BIBLIOGRAPHIC DATA SHEET	1. CONTROL NUMBER PN-AAJ-593	2. SUBJECT CLASSIFICATION (695) AP00-0000-G302

3. TITLE AND SUBTITLE (240) Strategy for training in natural resources and environment: a proposal for development of personnel and institutions in Latin America and the Caribbean: final report

4. PERSONAL AUTHORS (100)

5. CORPORATE AUTHORS (101)

World Wildlife Fund - U.S.

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1980	327p.	LAT333.72.W927a

9. REFERENCE ORGANIZATION (150)

WWF-US

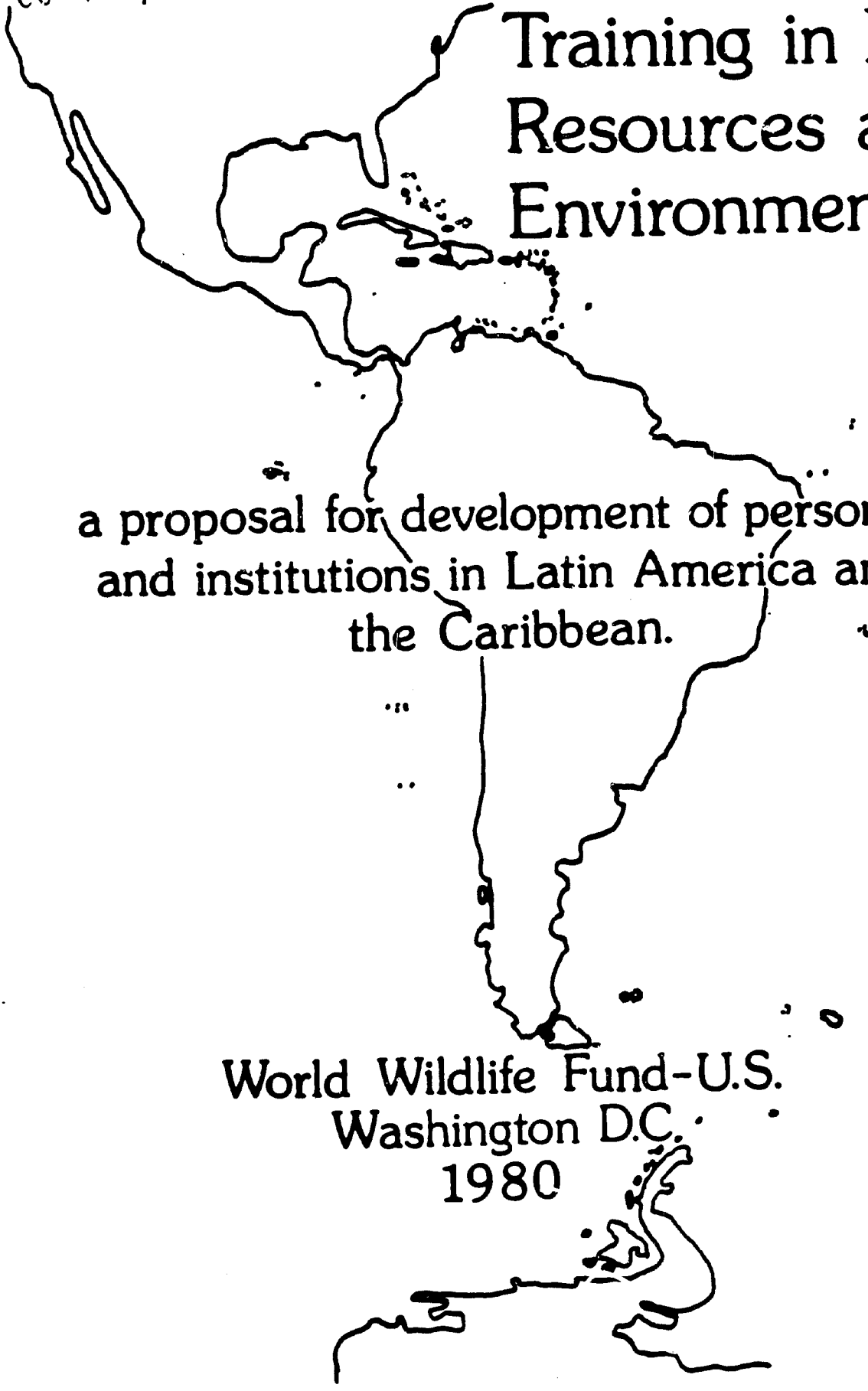
10. SUPPLEMENTARY NOTES (500)

11. ABSTRACT (950)

12. DESCRIPTORS (920)		13. PROJECT NUMBER (150)	
Latin America	Personnel development	598060500	
Caribbean	Institution building		
Natural resources	Environmental management	14. CONTRACT NO.(140)	15. CONTRACT TYPE (140)
Environmental education	Ecology	AID/LAC-G-1405	
Development strategy		16. TYPE OF DOCUMENT (160)	
Training methods			
Educational planning		68	

AID 590-7 (10-79)

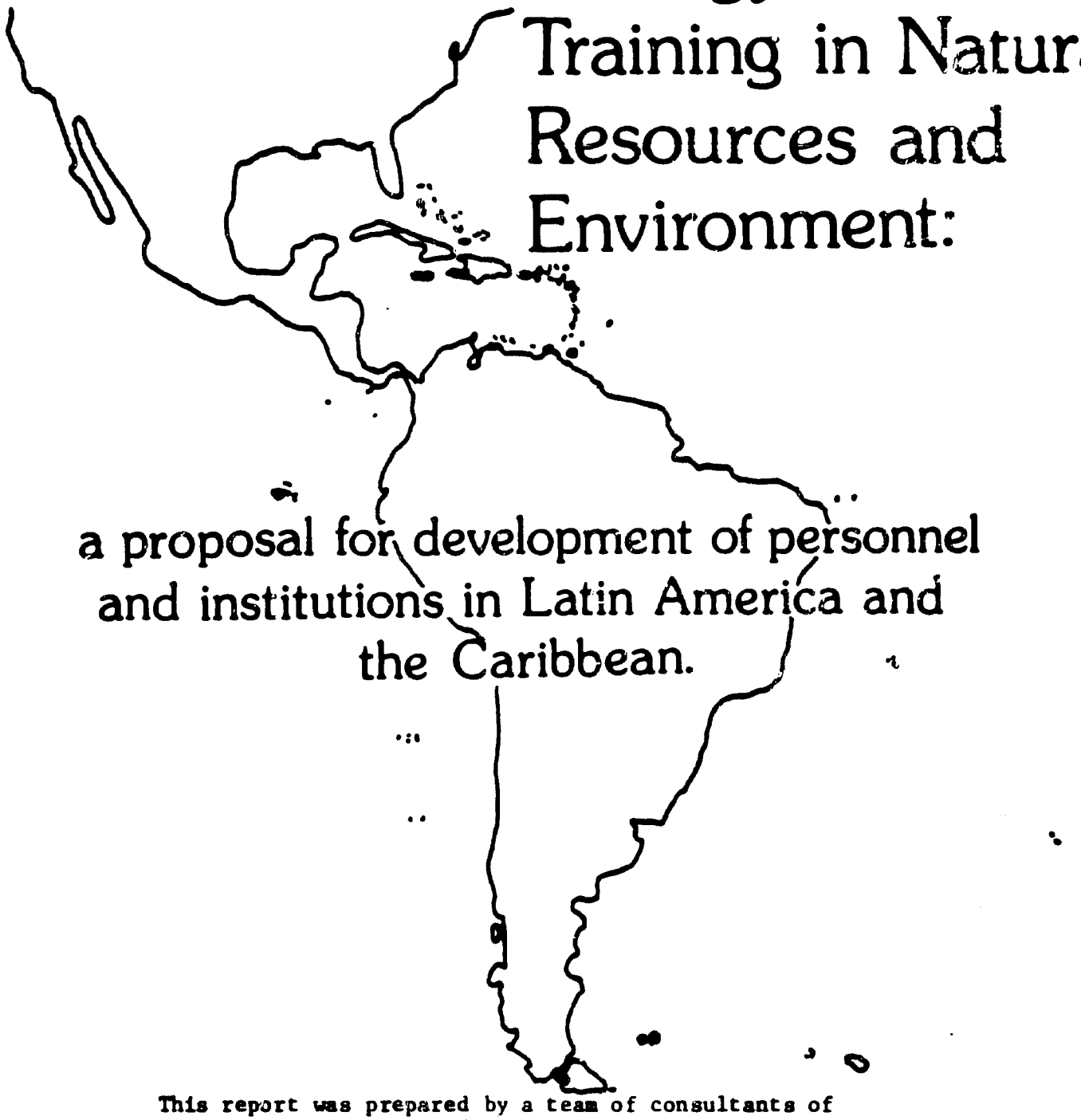
Strategy for Training in Natural Resources and Environment:



a proposal for development of personnel and institutions in Latin America and the Caribbean.

World Wildlife Fund-U.S.
Washington D.C.
1980

Strategy for Training in Natural Resources and Environment:



a proposal for development of personnel and institutions in Latin America and the Caribbean.

This report was prepared by a team of consultants of the World Wildlife Fund/US, under the leadership of the School of Natural Resources, University of Michigan, as part of the *Study of Requirements for Training in Natural Resources and the Environment in Latin America and the Caribbean*, under contract to the U.S. National Park Service and the U.S. Agency for International Development.

World Wildlife Fund/US
1601 Connecticut Ave., N.W.
Washington, D.C. 20009

1980

Executive Summary

EXECUTIVE SUMMARY

The Strategy for a Regional Training Project is intended to provide a practical framework for building human and institutional capacity in the countries of Central and South America and the Caribbean:

- to manage living natural resources (soil, water, plant and animal species), and
- to solve related environmental problems (deforestation, desertification, loss of soils, among others).

1. *The aim of the Strategy* is to assist the promotion and implementation of action in support of training by four groups:

- government officers responsible for natural resources, planning and development
- educators and scientists involved in training and research regarding natural resources and environmental fields
- donor institutions interested and committed to the support of training, natural resources and environment (international, regional, bilateral and non-governmental organizations) and
- interested citizens and citizen groups wishing to support this effort

2. *Status and trends for natural resources* in the region establish that ten key ecological problems will become sufficiently acute by the turn of the century to challenge development:

- loss of soil resources
- desertification
- destruction of native forests
- destruction of coastal and island resources
- overfishing and destruction of fresh water and marine resources
- general destruction of natural resources in rural areas
- inappropriate development of ecologically fragile and sensitive ecosystems and sites
- absence of ecological consideration in development planning
- irreversible loss of key natural areas
- loss of wild plant and animal resources

3. *Current and planned training programs* provide opportunities at the university, post-graduate and technician level, complemented with courses offered by international, regional and bilateral organizations and non-governmental institutions. In a very positive way, the existing programs cover the major disciplines related to natural resources and the environment. In general, however, these training opportunities can be characterized by:

- orientation to traditional disciplines
- concentration upon tactical issues
- lack of involvement with strategic issues for development
- lack of field contact and practical work and
- lack of current information

4. *Four target groups* require training opportunities:

- senior policy level (ministers, directors, legislators)
- senior professional/manager level (department directors, project directors, planning officers, deans)
- professional level (professors, teachers, researchers, field officers)
- technician level (resource guards, middle-level managers in forestry, fisheries and agriculture)

5. *Gaps in training opportunities* are identified by comparing (a) the major environmental problems, (b) current training opportunities, and (c) the needs of the four target groups. The gaps consist not of a simple list of disciplines or faculties which may be lacking, but a set of attributes to complement existing efforts:

- reorient training to focus upon key environmental problems (of significance to development)
- develop new programs where necessary to cover all subregions, biomes and major environmental problems
- demonstrate management methods and techniques in the field (by relating teaching to field management and research)
- provide information on methods and case histories (e.g. films and literature)

6. A wide *variety of training methods* have been employed in the region. In view of the ecological and cultural diversity in the region and the agenda of environmental problems to be addressed, each method will be useful to support the four target groups:

- university degree programs
- university post-graduate programs
- short courses
- seminars
- workshops
- technician programs of study
- conferences
- congresses
- panels and debates
- in-service training
- field visits to case study sites
- informal meetings
- TV and radio reports, press editorials and reports

7. *Action to support training* can be organized in various ways, ranging from the development of a new centralized regional training center to a decentralized, loosely coordinated collection of established institutions. Arguments have been examined for and against the various alternatives.

8. A five-year *Regional Training Project is proposed* which features three organizational elements:

- a central office (project headquarters with three officers, to establish and update a regional training program and set of priorities, initiate and develop training activities and promote the project with potential donors)

- eight national or sub-regional offices (a single officer in each to establish the priorities and activities for a sub-region, to focus specifically on the senior policy level and promote action locally)

- a network of existing and new institutions and faculties (a set of programs selected to provide training on environmental problem areas, in various biomes, to particular target groups, and which possess demonstrated managerial and administrative capacity; these will develop field demonstration sites)

9. The *results of the Project* can be expected to include:

- regional overview report on training requirements
- service to governments to identify and prepare projects
- service to donors to identify potential projects
- preparation of project staff and instructors
- production of teaching aids
- establishment of demonstration areas
- design and implementation of some 50 training projects

10. The *financing of the Project* will require:

- funding of the Project central office, national or sub-regional office and training workshops for instructors ($US 717,000 per year, or $US 3,585,000 in 5 years) through an existing regional or international organization and

- supporting the reorientation, expansion or development of some 50 individual schools, departments and institutes in the region (totaling some $US 2,000,000 per year or $US 10,000,000 in 5 years) through normal channels for technical and financial cooperation)

11. The *justification for the Project* is that:

- recipient countries and institutions will have full participation and control in the design of the program and priorities of the project

- a balanced program can be developed and updated which focuses upon strategic aspects of development at the regional and local scope

- training is provided to all levels of management simultaneously to attain political decision and field action

- donor institutions can observe and attain a regional overview of needs and priorities to support a key aspect of development and

- donors can work with recipient institutions and governments through established channels and mechanisms, and retain donor identity, yet form part of a coordinated regional effort

Preface

This document is the final report of a team of consultants to the World Wildlife Fund/US on the subject of training needs in natural resources and the environment in Latin America and the Caribbean.

