.4.2	Ex-situ conservation of genes in seed orchards or clone banks according to each species' needs	Special reports Special reports
B.1.1	In service training of Project personnel	Personnel trained
B.2.1	Improvement course offered at a regional level (for graduates)	One/two yrs
B.4.1	Post graduate level course in improvement offered to post graduate students	Once per year
B.4.2	Research topics offered to post-graduate students	Theses or reports

Subactivity	Control	Indicators
C.1.1	Establishment of regional network in genetic resources (with BLSF)	Network established
C.2.1	Production of improved seed or propagative material	Production of propagation material
C.2.2	Technical assistance to the region	As requested
C.4.1	Newsletter	2 editions/yr
C.4.2	Distribution of information and results	Specialized articles
5.7.3 Sub-project: Vegetative propagation of multipurpose trees		
A.3.1	Research into needs for vegetative propagation of each priority species	Report on propagation method for each priority species (see Appendix)
A.3.2	Development of commercial rooting techniques	Report and publications
A.3.4	Development of vegetative propagation techniques for preservation of species for which seed is inappropriate	Report and publications
A.3.5	Research of tissue culture techniques	Report and publications
B.2.1	Short courses will be given to regional professionals	One course in the second and fourth years
B.4.1	CATIE post graduate students will be offered research topics and special projects	Theses and reports
B.4.2	A post graduate level propagation course will be offered in conjunction with "BLSF" and "Conservation" subprojects	Once per year
C.1.1	Technical assistance to national groups	Three times/yr
C.4.1	Publication in scientific journals	Publications

Subactivity	Control	Indicators
C.4.2	Publication of manual on establishment by asexual methods for each species	Publication of manuals
5.7.4 Sub-project: Conservation of forestry species from tropical moist forest		
A.1.1	Important taxa will be identified in the first year	Defined work list
A.1.2	Study of phenology and seed collection	Publication and sufficient material for research
A.1.3	Collection of orthodox seeds for preservation	5000 viable seeds/species
A.3.1	Recommendation of best germination conditions	Report and publication
A.4.1	Recommendation of best seed storage conditions	Report and publication
A.4.2	Distribution of seed for conservation	Seed conserved: 1/3 BLSF/CATIE 1/3 DGF Bank 1/3 Kew, England
B.1.1	In service training	Trained personnel
B.4.1	A postgraduate level course in propagation will be offered in conjunction with BLSF and Propagation subprojects	Once per year
B.4.2	Carrying out special research	Theses or special work
C.3.1	Distribution of seed to other institutions for research	Report
C.4.1	Information transfer	Publication

APPENDIX 1

Species with which BLSF will work

Indigenous speciesPrincipal

Alnus acuminata
 Astronium graveolens
 Bombacopsis quinatum
 Calliandra calothyrsus
 Cedrela odorata
 Cordia alliodora
 Gliricidia sepium
 Guazuma ulmifolia
 Jacaranda copaia
 Pinus spp. (varias)
 Platymiscium spp. (2)
 Rollinia microcephala
 Samanea saman
 Simarouba spp. (2)
 Swietenia macrophylla
 Tabebuia spp. (varias)
 Terminalia (varias)
 Vochysia ferruginea
 Vochysia hondurensis

Potential

Anacardium excelsum
 Brosimum spp. (varias)
 Caesalpinia velutina
 Calophyllum brasiliensis
 Carapa guianensis
 Cybistax donnell-smithii
 Dalbergia retusa
 Goethalsia meiantha
 Guarea grandiflora
 Hieronyma oblonga
 Inga spp.
 Lecythis costaricensis
 Miquartia guianensis
 Peliogyne purpurea
 Pentaclethra macroloba
 Sterculia apetala
 Ulmus mexicana
 Virola koschnyi
 Virola sebifera
 Xylopia

Exotic speciesPrincipal

Acacia mangium
 Acrocarpus fraxinifolius
 Azadirachta indica
 Cassia siamea
 Casuarina equisetifolia
 Casuarina diversifolia
 Dalbergia sisoo
 E. camaldulensis
 E. citriodora
 E. deglupta
 E. grandis
 E. saligna
 Gmelina arborea
 Grevillea robusta
 Melia azedarach
 Mimosa scabrella
 Tectona grandis
 Terminalia ivorensis

Potential

Agathis macrophylla
 Albizia carbonaria
 E. globulus
 E. torelliana
 E. urophylla
 Fraxinus chinensis

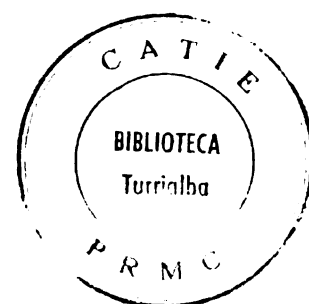
Species with which the Improvement Subproject wil work:

Advanced level-
Genetic improvement program

Acacia mangium
 Bombacopsis quinatum
 Cordia alliodora
 Eucalyptus camaldulensis
 Gmelina arborea
 Pinus caribaea var hondurensis
 Pinus patula subsp tecunumanii

Intermediate level-
Establishment of provenance/
progeny trials

Alnus acuminata
 Eucalyptus grandis
 Eucalyptus urophylla
 Jacaranda copaia
 Vochysia hondurensis



Basic level-
Selection within natural
stands

Albizia caribaea
Albizia guachapele
Enterolobium cyclocarpum
Juglans olanchana
Samanea saman
Sterculia apetala

The propagation subproject will work with the following species:

Alnus acuminata
Araucaria hunsteinii
Cordia alliodora
Eucalyptus camaldulensis
Eucalyptus grandis
Eucalyptus saligna
Eucalyptus urophylla
Gmelina arborea
Jacaranda copaia
Vochysia hondurensis
y especies seleccionadas
por el Proyecto de
Conservación.

The conservation subproject will study a range of species within a limited number of families selected from this preliminary list:

Families: *Anacardiaceae*, *Annonaceae*, *Apocynaceae*, *Bignoniaceae*,
Bombacaceae, *Burseraceae*, *Combretaceae*, *Euphorbiaceae*,
Flacourtiaceae, *Guttiferae*, *Humiriaceae*, *Lauraceae*,
Lecythidaceae, *Leguminosae*, *Melastomataceae*,
Meliaceae, *Moraceae*, *Myristicaceae*, *Myrtaceae*,
Rubiaceae, *Sapindaceae*, *Sapotaceae*, *Tiliaceae*,
Verbenaceae & *Vochysiaceae*