The scope of work presented a continual challenge to the team since "natural resources" and "environment" are not only limitless in themselves, but their use in the English and Spanish languages differs considerably. The team chose to restrict the scope to that employed in the World Conservation Strategy, that is, to concentrate upon those renewable natural resources and those aspects of the environment which relate to the maintenance of ecological processes and life-support systems, to preservation of genetic diversity, and to sustainable utilization of species and ecosystems.

This restriction in scope is justified in view of the limited work in this area. The work of individual governments, the Pan American Health Organization, UN Environment Program, and the Organization of American States, among others, has provided a head start in environmental health, environmental sanitation, human settlements, resource inventory and evaluation and environmental impact assessment fields.

Meanwhile, the inventory, evaluation, management, utilization and development of such basic natural resources as soil, water and plant and animal species remain drastically deficient. Environmental problems including soil erosion, deforestation and desertification

can affect all of development at a scale which negates the hard-earned gains of recent decades.

The report represents a starting point. The data from the field deserves several additional months of analysis and synthesis. The data could be vastly improved if return field visits were possible. The proposal of a Regional Training Project is the result of bringing together the knowledge and experience of team members who know the region intimately. Intensive time and care has gone into its conceptualization. It is bold in its departure from a standard format for technical and financial cooperation. It advocates a programmatic approach which depends upon the decentralized input of local specialists in the region.

The study was designed to include remote sensing as an integral aspect of the work and this final report. Unfortunately, recent events in Bolivia have prevented team member Carlos Brockmann from finalizing his written contribution in time to meet the reporting deadline. This important material will be added to this report, subsequently, as an addendum.

The team leader would like to thank the members of the team--Carlos Brockmann, Leslie Brownrigg, Bradley Cross, Marc Dourojeanni, Mercedes Velasco de Garzon, Caldwell Hahn, Ivor Jackson, Craig MacFarland, Roger Morales, Juan Oltremari, Maria Tereza Jorge Padua, Carlos Ponce del Prado, Allen Putney, Yves Renard and Steve Romanoff--for their contribution and reports. Carlos Ponce and J. Antonio Michel prepared the Spanish-language version of the report. Bradley Cross, Dennis Glick and John Shores were instrumental in the synthesis

of data and the preparation of the document. Sharon Bradford typed the English text. Rita Guidi Anderson and Carmen Cross typed the Spanish text.

Finally, Robert Otto, Environment Officer for Latin America and the Caribbean (USAID), had the foresight and courage to establish this project and attempt an innovative and creative approach. Robert Milne and Gary Wetterberg of the International Park Affairs Division of the National Park Service (U.S. Department of Interior) provided support on technical matters and again displayed their sensitivities and dedication to natural resources in the Hemisphere. Thomas Lovejoy, Vice President for Science, World Wildlife Fund/US, staff scientist Caldwell Kahn, and project administrator Nancy Hammond were instrumental in the implementation of the project.

To all these individuals goes the deepest appreciation and respects for their personal dedication to the goals of the project.

Kenton R. Miller
Team Leader

INTENTIONALLY
LEFT
BLANK

TABLE OF CONTENTS

INTENTIONALLY
LEFT
BLANK

LIST OF ACRONYMS

ACUA	Asociacion para la Conservacion de la Naturaleza, Popayan, Colombia
AID	Agency for International Development, Department of State, Washington, D.C.
CATIE	Centro Agronomico Tropical de Investigacion y Ensenanza, Turrialba, Costa Rica
CCA	Caribbean Conservation Association, Barbados, West Indies
CDIRB	Centro para el Desarrollo y la Investigacion de Recursos Bioticos, (proposed network of centers, not in existence)
CEPIS	Centro Panamericano de Ingenieria Sanitaria y Ciencias del Ambiente,(PAHO) Lima, Peru
CFTDI	Caribbean Fisheries Training and Development Institute, Trinidad
CIAF	Centro Interamericano de Fotointerpretacion, Bogota, Colombia
CIAT	Centro Internacional de Agricultura Tropical, Palmira, Colombia
CIDIAT	Centro Interamericano para Desarrollo Integrado de Aguas y Tierras, (OAS) Merida, Venezuela
CIFCA	Centro Internacional de Formacion en Ciencias Ambientales, Madrid, Spain
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo, El Baton, Mexico
CINDER	Centro Internacional para el Desarrollo Regional, (OAS) Maracaibo, Venezuela
CIZA	Centro de Investigaciones de Zonas Aridas, Lima, Peru
ECIAF	Eastern Caribbean Institute of Agriculture and Forestry, Trinidad/Tobago
ECNAMP	Eastern Caribbean Natural Areas Management Program, St. Croix, Virgin Islands
ECO	Pan American Center for Human Ecology and Health, (PAHO) Mexico City, Mexico

List of Acronyms, continued

ERTS	Earth Resources Technological Satellite
FAO	Food and Agriculture Organization, United Nations
FUDENA	Fundación para la Defensa de la Naturaleza, (WWF) Caracas, Venezuela
IBDF	Instituto Brasileiro de Desenvolvimento Florestal, Brasilia, Brazil
IICA	Instituto Interamericano de Ciencias Agricolas (OAS)
INPE	Instituto Nacional de Pesquisas Espaciales, San José dos Campos, Brazil
IUCN	International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland
IVIC	Instituto Venezolano de Investigaciones Cientificas, Caracas, Venezuela
MAB	Man and the Biosphere, UNESCO
OAS	Organization of American States
OICD	Office of International Cooperation and Development, USDA, Washington, D.C.
ONERN	Oficina Nacional de Evaluación de Recursos Naturales, Lima, Peru
OTS	Organization of Tropical Studies, San José, Costa Rica
PAHO	Pan American Health Organization
RBF	Rockefeller Brothers Fund, New York
SCS	Soil Conservation Service, USDA, Washington, D.C.
SIDA	Swedish International Development Agency, Stockholm, Sweden
STINAPA	Netherland Antilles National Parks Foundation
STINASU	Foundation for Nature Preservation in Surinam

List of Acronyms, continued

UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	AID
USDA	U.S. Department of Agriculture, Washington, D.C.
USDI	U.S. Department of the Interior, Washington, D.C.
USFS	U.S. Forest Service, USDA
USFWS	U.S. Fish and Wildlife Service, USDI
USGS	U.S. Geological Survey, USDI
USNPS	U.S. National Park Service, USDI
WWF	World Wildlife Fund, Gland, Switzerland
WWF-US	World Wildlife Fund - United States, Washington, D.C.

LIST OF TABLES

LIST OF TABLES, continued

LIST OF FIGURES

LIST OF APPENDICES

Chapter I.

Introduction to the Study.

Chapter I

INTRODUCTION TO THE STUDY

Interest in the development of a regional training program in natural resources has been reflected in regional meetings and in a series of studies conducted over more than a decade. The scope of this process has evolved from concerns for the appropriate management of specific resources to a larger, comprehensive view of natural resources and the environment.

This study represents a step in the long effort to articulate the needs for training in the natural resources field in the region of Latin America and the Caribbean. It expands the scope of previous work to attempt a more ecologically holistic view of the environment, and it relates natural resources to social and economic development and the fundamental requirement to make this development sustainable.

Thirteen highly qualified individuals visited most countries of the region, examined existing training facilities, met with local leaders and specialists, and observed field projects and conditions. The potential contributions of modern science and technology were evaluated particularly in relation to resource management. And, the native peoples, cultures and technologies were examined to ensure full consideration of their unique knowledge and their future role in contributing to a more harmonious relationship between humans and their environment.

The study attempts to expand the traditional view of the natural resources field, and to come to practical terms with the concept of environment. Simultaneously, however, it opened many more avenues than could be followed and utilized in the limited time available.

A strategy is offered for the development and implementation of a Regional Training Project. And, suggestions are made for follow-up steps to explore further insights and ideas of the study team which could not be fully pursued.

Background

Some of the earliest articulations of the wish of the countries of Latin America and the Caribbean to have a regional training facility in natural resources were manifested in the resolutions of several international meetings. They included the Forestry Commission for Latin America, which met in Trinidad and Tobago in 1967 (FAO, 1967), the Second World Conference on National Parks (USNPS, 1972), the First and Second Meetings of the International Technical Committee for the Protection and Management of Amazon Flora and Fauna (CIT, 1976 and 1977), and the Meeting on Regional Cooperation in the Management of Central American Wildlands (CATIE, 1977). The scope of concern was the preparation of personnel to manage and protect national parks and to manage wildlife resources. Models discussed included the College of Wildlife, at Mweka, Tanzania, and the Ecole pour la formation de specialistes de la faune, at Garou Cameroun. Both of these facilities were established on a sub-regional

basis with the technical and financial assistance of FAO, the United Nations Development Program, and bilateral and non-governmental organizations from Europe and North America.

A 1968 study by the Instituto Interamericano de Ciencias Agricolas (IICA) examined the forestry schools of Argentina, Brazil, Chile, Paraguay and Uruguay to determine needs for support and development (Castronovo, Barres and Miller, 1968). As a result of this work, nine forestry faculties from the Southern countries joined with IICA and FAO to provide opportunities for professors to study the management of wildland resources and to teach the material in their respective faculties (FAO, 1972a and 1973).

FAO studied training needs for fields related to forestry in Latin America and the Caribbean, (FAO, 1978a, 1978b, 1979a), and held its Ninth Session of the Advisory Committee on Forestry Education in Jakarta in October 1978 (FAO, 1979b). Technical and financial cooperation among the governments of the region and FAO, UNDP, and bilateral organizations to strengthen forestry education has been considerable during the past 15 years. Examples of such collaboration can be found in almost every country of the region.

The Government of Argentina requested the support of FAO and UNDP in 1972 to formulate a project to expand and further develop its ongoing training center in Bariloche. The school was oriented principally toward preparation of middle-level personnel to manage Argentina's extensive system of national parks. Candidates were also invited from neighboring countries. It was the desire of the Government to provide training for a broader set of concerns

including the development of the wildlife resources, the management of the Eastern Andean slope forests and watersheds, the protection of the watersheds of that area which are critical to agricultural and industrial development of the nation, and the provision of environmental training opportunities for architects, engineers, school teachers and other professions requiring ecological re-orientation. The many changes which followed in Argentina during 1972 and the following years did not permit the realization of the project.

The Organization of American States (OAS) initiated a series of working meetings in 1977 to examine the Western Hemisphere Convention (Pan American Union, 1940) and consider its updating and further implementation. Within this context, the Fundacion para la Defensa de la Naturaleza (FUDENA) of Venezuela, the U.S. National Park Service, the Fish and Wildlife Service and the World Wildlife Fund/US jointly sponsored a "Study for the Establishment of an Inter-American Training Center for Management and Operations Personnel of National Parks and Similar Areas" in Latin America (Fahrenkrog, 1978). Requirements for training to manage the national parks and equivalent reserves were examined, alternative sites for the center were analyzed, and a proposal prepared. The results were presented to the OAS Meeting on Training, held in Merida, Venezuela in 1978 (OAS, 1978).

The International Union for the Conservation of Nature and Natural Resources (IUCN) presented the first draft of the *World Conservation Strategy* to its General Assembly in October 1978. This document was prepared with the participation of technical

experts and political leaders from around the world. It was prepared with the support of the United Nations Environment Program (UNEP) and the World Wildlife Fund (WWF) and received the endorsement of the UN Food and Agricultural Organization (FAO) and the UN Educational Scientific and Cultural Organization (UNESCO). An explanation and examples are given of the major environmental problems facing the world's citizens, the ways in which conservation *with* development can contribute to human welfare, and the importance of building and ensuring the *sustainability* of development.

The Strategy aims to achieve three main objectives:

a) *To maintain essential ecological processes and life support systems* (such as soil regeneration and protection, the recycling of nutrients, and the cleansing of waters), upon which human survival and development depend;
b) *to preserve genetic diversity* (the range of genetic material found in the world's organisms), on which depend the functioning of many of the above processes and life support systems, the breeding programs necessary for the protection and improvement of cultivated plants, domesticated animals and microorganisms, as well as scientific and medical advance, technical innovation, and the security of the many industries that use living resources;
c) *to ensure the sustainable utilization of species and ecosystems* (notably fish and other wildlife, forests and grazing lands), which support millions of rural communities as well as major industries (IUCN, 1980).

These objectives warrant urgent attention since the planet's capacity to support people is being irreversibly reduced and rural people are forced to destroy the resources upon which they depend. Reservoirs are silting and croplands flooding in response to upstream deforestation. The production of food, water, timber and fish will become more difficult and expensive as basic resources shrink.

The management of living resources is not a sector in traditional terms, but rather a process which relates to all other sectors. Thus, development must consider resource management as a pervading and necessary element. Environmental problems, to a considerable extent, are manifestations of a development process in which due consideration for living resource management is lacking. It is one thing to win or lose production; it is another matter to lose productivity.

Scope

A major obstacle to accomplishing sustainable development is the lack of human and institutional capacity to manage living natural resources and to solve the environmental problems that have resulted from inappropriate resource use. Managers, researchers and field implementors are needed in the fields of forestry, agronomy, biology and ecology. Furthermore, the fields of engineering, architecture, economics and planning must grasp ecological principles.

Since this study attempts to undertake a broader scope than previous efforts, based upon the concepts generally associated with *ecodevelopment* philosophy, the study views natural resources and the environment as an aspect of the development process. The primary focus is upon such natural resources as soil, water, fish, and wild plant and animal species which provide the raw materials and context for development.

It is assumed that peoples and governments not only wish development *per se* but also want progress to be sustainable. Thus

management of natural resources is charged not only with production of goods and services, but with the maintenance of ecosystems and the natural elements of those systems.

Along with growing ecological awareness, people have come to perceive that, in fact, environmental problems exist in *all* sectors of development. Public health, human settlements, sanitation, transportation and other fields all face problems that affect the quality of the human environment and involve natural resources. For the purpose of this study, those environmental problems that relate to soil, water, and wild plant and animal species receive major emphasis.

The study is thus of interest to foresters, agronomists, fisheries specialists and other professionals who deal with the use of land, water and primary renewable natural resources. Biologists, ecologists, geologists and soils specialists will be interested in the study of ecosystems and natural materials and the possibility of reorienting resource use.

Further, public health, human settlements, sanitation and transportation relate to natural resources, and considerable work is already under way towards environmental management in these important fields. Energy is obviously a critical factor in development, environment and natural resources: the study considers the contributions of renewable natural resources to growing energy demands.

The study focuses with greatest intensity upon those natural resources and environmental problems which relate to the support and maintenance of development. This includes a particularly close view of

ecosystems and wild plant and animal resources since these are the processes and elements upon which food, fiber, water and biomass energy depend. Use and abuse of land and fresh water and marine resources serve to focus the study upon those human activities which affect the environment.

The scale and magnitude of environmental problems are expanding to levels difficult or impossible to apprehend and analyze by direct observation. Remote sensing now offers opportunities for the inventory, evaluation and monitoring of natural resources and the environment.

With the advent of satellites of high quality imagery, it has become possible to observe resources or the indications of resources for extremely large areas. Coupled with low-altitude photography and ground-level field work, satellite imagery makes it practical to study forests, minerals, geology and geomorphology, hydrology, weather, coastal zones, fisheries, erosion and sediment, agricultural production, pests and diseases of crops and forests, and other topics of interest. Remote sensing also opens the possibility for monitoring, or making systematic and periodic observations of ecological baseline sites for comparison with areas under various uses in order to denote change and forecast trends.

The U.S. Agency for International Development (USAID) sponsored a study on remote sensing in 1978, to examine the activities ongoing in Latin America and the Caribbean, and to suggest potential collaborative efforts for the future (Smith, 1979).

This present study included a review of remote sensing capability

in Latin America and the Caribbean. Training opportunities and requirements were analyzed as part of the overall study, giving emphasis to the application of remote sensing to natural resources management and related environmental problems.

Objectives of the Study

USAID sponsored the present new study in order to consider a broader, more integral approach to training in natural resources and the environment. The region of study is defined as Latin America and the Caribbean: the countries and territories of Central and South America, Mexico and the Greater and Lesser Antilles.

USAID contracted to the U.S. National Park Service to provide the technical support for the work in view of its on-going relations with the region and its in-house capacity to support the study. The World Wildlife Fund of the United States (WWF/US) was in turn contracted to administer the project. The World Wildlife Fund/US was responsible for the assembly of a team of experts in the fields of environmental and natural resource planning, policy, management, technology and training with appropriate experience in Latin America and the Caribbean to carry out this study with the following general and specific objectives:

General Objectives

1. To prepare a comprehensive assessment of environmental training needs.

2. To determine the most appropriate manner in which those needs can be met.

3. To provide decision makers with the background material necessary to make reasoned decisions

concerning financial and technical assistance in the area of environmental training.

4. To determine the level of interest in expanded environmental training opportunities in the region.

5. To stimulate regional and international support for an international program dedicated to training environmental professionals.

Specific Objectives

1. To define existing conditions and forecast trends for the region through the 1980's and 1990's which will have a bearing on needs for environmental manpower in Latin America.

2. To define in terms of disciplinary focus and target groups (e.g., technical, professional, middle-level managerial, etc.) the environmental and natural resources training needs of Latin America.

3. To examine existing and planned environmental and natural resources training programs in the region.

4. To identify the areas of training which are or will be unfulfilled by existing or planned programs with particular emphasis on gaps which may exist for technical, para-professional, professional and middle-level management personnel in the natural resource management fields.

5. To identify and evaluate alternative delivery systems for training opportunities which most adequately meet regional needs.

Originally, the project was to recommend appropriate location(s) for a training center and/or sub-center(s), and assess regional receptivity to the proposal. However, during the course of the study, the sponsors agreed to consider the end product of the project to be a strategy for a regional training program. Subsequent to the study, USAID is to sponsor a Review Panel of outstanding personalities, educators, policy-makers and leaders from the region which will examine the proposal and assess regional receptivity.

In addition to the above objectives, and to be incorporated within them, were a series of specific objectives regarding remote sensing; (a) expand upon the results of the 1979 Regional Remote Sensing Training Center(s) Feasibility Study, and (b) recommend how such a remote sensing center(s) could be combined with an environmental/natural resources training program.

Study Team

A team was formed of individuals with established background and credentials in the fields of natural resources with experience as educators, managers of field projects, public administrators and researchers. All team members have spent most or all of their professional careers in the region and have been instrumental in the formulation and implementation of environmentally sound approaches to social and economic development. Yet, each member brings particular and different experiences and talents to the study:

Dr. Carlos E. Brockmann, Project Consultant on Remote Sensing (Bolivia). Principal Investigator in Remote Sensing, Satellite Programs for ERTS-1 and LANDSAT 2. Consultant to NASA; UNEP on Regional Desertification Project; UNESCO on the Scientific Committee of the International Program of Geological Correlation; US National Academy of Sciences, ad hoc committee on Remote Sensing for Development - 1977.

Ing. Bradley Cross, Project Research Associate to the Team Leader (USA). Field management experience in Colombia, environmental consultant with USAID in Bolivia and the IUCN Strategy for Conservation in the Caribbean. Forester, wildlands management and ecodevelopment specialties.

Dr. Marc J. Dourojeanni, Project Consultant on Ecology and Natural Resources (Peru). Currently, Director and Professor, Forestry Faculty, Universidad Nacional Agraria La Molina, Lima, Peru. Formerly, Director General for Forestry and Wildlife of Peru. Consultant for FAO and other organizations on many missions throughout the region. Past president

of working group of the Directors General of Natural Resources of the Andean Pact countries, of the FAO Latin American Forestry Commission, and other regional activities. Currently, Vice-Chairman of IUCN's Commission on National Parks and Protected Areas.

Sra. Mercedes Velasco de Garzon. Project Consultant on Mexico (Mexico). Currently, science coordinator for the Division of Research and Technology of the Direccion General de Institutos Tecnologicos, and the technical secretary for the Ecology Program of the National Council on Science and Technology.

Dr. Caldwell Hahn. Project Liaison Person for World Wildlife Fund/US (USA). Currently, staff scientist with WWF/US in Washington, D.C. Researcher in natural resources and wild flora and fauna.

Mr. Ivor Jackson. Project Consultant on the English-Speaking Caribbean (Antigua). Currently, consultant in wildland management and ecodevelopment with the Caribbean Conservation Association (CCA), Barbados. Professional Regional Planner with work experience throughout the sub-region.

Ing. Craig MacFarland. Project Consultant for Central America (USA). Currently, Head of the Watershed and Wildlands Management Project of the Renewable Natural Resources Program of the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE), Turrialba, Costa Rica. Formerly, Director of the Charles Darwin Research Station, Galapagos Islands, Ecuador. Researcher, educator and consultant in natural resource management throughout Central America and in several South American countries for UNESCO, IUCN and directly for national governments.

Dr. Kenton R. Miller, Project Director and Team Leader (USA). Currently Associate Professor of Natural Resources and Associate Research Scientist at the School of Natural Resources, University of Michigan, USA. Former Director of the FAO/UNDP Regional Project on Wildland Management for Environmental Conservation in Latin America and the Caribbean. Educator, manager and researcher; consultant for FAO, UNESCO, IUCN and directly for governments throughout the region. Currently, Chairman of the IUCN Commission on National Parks and Protected Areas.

Sr. Roger Morales. Project Consultant for Central America (Costa Rica). Currently, research assistant of the Watershed and Wildlands Management Project of the Renewable Natural Resources Program at CATIE. Experienced field manager on activities throughout Central America.

Ing. Juan Oltremari, Project Consultant for the Southern Cone Countries (Chile). Currently, Professor, Forestry Faculty, Universidad Austral de Chile, Valdivia, Chile. Director of Research Program of the Faculty. Educator, researcher and manager in natural resources.

Dra. Maria Tereza Jorge Padua. Project Consultant for Brazil (Brazil). Currently, Director of National Parks and Equivalent Reserves, Instituto Brasileiro de Desenvolvimento Florestal (IBDF), Brasilia. Instrumental in the inventory and selection of critical areas requiring protective management in the Amazon, and the implementation of a national strategy for protected areas management as part of the National 5-Year Development Plan. Educator, researcher and manager in agronomy, biology and natural resources.

Ing. Carlos Ponce del Prado. Project Consultant on the Andean Pact Countries (Peru). Currently, Professor of the Forestry Faculty, Universidad Nacional Agraria La Molina, Lima, Peru. Formerly, Director of Conservation Department, Direccion General Forestal y de Fauna, Ministry of Agriculture, Lima. Educator, researcher and manager in forestry, agriculture and wildlife, natural resources policy and planning, and protected areas management. Consultant for FAO to governments in the region. Head of IUCN's Vicuna Working Group.

Mr. Allen Putney. Project Consultant on the Caribbean (USA). Currently, Associate Research Scientist of the School of Natural Resources, University of Michigan, responsible for the Eastern Caribbean Natural Areas Management Program (ECNAMP), a joint program of the Caribbean Conservation Association and the University of Michigan, based at the West Indies Laboratory on St. Croix. Formerly, FAO advisor in Ecuador and Costa Rica, with consulting to other countries in the region. Educator, researcher and manager on current activities in the Antilles.

Mr. Yves Renard, Project Consultant on the French-Speaking Caribbean (France). Currently, consultant to the Caribbean Conservation Association (CCA), Barbados. Specialist in environmental perceptions, education and training, rural development and ecodevelopment, working throughout the Caribbean sub-region.

Methods and Procedures

The team members were contracted by the WWF/US for periods varying between one and six months with responsibilities for specific portions of the study. In most cases personal briefing sessions were held with the Team Leader prior to the initiation of the activities of each consultant.

The individual responsibilities were:

- Dr. Brockmann--remote sensing throughout the region.
- Dr. Dourojeanni--analysis of trends in natural resources for the coming decades and the implications for training.
- Sra. Garzon--analysis of training in Mexico.
- Ing. MacFarland and Sr. Morales--analysis of training in Central America.
- Sres. Putney, Jackson and Renard--analysis of training in Antilles and Guyanas.
- Ing. Ponce del Prado--analysis of training in the Andean Pact Countries.
- Dra. Jorge Padua--analysis of training in Brazil.
- Ing. Oltremari--analysis of training in the Southern Cone Countries.
- Dra. Hahn and Ing. Cross--analysis of training activities of international, regional, bilateral and non-governmental organizations.

As a separate, but coordinated and parallel aspect of the work, Dr. Leslie A. Brownrigg and Mr. Steven A. Romanoff, of the Amaru IV Cooperative, prepared a consultant report on the native peoples of Latin America and their roles in modern resource management. Due to timing difficulties, it was unfortunately impossible to incorporate this work fully into that of the team. However, the results were integrated into this final report.

The members of the team held two working meetings; the first in Lima, Peru, hosted by colleagues Dourojeanni and Ponce del Prado. The second was held at CATIE, in Turrialba, Costa Rica, hosted by that institution and our colleagues MacFarland and Morales. During the first meeting which was held early in the study, concepts and terms were clarified and defined, work plans established or revised, and problems encountered in the field were amply discussed. The second session consisted primarily in a synthesis of results from the field work and formulation of the Strategy for a Regional Training Prograr

Field work by the consultants involved extensive travel and intensive inquiry in their respective sub-regions or according to their assigned themes. Key institutions were personally visited, conversations were held with ministers, deans, project managers, students, international agency officers, and research personnel. Each consultant provided a written report, which taken together provide some 1,500 pages of information.

Based upon the work of the consultants, the two team meetings and copious correspondence and frequent meetings with team members and colleagues from the sponsoring institutions, the team leader and his research assistant prepared a first draft report. The first draft and revised sections were circulated to all team members and sponsors for revision and comment to ensure that the effort could benefit from the input of all associated with the project. Subsequently, a revised draft was submitted to the sponsors by the team leader in early November 1980.

Organization of the Report

The report is organized into six chapters and a series of appendices. The chapters cover an introduction of the study; status and trends in natural resources and the environment which will affect the training needs for the 1980's and 1990's; present opportunities for training; requirements for training to meet future needs; alternative means and organizational options; and a strategy for a regional training project in natural resources and the environment. Because of the large volume of information generated during the study, highly condensed summaries of the existing and planned training opportunities are presented in appendices. A bibliography lists the references cited in the text.

Use of this Report

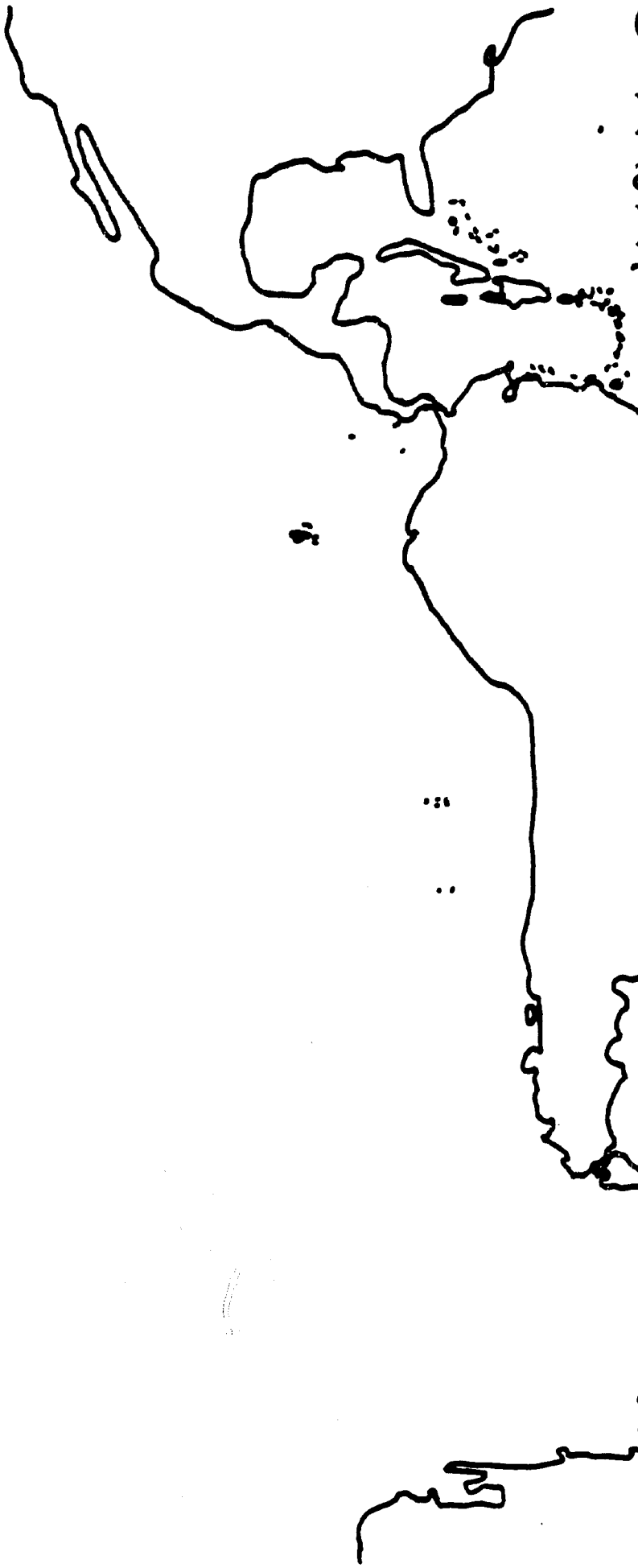
The report is written to offer an approach by which training opportunities can be improved and expanded in Latin America and the Caribbean to support the appropriate use and management of natural resources and to solve and prevent environmental problems. As such, the report will be of interest to educators, resource managers, environmental scientists and planners in Latin America and the Caribbean. It will also be of interest to institutions with a desire to support training in these fields technically or financially.

The proposal is presented at the conceptual level to stimulate dialogue on alternatives. The proposal is designed in Chapter VI to set the stage for further planning and project development. While

based upon intensive field study and debate, there is no attempt in the report to cover details of curriculum design, site selection for training facilities, or the naming of specific host countries for particular activities. More important at this stage is the exploration of trends in resources and environment, the current training capacity, and the alternatives by which present efforts can be supported to prepare for the realities of the coming decades.

The study team wishes to emphasize their most profound affirmation that what is needed is a *regional training process* of sufficient duration to allow for incremental growth in training capacity. Traditional short-term technical assistance projects by themselves can do little in the face of immense and rapidly evolving global environmental problems and the biological and cultural diversity of the region. The details of curriculum, sites and action must be developed in a programmatic way and evolve with the region based upon local considerations.

Thus, it is hoped that governments, universities, assistance agencies, banks and foundations will find this proposal useful in moving towards a major thrust in training in the region.



Chapter II.

Natural Resources and Environment. Problems Affecting Training Needs for the 1980's & 1990's.

Chapter II

NATURAL RESOURCES AND THE ENVIRONMENT —PROBLEMS AFFECTING TRAINING NEEDS FOR THE 1980's AND 1990's

Introduction

Social and economic development in Latin America and the Caribbean, is dependent in a most fundamental way upon renewable natural resources. Human welfare is linked to the soil for food, the forest for fiber, streams and lakes for water and fish. Natural ecosystems provide nutrients to soil and water, filter chemical and physical wastes, and serve to balance the various parameters of the environment. Mountain and coastal areas offer land and seascapes for tourism and recreation. Wild species supply meat to rural dwellers and a wealth of medicinal and pharmaceutical products and breeding materials for food production and biological pest control.

Some development efforts are tending to disturb natural processes and ecosystems to the degree that apparent gains to human welfare are offset by short and long-term threats to the base upon which production rests. Too often the pressures for development are taken as reasons for forsaking ecologically sound development practices, because sound planning appears to be too slow. Yet, ironically, undue speed in development has greatly slowed the pace of improving standards of living in many cases.

In approaching renewable natural resources, there is a tendency to assume that forests, savannahs, coastal mangrove forests,

the Andean mountains, and inshore marine waters in their free and uncommitted state are waiting for the people of this generation to select and implement the uses which most conform to our needs. However, with few exceptions, virtually every sector of the region is actually committed to one or another groups of people. Approximately one-half of the region's population lives in the rural land.

Among these rural residents are the native Americans. There are many arguments concerning the plight of the American Indian and the responsibilities that society should bear. In this case however, it is the relationship of native peoples to renewable natural resources which is of particular interest to the study. Indigenous culture possesses a wealth of information and practice which is of the utmost importance to all people of the region. Skills in crop and animal production, preparation of medicines from wild species, understanding of tropical ecosystems, biological indicators of ecological processes, and many other factors suggest that a two-way exchange of knowledge and methods between native and modern cultures is warranted.

Achieving better balance in development through the sustained productivity of the natural ecosystems requires a complex and multi-faceted effort. A key task among these is to prepare people with a philosophy, a set of tools, a language, and an approach which permit innovative and creative formulation and implementation of solutions to problems, and which create opportunities for development.

Status and Trends of Renewable Natural Resources in the Region

The study region covers an extensive and an ecologically, economically and socially diverse portion of the world. In this chapter the status and trends of tne renewable natural resources and environmentally related problems of the region are reviewed by resource types. Conclusions are then drawn to substantiate training needs for the coming decades.

Comprising the total of 38 distinct political units in the study area are 29 independent countries plus the territories, dependencies and overseas departments of France, Netherlands, the United Kingdom, and the United States, as shown in Figure 1. The basic characteristics of these nations and territories are given in Table 1.

Ecological Zonation of the Region

Latin America and the Caribbean impinge upon three continents: North America, South America and Antarctica. At the extreme northern end of the region Mexico, lying within North America, pertains in great part to the nearctic: at the opposite end, extensive territories are claimed by Argentina and Chile on the Antarctic continent.

Aside fro- Antarctica the study area covers more than 20 million square kilometers of land. Three-fourths of South America is covered by tropical and sub-tropical forests. Mountain landscapes run the length of Central and South America and dominate most of the Caribbean islands. Deserts are abundant in the Southern Cone countries, Peru and Mexico. Grasslands reach their

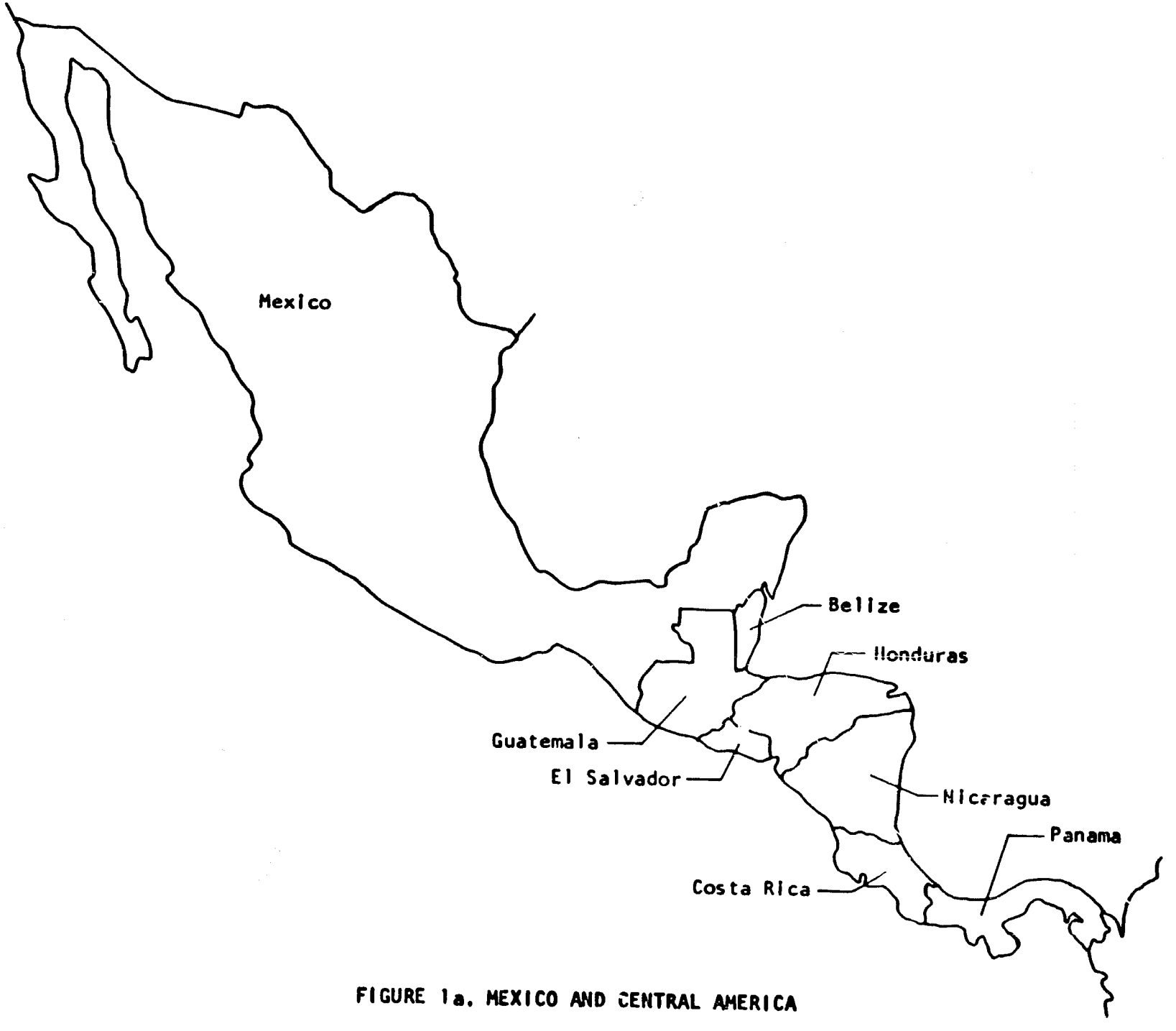


FIGURE 1a. MEXICO AND CENTRAL AMERICA

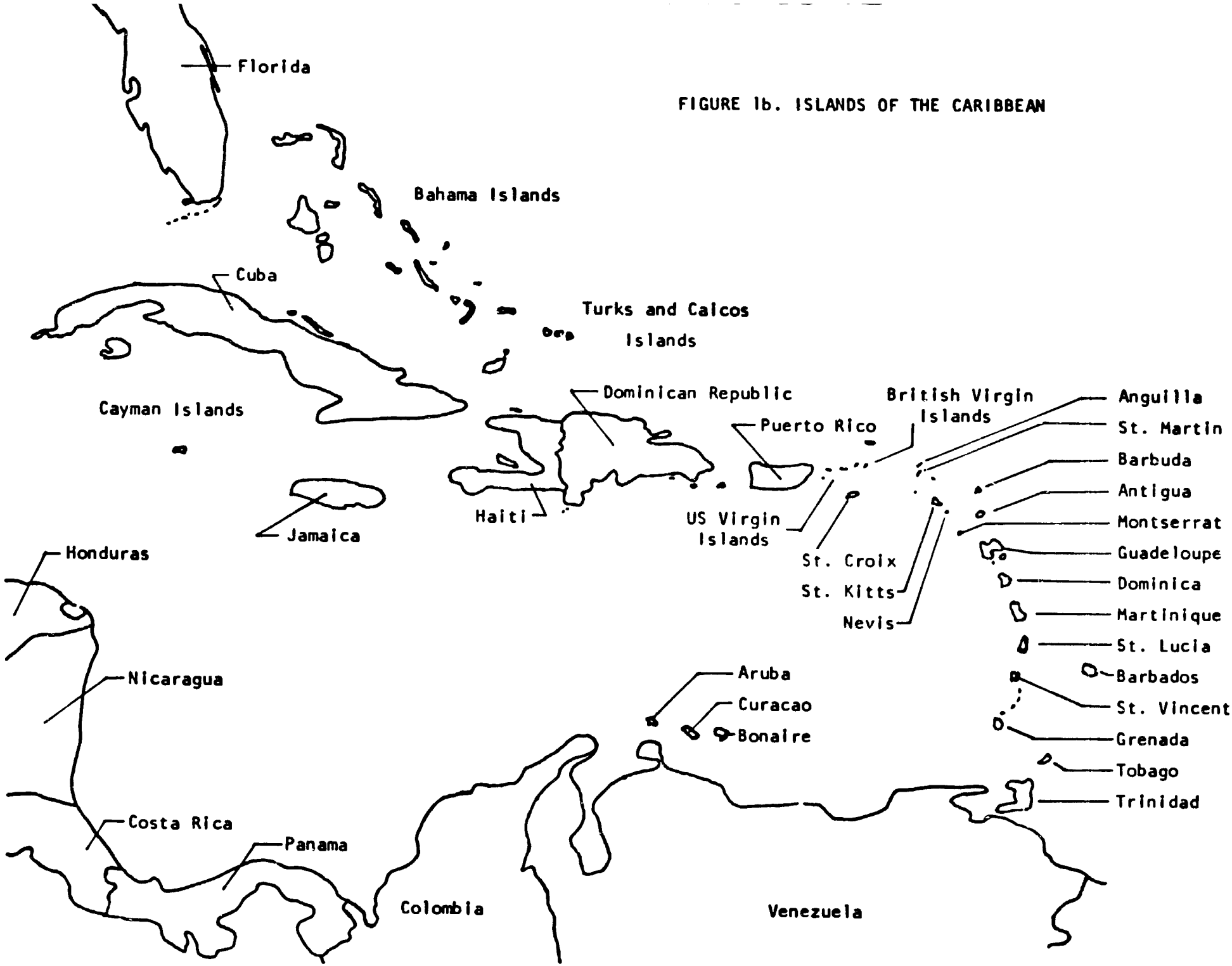


FIGURE 1b. ISLANDS OF THE CARIBBEAN

FIGURE 1c. SOUTH AMERICA

TABLE I

REGIONAL TRAINING PROJECT

NATIONS AND TERRITORIES OF LATIN AMERICA AND THE CARIBBEAN:
THEIR AREA, POPULATION, POPULATION DENSITY AND GROWTH, AND PER CAPITA INCOME

REGION / COUNTRY	Surface Area [2] (km²)	Population [1] (thousands)	Density (pers/km²)	Population Growth [3] (%)	Income per Capita [2] ($US)
NORTH AMERICA					
Mexico	1,958,201	65,421	33	3.5	991.4
Total/Average	1,958,201	65,421	33		
CENTRAL AMERICA					
Belize	22,965	140 [2]	6	3.1 [4]	
Costa Rica	50,900	2,111	42	2.6	1,048
El Salvador	21,156	4,524	214	2.6	604
Guatemala	108,889	6,839	63	2.0	898
Honduras	112,088	3,439	31	3.3	514
Nicaragua	148,000	2,559	17	3.5	857
Panama	77,082	1,823	24	3.1	1,271
Total/Average	541,080	21,435	40		
CARIBBEAN					
British Antilles	2,173	357 [2]	164	1.0 [5]	
Dutch Antilles	992	240 [2]	242	1.7 [5]	1,590 [4]
American Antilles	345	96 [2]	278	1.5 [5]	
Bahamas	13,935	220 [2]	16	3.9 [2]	2,600
Barbados	430	263	611	0.2 [2]	1,654
Cuba	114,524	9,718	85	1.6 [5]	800 [4]
Dominica	751	80 [2]	107	1.1 [5]	410 [4]
Granada	344	108 [2]	313	0.4 [2]	440
Guadaloupe	1,780	334 [2]	188	1.6 [5]	240
Haiti	27,750	5,534	199	1.7	188
Jamaica	10,962	2,102 [3]	194	1.7 [5]	1,204 [4]
Martinique	1,100	346 [2]	315	1.5 [5]	1,540 [4]
Puerto Rico	8,897	3,468 [2]	390	1.8	2,472
Dominican Republic	48,442	5,658	117	2.9	837 [4]
Saint Lucia	616	120 [2]	181	1.6 [2]	530 [4]
Trinidad & Tobago	5,128	1,200 [2]	234	1.0	1,329
Total/Average	238,169	29,844	125		
SOUTH AMERICAN ANDES					
Bolivia	1,098,581	5,285	5	2.7	484
Colombia	1,141,736	25,614	22	2.8	612
Ecuador	270,670	7,543	28	3.4	619
Peru	1,285,216	16,821	13	2.8	889
Venezuela	916,490	13,989	15	3.1	2,083
Total/Average	4,712,693	69,252	15		
ATLANTIC					
Brazil	8,511,965	119,477 [2]	14	2.8 [e]	1,090
French Guyana	90,000	58 [3]	0.6	1.5 [e]	
Guyana	214,970	803 [3]	4	1.9	538
Paraguay	406,752	2,888 [3]	7	2.9	520
Surinam	103,265	461 [3]	3	3.2	1,370
Total/Average	9,386,952	123,687	13		
SOUTHERN CONE					
Argentina	2,776,656 [b]	26,395	10	1.3	1,720
Chile	624,593 [b]	10,732 [2]	17	1.9 [e]	1,314
Malvina Islands	12,173	2	0.2	1.0	
Uruguay	176,215	2,886	16	1.2	1,331
Total/Average	3,589,637	40,015	11		
SOUTH AMERICA /Average	17,689,282	232,954	13		
LATIN AMERICA AND THE CARIBBEAN /Average	20,426,732	349,654	17		
ANTARCTIC					
Argentina	990,727 [c]				
Chile	1,250,000 [d]				

Source: 1) CEPAL (1978), 2) World Almanac (1980), 3) OEA (1977), 4) World Bank Atlas (1976), 5) UN World Demographic Yearbook (1976).

Notes:
a) Information corresponds to 1977 or 1978.
b) Continental area, without Antarctic territories.
c) Without Malvina Islands, but including terrestrial components of other claimed islands.
d) There is some overlap with territories claimed by Argentina.
e) Estimates by M.J. Dourojeanni.

most extensive development in Argentina, and Argentina and Chile feature sub-antarctic landscapes.

The Holdridge "Life Zone Classification System" (1978) is the most widely employed method for the ecological classification of land resources in the region. J. Tosi and his colleagues have applied the system throughout the American tropics. The system is easily utilized in the field and is particularly useful for orienting land use planning, especially integral rural development.

For purposes of this study, however, the Udvardy Classifications System (1975) will be utilized. The territory of Latin America and the Caribbean pertains to the Neotropical, Nearctic, Oceanic and Antarctic Realms (with 47, 5, 1 and 3 Biogeographic Provinces, respectively).

The extent and distribution of each biogeographic province in the study area are shown in Table 2. These approximations are taken directly from the Udvardy map *(op. cit.)*, and are useful in apprehending the relative magnitude of each major ecological type. The provinces which cover the greatest territory (outside of Antarctica) are Amazonian (2,500,000 km^2), Humid Brazilian Forest (1,900,000 km^2), Campos Cerrados (1,800,000 km^2), Madeiran (1,600,000 km^2), Gran Chaco (1,100,000 km^2), Monte (1,000,000 km^2), Coatinga (900,000 km^2), Guyanan (800,000 km^2), Cordillera Madre (700,000 km^2), Patagonian, Southern Andes and Yungas (600,000 km^2 each), and Puna, Argentine Pampas, Uruguayan Pampas and the Chihuahuan (approximately 400,000 km^2 each). Those provinces which

TABLE 2

REGIONAL TRAINING PROJECT

BIOGEOGRAPHIC PROVINCES AND THEIR AREAS
FOR LATIN AMERICA AND THE CARIBBEAN

Región	Provincia biogeográfica	Código	Superficie (km.2)	% de la superficie de la Región
NORTE AMERICA	Campechana	8.1	186,225	9.5
	Yucatanense	8.15	51,308	2.6
	Costanera	8.14	170,363	8.7
	Sinaloense	8.13	162,538	8.3
	Californiana	1.7	27,806	1.4
	Sonorense	1.8	178,392	9.1
	Chihuahuense	1.9	364,617	18.6
	Cordillera Madrense	1.28	610,371	31.2
	Tamaulipana	1.10	206,395	10.5
Total			1'958,201	100.0
CENTRO AMERICA	Campechana	8.1	76,809	14.2
	Balsense	8.2	68,275	12.6
	Addirtes Central	8.16	320,893	59.3
	Cordillera Madrense	1.28	75,103	13.9
	Isla Cocos	8.43	32	-
Total			541,112	100.0
CARIBE	Bahamas Bermudas	8.38	14,265	6.0
	Cubanense	8.39	114,524	48.1
	Gran Antillanense	8.40	96,051	40.3
	Pequeña Antillanense	8.41	12,029	5.1
	Guyanense	8.4	1,300	0.5
Total			238,169	100.0
ANDINA	Cordillera costera	8.3	179,534	3.8
	Guyanense	8.4	142,223	3.0
	Amazonense	8.5	1'080,423	22.5
	Madalenense	8.6	140,438	3.0
	Bosque seco Venezolano	8.17	230,451	4.9
	Bosque deciduo Venezolano	8.18	42,886	0.9
	Bosque seco Ecuatorial	8.19	73,874	1.6
	Desierto del Pacífico	8.24	164,002	3.5
	Llanos	8.27	401,993	8.5
	Campos llanuras	8.28	89,341	1.9
	Montano Colombiano	8.34	154,105	3.3
	Yungas	8.35	620,642	13.2
	Puna	8.36	372,014	7.9
	Andes del Norte	8.33	261,598	5.6
	Andes del Sur	8.37	218,669	4.6
	Gran Chaco	8.21	398,223	8.5
	Campos cerrados	8.30	97,553	2.1
	Monte	8.25	4,713	0.1
	Lago Titicaca	8.47	8,300	0.2
Total			4'712,693	100.0
ATLANTICA	Guyanense	8.4	706,726	7.5
	Amazonense	8.5	1'433,327	15.3
	Madalenense	8.6	1'505,948	16.0
	Sierra del mar	8.7	215,955	2.3
	Bosque húmedo Brasileño	8.8	1'851,858	19.7
	Planalto Brasileño	8.9	240,799	2.5
	Caatinga	8.20	917,229	9.8
	Gran Chaco	8.21	266,445	2.8
	Campos limpios	8.28	89,822	1.0
	Babacu	8.29	267,554	2.9
	Campos cerrados	8.30	1'700,881	18.1
	Pampas Uruguayos	8.32	170,088	1.8
Total			9'356,952	100.0
CONO SUR	Bosque húmedo Brasileño	8.8	23,372	0.8
	Bosque Valdiviano-Magallánico	8.10	134,457	3.7
	Nothofagus Chileno	8.11	117,187	3.3
	Gran Chaco	8.21	426,809	11.9
	Araucano Chileno	8.22	24,671	0.7
	Esclerophylo Chileno	8.23	56,743	1.6
	Desierto del Pacífico	8.24	74,013	2.1
	Monte	8.25	1.030,016	28.7
	Patagoniano	8.26	579,770	16.7
	Pampas Argentinas	8.31	444,079	12.3
	Pampas Uruguayos	8.32	256,579	7.2
	Andes del Sur	8.37	388,493	10.8
	Puna	8.36	28,448	0.8
Total			3'589,637	100.0

Source: Udvardy (1978)

Note: Table is based upon the Map by M. Udvardy. Given the scale, these numbers serve only to indicate relative size and percent of coverage.

cover less than 100,000 km^2 include the Yucatecan, Californian, Panamanian, Bahamas-Bermudan, Lesser Antilles, Ecuadorian Dry Forest, Venezuelan Deciduous Forest, Chilan Araucaria Forest and Chilean Sclerophyll. Not shown in the Table are small and isolated units that are nonetheless of considerable importance, including the islands of Cocos, Juan Fernandez, Galapagos, Fernando de Noronja, Trinidad del Los, Revilla Gigedo, and Lake Titicaca.

Significant is the high ecological diversity of the region. Few biogeographic province types make up more than 20% of the sub-regions of the study. The majority of the provinces cover 5% or less of their respective sub-regions. In just the Andean sub-region (including the Galapagos) 20 provinces are represented.

Population, Demography and General Economic Welfare

In 1977, Latin America and the Caribbean region had a *population* of approximately 350 million inhabitants. Population has been growing at 2.8 percent annually, and it is expected that the rate will be dropping to around 2.5 percent in the 1980's. By the year 2000 the region's population is expected to reach some 600 million, which implies an average density of 30 inhabitants per square kilometer. Maximum density will be found in the Caribbean with some 195 persons/km^2 and the minimum will be found in the Southern Cone countries at some 14.3 persons/km^2. By that time, some 75 percent of the population will live in cities of more than 10,000 habitants, and about 53 percent will live in cities of over 100,000.

Presently, the population of the continent has a *per capita gross national product* of US$ 1,100 which represents, on the average, a relatively low standard of living. It is expected that the per capita share of the gross national product will double by the year 2000.

Nutrition levels are appreciably better than other countries with developing economies, but still some 56 percent of the children less than 9 years of age receive deficient diets.

Land Use

Current *land use* in the region is shown in Table 3. It is comprised of 9 percent arable, 26 percent in natural pastures, 49 percent in forests and 16 percent non-arable including urban, industrial and infrastructure developments. In other words, no less than 35 percent, and perhaps as much as 45 percent of the territory has already had the natural vegetation removed or the former natural ecosystems have been appreciably altered.

The natural *capacity of the soils* of the region for agricultural production is generally low, reaching realistically between 8 and 16 percent of the total area. Several sources estimate optimistically that as much as 27 to 32 percent of the land area can be cultivated, but use of these additional lands--without significant deterioration--would require the application of high and costly technology and very favorable socio-economic and cultural conditions. In addition, only about 65 percent of the lands considered to be currently arable, are actually harvested

TABLE 3

REGIONAL TRAINING PROJECT

PRESENT LAND USE IN
LATIN AMERICA AND THE CARIBBEAN

Regiones / Países	Tierras arables		Tierras cosechadas		Cultivos permanentes		Pastos		Bosques y Similares		Otros	
	Superficie (km2.)	%	Superficie (km2.)	% de arables	Superficie (km2.)	% de arables	Superficie (km2.)	%	Superficie (km2.)	%	Superficie (km2.)	%
N. AMERICA												
México	232,200	12.1	151,900	65.5	15,200	6.5	744,900	38.7	707,600	36.8	238,900	12.4
Total/Promedio	232,200	12.1	151,700	65.5	15,200	6.5	744,900	38.7	707,000	36.8	238,850	12.4
C. AMERICA												
Belice	510	2.2	408	80.0	190	37.2	210	0.9	10,130	44.3	11,960	52.4
Costa Rica	4,900	9.7	3,631	74.1	2,070	42.2	15,580	30.6	25,007	49.4	5,130	10.1
El Salvador a)	7,310	35.3	7,340	100.4	2,240	30.5	6,130	29.4	2 630	12.6	4,680	22.6
Guatemala	18,000	16.7	13,920	77.3	3,500	19.4	8,600	8.2	58,800	53.6	22,090	21.6
Honduras	9,150	8.2	7,590	82.9	1,850	20.2	20,000	17.9	71,000	63.5	11,740	10.6
Nicaragua	15,050	13.6	7,450	49.5	1,760	11.6	33,840	28.5	62,880	52.9	7,040	5.9
Panamá	5,660	7.5	3,640	64.3	1,150	20.3	11,610	15.3	41,560	54.6	17,160	22.5
Total/Promedio	60,380	11.9	43,979	74.1	12,760	21.5	96,140	18.9	277,130	53.3	80,850	15.6
CARIBE												
Antillas Británicas	440	20.7	368	80.0	80	19.1	140	6.6	390	18.3	1,160	54.6
Antillas Neerland	80	8.3	64	80.0	---	---	---	---	---	---	880	91.7
Antillas USA	60	17.6	48	80.0	10	16.6	90	26.5	20	5.9	170	50.0
Bahamas	160	1.6	128	80.0	140	87.5	10	0.1	3,240	32.2	6,660	66.1
Barbados	330	76.7	264	80.0			40	9.3			60	14
Cuba	31,500	27.5	20,880	66.2	6,700	21.2	27,700	24	20,300	18	35,020	30.6
Dominica	170	22.6	8,540	5,023.5	100	1.1	20	2.7	350	46.7	210	28
Granada	160	47.1	118	80.0	140	87.5	10	2.9	40	11.8	130	38.2
Guadalupe	480	27.2	384	80.0	90	18.8	210	11.9	790	39.8	370	21
Haití	8,700	31.6	10,370	119.2	3,350	32.3	5,200	18.9	2,000	7.2	11,660	42.
Jamaica	2,630	31.5	1,760	66.4	600	22.8	2,100	19.4	4,920	45.4	1,160	10.7
Martinica	260	34.5	208	800	190	73.0	250	23.6	280	25.4	270	25.5
Puerto Rico	1,590	17.9	1,193	750	620	39.0	3,340	37.7	1,710	19.3	2,220	25.1
R. Dominicana	12,300	25.4	9,913	80.6	3,500	28.45	14,800	30.6	11,340	22.8	10,240	21.2
Santa Lucía	170	27.9	136	80.0	120	70.5	20	4.9	110	18	300	49.2
Trinidad y Tobago	1,570	30.6	943	60.0	870	55.4	110	2.1	2,280	44.1	1,190	23.2
Total/Promedio	60,630	25.9	55,175	91.2	16,500	27.2	54,030	23.1	47,220	20.2	71,700	30.7
ANDINA												
Bolivia	33,050	3.0	10,890	32.9	850	2.5	271,000	25.0	562,000	51.8	219,420	20.2
Colombia	35,050	5.3	62,470	77.1	15,700	28.5	175,500	16.9	771,990	74.3	24,250	3.5
Ecuador	50,890	18.4	17,980	35.3	11,000	21.6	22,000	7.9	148,500	53.6	55,450	20
Perú	34,330	2.7	19,860	57.8	3,300	9.6	271,200	21.2	738 900	57.7	236,470	18.4
Venezuela	53,370	6.1	17,630	33.0	5,570	10.4	168,200	19.1	479 700	54.4	160,680	20.4
Total/Promedio	226,640	5.0	108,830	48.0	36,420	16.0	908,000	19.9	2'700,130	59.2	728,270	15.9
ATLANTICA												
Brasil	726,889 b)	8.6	458,200	63.2	84,200	11.6	1'660,000	19.6	4'760,472	56.4	1'299,310	15.4
Guayana Francesa	30	0.03					50	0.06	88,010	89.7	9,960	10.2
Guyana	3,790	1.9	2,080	54.8	150	3.9	9,990	5.1	181,900	92.4	1,170	0.
Paraguay	11,200	2.8	10,720	95.7	1,700	15.1	150,000	38.0	204,000	51.3	31,100	7.
Surinam	460	0.3	590	128.3	100	16.9	100	0.1	143,000	88.3	17,910	11.
Total/Promedio	740,369	7.9	471,590	63.7	86,150	11.6	1'221,140	19.6	5'378,382	57.3	1'358,550	14
CONO SUR												
Argentina	288,000	12.8	277,430	73.2	100,000	28.5	1'435,000	52.4	602,200	22.0	349,490	12.
Chile	58,280	7.8	20,210	34.6	1,980	3.3	118,000	15.7	206,840	27.7	365,660	48.
I. Malvinas							12,000	99.0			170	1.
Uruguay	19,100	11.0	12,720	66.5	600	3.1	135,500	78.0			19,020	11.
Total/Promedio	427,380	11.6	310,360	72.6	102,580	24.0	1'700,500	46.3	809,040	22.0	734,360	20.
SUR AMERICA	1'394,439	7.9	890,800	63.9	225,150	16.1	4'429,020	25.3	8'257,542	30.7	2'821,160	16.
AMERICA LATINA y CARIBE	1'747,839	8.5	1'141,854	65.4	269,610	15.4	5'324,780	26.3	9'912,892	49.1	3'211,730	15.9

Notes: Information corresponds to 1977

a) In El Salvador and Haiti, the area cropped is greater than the arable. The cropped area is used.

b) The cropped area was estimated based upon the projections of FAO, with the same true for arable land in Brazil. When data are not available from FAO (1978d), they are estimated by M. J. Duorojeanni (in the case of the Caribbean Islands)

Source: Based upon the Anuario FAO de la Produccion (FAO, 1978d), but the column on croppable lands was calculated for 1977 based upon FAO material for the Agriculture 2000 study, with the same being the case for arable lands in Brazil.

on an annual basis, and yields are several times below the potential returns to be expected. This points to the importance of increasing the productivity of existing open lands versus the often suggested alternative of expanding the agricultural frontier.

By the year 2000, agriculture will have to occupy somewhat more than 14 percent of the land to meet the needs of the population. Thus, all lands which can theoretically support agriculture will be in crop use. It is significant to note that much of this land is currently under livestock production which is managed in ways as to provoke considerable soil and water degradation.

Livestock management is the human activity which has greatest environmental impact in the region. It is characterized by its low level of technical development and practice, and its use of an enormous extension of land principally at the expense and detriment of forests. If the numbers of livestock, including cattle, sheep, goats and horses, continue to increase according to present trends, there will exist by the year 2000 some 480 million head. Assuming an intensification of management from 0.58 head/ha to 0.69 head/ha, the pasture lands under livestock utilization will reach about 34 percent of the continent, that is, an area greater than that covered by forests in the year 2000. Other estimates suggest lower rates of increase of livestock, which in turn will imply a lower portion of the land in pasture.

At present, the *expansion of agriculture and livestock* is done at the expense of natural forests. Irrigation and drainage activities occupy a relatively insignificant portion of the region.

The current land actually occupied in forests is controversial. A reasonable estimate suggests some 991 million hectares of which about 681 million correspond to dense tropical forests, 81 million to dense temperate forests and 229 million to low-density forest. By the year 2000 it is estimated that the forest cover will be reduced to around 673 million hectares, with 524 million in dense tropical forests, 72 million in dense temperate and only 77 million in low-density forests which will be the forest type most affected by the expansion of grazing. This future scenario would imply that only 33 percent of the region will remain in forest cover by the year 2000.

The *non-arable lands* and others without potential for agriculture will cover about 18 percent by 2000. This increase, from 16 to 18 percent, will arise principally as a result of desertification, accelerated water and wind erosion, salinization, and urban and industrial expansion. It is expected that around 22 million hectares of the dry non-arable lands will be under irrigation by 2000, from which the major part of the agricultural production will be yielded.

Even though the major part of the new arable lands, in absolute terms, will be procured in the Brazilian Amazon and other lower sectors of the basin, a relatively large sector will be drawn from the upper Amazon. This Eastern Slope of the Andes is particularly fragile and its opening to agriculture can be expected to carry disastrous ecological consequences. A similar situation will result in Central America, where, as in the rest of the

region, agricultural expansion is achieved primarily at the expense of forests which are required for soil and watershed protection rather than for wood production. Livestock expansion will occur basically on savannah lands and sparse forests rather than the tropical dense forests. Certain ecosystem types are in danger of total disappearance through agricultural and livestock expansion, including the *Araucaria* forest of Brazil, the *Podocarpus* in various areas, and several forest types in Southern Chile.

Erosion is the chief cause of *soil loss*. Water borne erosion has already lead to severe levels of soil movement over major portions of several countries of the region. *Desertification* affects some 20% of the region, and it is advancing rapidly. Also, the inappropriate management of water in irrigation projects is causing salinization and alkalinization to 8% of the region. Additionally, the loss of soil fertility, urban development, contamination and natural disasters contribute to the loss of soils.

Typically, the response to the loss of crop lands is to clear forests to gain more land. Major investments in agricultural development go into costly irrigation works. Agrarian reform, which could contribute to the intensification of land use has been implemented only partially and in few countries. Reforestation, which could serve to recover lands that have been abandoned and abused, is incipient with 5 million ha currently and an additional 3 million expected by 2000.

The most forward thinking for agricultural production on land which has less-than-optimal characteristics suggest what can be

termed *integral rural development.* Under this approach the potential of forest, agriculture, livestock, wild fauna, fish, tourism and related products and services can be utilized. Among the important techniques to be employed are agroforestry, livestock grazing in association with forests, watershed management, integrated pest and disease control, management of natural forests, and similar technological packages. Particularly important is the serious consideration of native species versus the exotic, vegetable protein versus animal, various forms of fertilizers, microbiological farming techniques, and genetic engineering, all of which will become available and realistic in the last decades of this century.

Water

Water resources are abundant although they are not evenly distributed. Only 3% of the water resources and 8% of the hydroelectric potential of the region are utilized. Most water is consumed for agricultural uses. More than 80% of the urban population has access to potable water, but less than 30% of rural people have similar benefits. Moreover, taking volume of potable water per capita, urban people enjoy 5 to 15 times more water than rural dwellers.

It is expected that water use will grow 120% between 1977 and 2000, the major increment associated with industrial development. Large projects for water and hydro energy development can be anticipated. There will be considerable room for improving

water distribution based upon simple, inexpensive techniques in rural areas, and for water conservation in agricultural areas.

The *contamination of fresh and marine waters* is a serious problem in the region, although perhaps not in relation to levels found in other parts of the world. Petroleum exploitation, mining, metalurgy, pesticides and urban and industrial wastes are the principal sources of contamination.

Flora

Plants play a pre-eminent role in human nutrition--which is of particular relevance to Latin America and the Caribbean. Cereal production is limited to the temperate zones of the region. However, root and legume crops and hundreds of other species offer unique opportunities in terms of their high nutritional value and potential growth characteristics in ecologically diverse sites. The production of *livestock feed* through the hydrolysis of wood and related techniques, shrub species and combinations of pasture and forest fodders is also a great possibility which has received only limited attention. The exploitation of *tropical forests* is highly selective and can become more rational through integral utilization schemes. This would include large scale industrialization of wood cellulose through chemical processes as well as current mechanical means. *Medicines, drugs, gums, resins, ornamental uses* and *recreation* are among the other uses of plants that have been given minimal or poor consideration.

The *threat of extinction* bears heavily upon plants, and the list of eliminated floral species is already long. It is expected that by 2000, several thousands of plant species will have disappeared, many of which will not yet have been known to science. *Genetic erosion* will also affect many species and varieties of domestic plants which are presently underutilized. This will reduce alternatives for the genetic improvement of commonly used plant relatives. Diverse studies on the importance of the humid tropical *forest biomass* support concepts for integral utilization of forests. Yet, this same technology can lead to grave ecological problems in the environment if strict precautions are not adopted for resource management.

Fauna

The importance of *wild animal species* has been minimized. It has been demonstrated, however, that more than 85% of the animal protein of rural inhabitants of the Amazon and Orinoco valleys comes from hunting and fishing. Other wild life products are equally important especially in the utilization of *lands* which are marginal to agriculture. Examples include the production of vicuna wool in semi-arid *puna* and crocodile hides in low wetland areas. Other promising species include all those upon which (photographic and visual) tourism and sport and commercial hunting can be based. The use of wild fauna resources will depend upon the application of management programs based upon approaches which are technically and economically viable.

Importantly, it will depend upon the acceptance and demonstration of methods for sustainable management of wild resources which both maintain the species and ecosystem *and* which yield important products and services for rural social and economic development.

The same *domestic animal species* are utilized in the region as elsewhere. There is an important and diverse genetic base due to the early introductions of these species from the Iberian Peninsula . Native domestic species, especially the camelids and guinea pigs are also important in the mid Andean area. The stock of 5 million llamas and alpacas represent an outstanding opportunity for development in the central, high altitude Andean valleys.

The *extinction of species, sub-species and races of animals* (wild or domestic, terrestrial or aquatic) is a grave and growing problem. Wild species are disappearing primarily due to the occupation and destruction of their habitat with hunting only of secondary relevance. Marine and continental aquatic species will be affected as pollution grows, and if overfishing continues to spread. Domesticated species will be lost through simple lack of attention. The animal groups faced most significantly by mass extinctions will be the invertebrates, especially insects.

Fish

Fish resources are abundant in the region especially in the southeastern Pacific. The estimated potential of the near-shore fisheries is on the order of 34 million tons annually. Present year exploitation has reached 20% of the potential. While this clearly

leaves a wide margin, the inappropriate use of such fisheries as the anchovy has already reduced future opportunities. The status of whales is particularly alarming. Krill in the Antarctic seas has opened a new possibility which could yield between 15 and 50 million tons/year on a sustained yield basis. Continental fishing yields only 170,000 tons, and will continue to fall unless management measures are adopted.

Ecosystems

It can be expected that many *unique ecosystems* will be severely reduced by 2000. This will result from general human development activities, especially grazing and agriculture and to a lesser extent, forestry, pollution, tourism, among others. Examples of endangered ecosystems include the podocarp forests, southern Chilean forests, araucarian forests, mangrove forests, coastal formations in Chile and Peru, the Galapagos Islands and the Matogrosso wetland.

Even with the rate of development and land clearing around the region, the rate of establishment of national parks and other types of conservation units in the last 10 years is remarkable. Protected areas have increased by 670% between 1970 and 1980, presently covering 1.63% of the region. Extension of protection to genetic resources and natural representative areas is imperfect. There are no reserves in 7 biogeographic provinces, and many other major ecosystems have only minor coverage. Importantly, 34% of the conservation areas are smaller than 10,000 ha.

The Andean sub-region has the most complete coverage, but a large number of these areas which carry the responsibility for nature protection are only partially managed. Lack of public understanding on the role and importance of these areas leaves open the possibility that recent successes in the establishment of new areas could be reversed. In looking at projects for new areas, it can be expected that protected areas will double by 2000.

Minerals

The region has vast mineral resources, especially in bauxite, copper, silver, tin, among others. The trends indicate that the region will expand its mineral exports through and beyond 2000. Negative environmental impacts from mining and mineral handling can be expected to increase.

Energy

The supply of energy is of critical importance to environment and development in the region. The major source of electric energy is from hydroelectric (58%) and thermoelectric (41%) facilities. Potential sources could reach 67% hydroelectric, 14% petroleum, 7% natural gas and 6% coal. It has been estimated that the petroleum reserves of the region could last, under present use levels and technology, some 30 years more.

Firewood and coal provide 31% of total energy consumption in the region, vegetable waste from sugar cane (bagasse) 9 %, Petroleum

55%, and water and geothermic power 5%. Alternatives for the future suggest that non-conventional sources of energy, such as solar, geothermic, biomass and all classes of organic wastes, among others, will supply between 11 and 26% of the region's total energy requirements. Biomass will continue to represent the principal source of material although of relative decreasing importance.

Health

Many development activities affect *human and animal health.* The most common cases in Latin America and the Caribbean, as elsewhere, include the large scale water works. Malaria, Schistosomiasis, and other diseases are often associated with such projects. Highway developments facilitate the spread of diseases between areas under colonization and the forests. The example of rabies demonstrates the dilemna of how colonists are threatened with a dreaded disease, and how in turn, the incidence of rabies engenders reprisals against wildlife species which may carry the disease but which also play key roles in the surrounding ecosystems.

Native Cultures

The *native peoples* of Latin America and the Caribbean warrant special mention because of their role in forming the prehispanic and present cultures of the region. The people of the Andes and Meso-America had established major civilizations prior to European contact and have mixed with European races and culture since that time. Large mestizo populations are present today in both areas,

having integrated to greater or lesser extent into the national culture.

In the rural and remote areas of the region, reduced numbers of native peoples still practice indigenous, subsistence and largely pre-colombian systems of production. They speak native tongues and live in communities or tribal groups with social organizations clearly distinguished from the national culture.

The knowledge of native peoples is of importance to present and future resource management and development. Because of the long evolution of native production systems, what appear to be simple hunting, gathering, fishing and horticultural methods represent adaptations of technology and cultural ecology to particular settings and resources. Conservation practices have evolved over the centuries. Plant and animal species have been screened for their usefulness. Long experience of variations in climate, soils, biological forms and natural disasters has produced strategies for survival which have been incorporated into production systems.

The knowledge and technology of native peoples is of considerable interest and applicability to resource management, as suggested in Table 4. Present trends indicate, however, that the rural native peoples and cultures are being transformed and lost at an increasing rate. This is due to acculturation as natives move into western agriculture, cash economies and cities. Traditional lands are removed from native use and converted to modern activities.

TABLE 4

REGIONAL TRAINING PROJECT

EXAMPLES OF THE POTENTIAL USE OF NATIVE PEOPLES' KNOWLEDGE AND TECHNOLOGY

Example	Use
Native people:	
- distinguish among ecological zones often aggregated by Western science	Provide hypothesis for research and experimentation
- identify some species and varieties not yet classified by science	Identifications of plant and animal species and varieties
- know the immature and variant forms of plants and animal habits	Amplification of scientific knowledge
- aware of species interrelationships and cycles often not observed by scientists under field conditions	Discovery of new phenomena, provide hypothesis for research and experimentation
- know former biota of regions, and history of land use	Provide resource history over long periods of time
- know the occurrence and effects of natural hazards, including floods, earthquakes, drought and volcanic eruption	Provide information upon which to plan for risk from natural disasters
- know local geography, social organizations, land tenure	Orient research, management and development work
- know wide variety of plant species and varieties for use as food	Discovery of new food sources for rural development and entire society
- know sources of plant materials for wide variety of medicinal purposes	Discovery of new medicines for entire society
- possess methods for utilization of biomes, such as rain forests	Suggest options for sustainable use of fragile ecosystems

TABLE 4, continued

- possess methods for maintenance of a wide variety of cultivars of key food crops	Provide means to deal with environmental variation and natural disasters
- possess methods for cultivation of wild and domestic plants in various biomes	Provide opportunities for study of breeding potatoes, palms and other important plants, for use in particular biomes
- utilize conservation practices including terracing, irrigation and drainage systems	Transfer of conservation practices
- employ labor intensive techniques for construction, food production pest control, etc.	Appropriate technology
- possess skills for work in wildlands	Serve as managers and employers of natural protected areas
- possess experience and methods for multiple cropping and extensive land use systems	Support development of wildland management mechanisms for the preservation of cultivars while utilizing resources for integral rural development, particularly with communal land tenure systems

Perspectives

Land Use

Four alternative scenarios for future land use in the region are presented in Table 5. Alternative IV is regarded as the most pessimistic because considerable arable lands are placed under grazing, the forest cover is reduced drastically, and the amount of lands given up to "other" is maximum.

Alternative III is considered to represent the most probable outcome: in this case, the nations of Latin America and the Caribbean, taken together, would enter the 21st century with more than 60% of the land surface and ecosystems modified by man. Specifically forests will have been reduced to 33.3%, agriculture will have expanded to 14.4% and pasture will have replaced forest as the dominant landscape with 34.4% of the area. A large portion of the land, 17.8% which will be totally out of or only marginally relevant to biological production consists of destroyed landscapes, urban and industrial centers, and those areas in permanent snow and ice cover (desert and swamp areas form part of the "other" but may be biologically rich and environmentally significant).

Details of the probable scenario are shown in Table 6. Of the arable lands, 66% will be cropped annually, while the remainder will be in fallow. Ninty-two percent will be based upon dry-land farming techniques while only 8% will be under irrigation. Dense tropical forests will represent 78% of the forest cover, while the temperate dense forests and open forest formation types will each occupy 11%

TABLE 5

REGIONAL TRAINING PROJECT

SUMMARY OF ALTERNATIVES (I,II,III,IV)
FUTURE LAND USE IN LATIN AMERICA AND THE CARIBBEAN

Alternatives		1977				1990				2000			
		Arable	Pasture	Forest	Other	Arable	Pasture	Forest	Other	Arable	Pasture	Forest	Other
I	Hectares (millions)	143	532	1019	321	168	569	980	296	188	596	951	276
	%	7.1	26.4	50.6	15.9	8.3	28.3	48.7	14.7	9.3	29.6	47.3	13.7
II	Hectares (millions)	175	532	991	321	238	569	915	297	291	596	854	279
	%	8.7	26.3	49.1	15.9	11.8	28.2	45.3	14.7	14.4	29.5	42.3	13.8
III	Hectares (millions)	175	532	991	321	238	640	801	340	291	695	673	360
	%	8.7	26.3	49.1	15.9	11.8	31.7	39.7	16.8	14.4	34.4	33.3	17.8
IV	Hectares (millions)									165	1048	411	395
	%									8.2	51.9	20.3	19.6

Source: Dourojeanni, M.J. Estado de los Recursos Naturales Renovables de America Latina y el Caribe y sus Tendencias Informe de Consulta al Proyecto WWF/US-119. Lima, Julio 1980.

NOTE: Alternative I is based upon the simple projection of uncorrected data.
Alternative II combines data from trends and normative concepts, and is based upon corrected statistics
Alternative III is similar to II except for the allocation of forest grazing to the pasture category.
Alternative IV is based on an assumption which emphasizes grazing expansion to the greater detriment of forest and agricultural lands.

TABLE 6

REGIONAL TRAINING PROJECT

DETAILS FOR ALTERNATIVE III
FUTURE LAND USE IN LATIN AMERICA AND THE CARIBBEAN

Years	Arable Lands				Pasture	Forests			Other Land Uses		
	Cropped	Fallow	Dry	Irrigated		Dense Tropical	Dense Temperate	Open Formations	Arid	Rock, Ice Swamps, etc.	Urban
2000	193	98	269	22	695	524	72	77	251	109	
1990	153	84	219	18	640	592	77	132	232	108	
1977	118	57	162	13	532	681	81	229	214	107	

Source: Dourojeanni, M.J. Estado de los Recursos Naturales Renovables de America Latina y el Caribe y sus Tendencias Informe de Consulta al Proyecto WWF/US-119. Lima, Julio 1980.

Note: Figures shown are in millions of hectares

of the forested area. Finally, the deserts will comprise 70% of the "other" lands.

With the expansion of human activity, many natural ecosystems with relatively small surface areas will disappear. In their place, crops, pastures or forest plantations will be formed. The process will be more or less intense depending upon the quality of soils.

Agricultural expansion will be at the expense of tropical humid forests, and in considerable part, of dry dense or open forests. Many forests thought to be maintained owing to steep slopes and high rainfall will be occupied by agriculture and livestock.

Water and Air

While the use of water is expected to increase some 120% between 1975 and 2000, with industrial requirements expanding 320%, total aggregate demands will only utilize some 10% of the water available. However, the scarcity in major cities and entire subregions will be of special concern. Deforestation and erosion will exacerbate this grave situation.

The contamination of air in global terms is not a major problem. But in industrial and urban areas pollution is expected to reach levels which can affect human health.

Flora

Threats to plant resources arise from diverse situations. Up until a few centuries ago, the principal causes of genetic

erosion were natural; more recently, human activities have predominated. Among these recent causes are the expansion of the agricultural and livestock frontier, forest extraction, urban and industrial development, soil water and air contamination, and pesticides and fertilizers.

Of greatest concern is the indiscriminate clearing of forests. Entire groups of species are expected to go extinct. The tropical humid forest is particularly cause for alarm since under current land use practices, this richest of all biomes is incapable of regeneration. Massive species extinctions will reduce plant (and animal) materials by the thousands and perhaps as many as one million by the year 2000. With this will go potential foods, medicines and other substances of probable importance to nature and man.

Fauna

The majority of the animal species to face extinction will be invertebrates, a fact which will be noticed in terms of altering biological processes. To the extent that such species as the vicuna, guanaco, capivaras, crocodilians, deer, primates, among others, are managed to produce meat, hides, furs and for hunting and recreation, these species and their habitats can be expected to survive.

Large areas of lands generally marginal to domestic livestock can be utilized for the production of wild species such as the camelids. This alternative, already in process, can provide a

mechanism for sustainable rural development. Conversely, to maintain domestic livestock on marginal lands will foster erosion and the irreversible loss of options for rural peoples.

Fish

The region still has a margin for the expansion of fish production. However, prior to the year 2000 it can be anticipated that problems of over-fishing and pollution will place the region in a position similar to that of other continents.

Energy

To supply the growing demands for energy in the region, conventional energy sources like water power will play an increasing role. Petroleum-based energy will give way to non-conventional sources.

Biomass energy will supply up to one third of the total demand by 1995. From the current use of biomass for 50% of the total, the proportion will drop, but the absolute amount will double. That is, energy demands will increase at 6.5% annually while biomass growth is a mere 3.6% annually.

In 1995 the contribution of forests will continue to be major (30%) among the sources of biomass. Non-conventional sources, taken together, can be expected to contribute 11% of total requirements for the region.

Watershed management is crucial for maintaining options for water power and forest management for biomass production, rapid growth and renewal.

Ecosystems

Present scientific thought suggest that some 5-10% of the territories of each nation should be dedicated to a network of conservation units (national parks, reserves, and other types of protected areas). Small ecosystems and islands may require larger percentages, and very extensive ecosystems may need smaller portions as conservation units. With well placed reserves of sufficient size and appropriate shape it is assumed possible to ensure the survival of selected ecological processes and species.

To achieve this goal, between one and two million km^2 will have to be placed under permanent management as protected areas by 2000. Obviously, this survival process has an irreversible aspect to it since lands which have been altered and converted from wild state to other uses cannot be returned to the original form.

The trends of the last decade, during which the number of protected areas has doubled over that of the previous 70 years, and the area has increased seven times, suggest that it may be possible to reach the goal before the end of the century.

Native Peoples

Perspectives for rural native peoples are particularly negative. The removal of forest and expansion of agriculture and livestock carries the loss of traditional lands and ways of life. It also carries the loss of knowledge and techniques for the maintenance, use and development of natural resources for the benefit of total society.

Efforts to develop sustainable means for the use of natural resources would benefit from the establishment of cooperative work between resource managers and native cultures. Conversely, the disappearance of native cultures carries the loss of a myriad of wild and domestic species and land use methods and knowledge which are required by western culture.

A partnership is needed in which:

a) resource managers are trained to learn from and work with native people and to transfer native knowledge and techniques to resource development; and,

b) native peoples are trained to collaborate with resource management in key roles as employees in extension programs, protected area rangers and managers, technicians in agriculture, forestry and fisheries, reforestation, wildlife and watershed management, trainers, auxiliary researchers and environmental monitors.

Conclusions

The status and trends for natural resources and environmentally related problems in Latin America and the Caribbean, looking to scenarios for the year 2000, suggest several conclusions:

1. *Loss of soil resources.* The arable soils of the region are limited in extent and quality. Present usage is promoting accelerated erosion and extensive pasture. Food and water supplies are placed at risk.
2. *Desertification.* Vast areas of the region have been destroyed through inappropriate use. Deserts are being created and lands capable of sustaining forests, livestock and agriculture are going out of production.
3. *Destruction of Native Forests.* Forests are being rapidly removed to make way for livestock and agriculture. Yet biomass is key for energy production. Watershed and mountain slopes are critical to development and maintenance of water supplies and water power. Plant and animal species yet to be examined by science are endangered, and their values for food energy and medicine being foregone. Options for integrated rural development are lost and native cultures are decimated. On the whole, the benefits of these resources are forfeited in exchange for extensive livestock and subsistence agriculture, both in turn giving way to loss of soil and water and to desertification.
4. *Destruction of Coastal and Island Resources*

   The highest human population densities are found in the

Caribbean islands and along the region's coasts. Lands for food production and fresh water supplies are at a premium, and pollution of fresh water and marine resources is detrimental to fish production. The ecological and cultural variations indicate the necessity for appropriate approaches to development and resource management.

5. *Overfishing and Destruction of Fresh Water and Marine Resources* Certain fish stock are being over-fished. Pollution is affecting marine environments. The region needs increasing supplies of protein, and the appropriate management of fresh water and marine fish resources is critical to future nutrition.

6. *General Destruction of Natural Resource in Rural Areas*

Alternatives for food production, water management, integrated pest control, and mixtures of tree, annual crops and livestock are available. Research is required and techniques must be tested for each ecological region; meanwhile, however, available information does not reach rural dwellers. Damaging land use practices are perpetuated and standards of living erode unnecessarily.

7. *Inappropriate Development of Ecologically Fragile and Sensitive Ecosystems and Sites.* The natural resource wealth of the region can provide the basis for development. However, scarce soil resources face destruction and mis-allocation. While current inventory and evaluation efforts identify and orient investment opportunities for agriculture in specific

areas, protection forests, key watersheds, important wild areas and coastal habitats and other resources critical to sustainable development will require identification and evaluation on a large scale.

8. *Absence of Ecological Consideration in Development Planning.* Development of natural resources disregards fundamental ecological processes and natural elements. Planning methods and procedures deal principally with financial economic considerations. Short-run goals are exaggerated. Techniques and methods of resource utilization are unadapted to the highly variable ecological situations.

9. *Irreversible Loss of Key Natural Areas.* Genetic resources are disappearing at accelerating rates prior to their study and screening for potential uses. Ecosystems are being destroyed and environmental balances are expected to increase. Future needs for genetic engineering, biological pest control and monitoring require protected natural areas, research facilities and monitoring stations.

10. *Loss of Wild Plant and Animal Resources.* The region has contributed species to present world food production. There is every reason to suspect that hundreds of new species are potentially of value for many uses. Integral rural development will depend upon the identification of wild species, selection and the development of management techniques including domestication and wildlife management.

Chapter III.

Present and Planned Training Opportunities in Natural Resources and Environment.

Chapter III

PRESENT AND PLANNED TRAINING OPPORTUNITIES IN NATURAL RESOURCES AND THE ENVIRONMENT

Introduction

Review of the status and trends in the natural resources and environment of Latin America and the Caribbean has suggested 10 key environmental problems. If natural resources are to support development and permit it to be sustainable, the 10 areas require serious attention.

The existence of these problems is related to the social, political and economic factors which create the conditions of landlessness and poverty which have prevented realistic access for millions of people to the benefits of education, technology, health and other fruits of social and economic development. The environmental disharmonies are in part the result of lack of development. Inappropriate utilization methods and undeveloped technologies are also at the root of natural resource and environmental problems.

One practical means for producing change towards a harmonious relationship between humans and their environment is through education. The critical question becomes: are there enough people, trained in the appropriate skills and disciplines, to manage the natural resources for improving human welfare in this generation and leaving open options for those who follow?

This chapter will review both existing and planned training opportunities offered in the region. The characteristics of the training opportunities will be summarized.

Existing and Planned Training Opportunities

The study of existing and planned training opportunities in Latin America and the Caribbean faced the formidable task of examining educational facilities across an enormous and complex region in less than four months. In the past, surveys of this type have been carried out by individuals or by small teams which visited the entire study region, or they utilized the literature. This present study differs from others in its far broader terms of reference and scope, as explained in Chapter I. For the same individuals to have examined the entire region and visited the region's major training centers would have consumed 18 months of solid field time.

For this reason, 13 consultants and two research assistants were employed to study six sub-regions and the relevant international, regional and bilateral and non-governmental institutions. Within the time constraints, visits were made to key sites directly. Interviews and data collections were conducted in the languages of the countries and territories: Spanish, French, Portuguese and English. Certain information had to be obtained by telephone and through third parties. In some countries, so many activities were in progress that it was difficult to set limits on the scope of what was to be examined. It was not possible to maintain local consistency in the gathering and presentation of information.

In what follows, an attempt has been made to describe briefly the existing and planned training activities in natural resources and the environment in Latin America and the Caribbean. It was methodologically impossible to quantify the data in any meaningful manner. The individual schools are difficult to compare; content of courses with similar names differs considerably. Management agencies vary in their organization of and approach to the administration of natural resources. Educational systems among countries differ—expecially when comparing the Spanish group, Brazil, the English-speaking and French-speaking Caribbean, and the Dutch Antilles. The similarities among the Andean countries make it simple to summarize the vast numbers of training activities in a short space. In contrast, variations among Caribbean countries require considerable explanation.

The reader who requires greater detail and comprehensiveness of information is urged to examine Appendix I as well as the original documents presented by members of the team. On the whole, the reader is certain to be impressed by the quantity of current and planned activities in the region.

The six sub-regions of the study consist of:

Mexico--the country of Mexico

Central America--the countries of Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama

Caribbean-the Greater and Lesser Antilles, consisting of countries, overseas territories and dependencies.

Andean Group--the countries of Bolivia, Colombia, Ecuador, Peru and Venezuela

Southern Cone--the countries of Argentina, Chile, Paraguay and Uruguay

Brazil--the country of Brazil

Mexico Sub-Region

Training opportunities in Mexico offering curriculum and programs related to natural resource fields are provided by 27 major institutions of higher learning. Within the network of autonomous national universities and other centers, university and post graduate training is available in agronomy, agricultural engineering, forestry and biology.

Scientific research institutes focus upon an array of natural resource and environmental themes. In total, some 40 organizations feature work in: ecology, water resources, agriculture, forestry, livestock, biotic resources and fisheries. Research and training are oriented to specific biological areas of the country through field centers in arid and humid lands.

Innovative programs are available in a wide variety of environmentally-oriented topics. These include: ecodevelopment, third world economic and social development, appropriate technology, environmental health, environmental extension, solar energy, human settlements, marine biology and fisheries.

Several specific projects warrant mention. Management of selected regions based upon integrated ecological considerations (food production, protection of watersheds, flora and fauna, and appropriate technology) is one program. Marine resources are

under study to determine sustainable management practices. Specific pollution problems are being studied to develop control techniques consistent with the socio-economic context. Methodologies are being developed for the management and administration of ecosystems to favor conservation and environmental quality.

An extensive range of field research projects addresses environmental problems. These include the evaluation of policy for colonization in the humid tropics, protection and development of wildlife resources, effects of pollution on ecosystems, and the utilization of plant and animal resources.

Governmental agencies deal with natural resources and environment at both the federal and state level. The federal Secretaria de Agricultura y Recursos Hidraulicos contains the departments of soil and water conservation, forestry and wildlife extension, ecological protection and management, reforestation and forest soils and pasture management. Similar public departments exist at the level of each state.

Central American Subregion

The countries of Central America feature university and middle-level training opportunities. Regional programs provide post-graduate training and research, middle-level training and advanced tropical research.

Forestry is offered at five universities in the sub-region: some 95 graduates per year are taught by 59 faculty. Degree programs are available in Environmental Education, Ecology, Biology, Natural Resources Management and Marine Biology.

At the middle-level, one marine technician and three forestry schools are operating. One forestry school is expected to be expanded to a full university-level program.

Three training programs operate at the regional level. The Centro Agronomico Tropical de Enseñanza y Investigación (CATIE) at Turrialba, Costa Rica, features a post-graduate degree in Renewable Natural Resources taught by 10 full time faculty. Specialization is available in Watersheds and Wildlands Management, Tropical Forestry and Agroforestry. Nine students graduate annually of which 50% are from Central America. The Organization of Tropical Studies (OTS) operates several field stations in various environments of Costa Rica. Some six field courses, generally in the English language, are offered annually to approximately 90 post-graduate level students in topics related to tropical ecology. Undergraduate courses are taught in Spanish and English.

The Escuela Nacional de Ciencias Forestales at Siguatepegue, Honduras offers a Forestry Technician course. During 1981 this program is expected to be expanded to include several fields of specialization including tropical silviculture and watershed management. The three year program is expected to graduate 30 students per year.

The new Peace University of Costa Rica is currently developing an innovative approach to education. Programs will be oriented around major problem areas for the future. Natural Resources will comprise a basic unit. The University is linked to the United Nations University System.

Each country of the sub-region has governmental agencies charged with the management of natural resources. Departments of forestry, natural resources, fisheries, national parks and wildlife are responsible for resource utilization, the administration of reserves, parks and species, and the general enforcement of resource legislation. In several cases, the national electricity institutes also have responsibilities for watershed management. Tourism organizations collaborate in the use of natural area reserves. Approximately 495 professionally-trained individuals and 680 technicians are employed in these governmental departments.

Development projects in the sub-region relate to important natural resource and environmental topics. CATIE has field projects in fuelwood production, alternative sources of energy, and the use and management of wildland resources. FAO sponsors a fisheries project in Panama. Several watershed management projects are supported by USAID and FAO. An integral management project is being supported by USAID and the World Bank in Costa Rica on national forest and park development; it may include a biosphere reserve in the Osa Peninsula.

Caribbean Subregion

The Antilles are reviewed in order of the four language groups: English, Spanish, French and Dutch. For the most part, training is severely limited and many students seek opportunities outside of the sub-region (information on Cuba was not available).

Biology is an important field in the English-speaking universities. The several campuses of the University of the West Indies

and the College of the Virgin Islands (St. Thomas) serve students from the entire sub-region in this field. The latter also includes university-level work in Marine Biology. The Eastern Caribbean Institute of Agriculture and Forestry (ECIAF), in Trinidad, offers a two-year program for students from throughout the region. Six faculty work with some 10 students per year. At the graduate level, a masters program is expected to begin shortly in Fisheries at the Mona (Jamaica) campus of the University of the West Indies.

In the Dominican Republic, university-level courses in Biology and Agriculture graduate 12 and 30 students per year, respectively. Forestry-Technician training is also available. The University of Puerto Rico offers graduate work in Environmental Planning and Environmental Health.

A university-level program in Ecology is taught at Cayene. In Haiti, the university offers a course in Agriculture and a technician-level program in Agronomy and Soils. In addition, a center for the training of technicians in Watershed Management and Soils is sponsored by Switzerland, UNDP and FAO.

The universities in Surinam and Curacao do not offer courses in natural resource management, environment or biological sciences. Training is offered for graduate students at the Caribbean Marine Biological Institute. (Additional opportunities are probably offered but information was not available.)

Forestry departments manage forest, soil and water resources and protected areas in most of the English-speaking countries. Some 13 university-level foresters and 215 forestry technicians are

employed by these departments. In addition, the Parks and Beaches Commission of Barbados has three professionals and the Jamaican Natural Resources Conservation Department has 10 professionals and 27 technicians responsible for parks, marine, soil and fauna resources. The Institute of Marine Affairs of Trinidad-Tobago undertakes marine research and supports training.

The government of the Dominican Republic includes a high-level environmental commission to evaluate environmental impacts of industry, and an environmental secretariat of the Presidency advises on policy matters. Departments charged with particular resources include fisheries, forestry, national parks, soil and water, and watersheds. Combined, these organizations employ approximately 82 professionals and 250 technicians.

Puerto Rico features the U.S. Forest Service Institute of Tropical Forestry, which provides limited training and a broad set of research activities. Historically, this institute managed the Luguillo National Forest and a range of experimental areas.

In the French Caribbean, the national forestry department manages forests, soils, water, and coastal zones. Some 11 professionals and 80 technicians work among the several islands and French Guiana.

In Haiti, the Department of Agriculture, Natural Resources and Rural Development is responsible for natural resources. Special emphasis is given to irrigation and the control of erosion: seven watershed management projects are of importance for soil reclamation and water control. Some 13 professionals and 20 technicians are employed. Other Haitian institutions include the planning department

for land management, the mining department which deals with rehabilitation of mining zones, a world heritage institute and "Operation Koumbite", a private reforestation project.

The Netherlands Antilles feature a national parks foundation (STINAPA) and a fisheries department. These employ 13 professionals and 5 technicians. In Surinam, the foundation for nature preservation (STINASU) works in research and interpretation. The Forest Service is responsible for managing forests and nature reserves.

Development projects in the English-speaking countries include marine resources development plan in Anguilla; reforestation and fisheries survey and lobster research in Jamaica; environmental education on fishing methods in Grenada; and artificial reef development in St. Lucia. The Dominican Republic is preparing a national strategy for wildland management. Coral reef management and reforestation are important activities in the Netherlands Antilles. STINASU is implementing ecodevelopment tourism in the nature reserves of Surinam.

Some of the most advanced management and research on mangroves and coastal zones is taking place in the French Caribbean. One government project in Haiti is studying the traditional systems of agricultural production including extension and training activities. The seven watershed projects are supported by USAID, UNDP/FAO and the Interamerican Development Bank.

Andean Sub-region

The five Andean countries have the greatest number of university-

level programs. There are approximately 85 faculties of agronomy (agriculture, animal husbandry and veterinary medicine); 9 architecture; 55 Biology (Botany, Zoology); 3 Conservation Engineering; 12 Fisheries, 13 Forestry; 4 Education (on natural resources); 1 Ecology; 1 Water Resources; 3 Marine Biology; 1 Natural Sciences; 3 Geography; 2 Planning; 5 Geology; 3 Oceanography; 1 Natural Resources and 34 in Economics.

Peru serves as an example of student enrollment levels and professors in each faculty: 5,960 students are enrolled in Agronomy with 132 professors; 930 in Forestry with 65 professors; 1,675 in Fisheries with 102 professors; 2,800 in Biology with 173 professors; and 3,460 in Architecture with 250 professors.

At the post-graduate level are 18 master's programs: 1 in Agricultural Economics; 1 in Agriculture; 1 in Architecture; 6 in Biology; 1 in Ecology; 2 in Forestry; 2 in Marine Biology; and, 2 in Soils and Water Resources Engineering. One doctoral-level program is offered in Sciences.

One technician-level school is available in Agronomy, 4 in Forestry and 3 for Forest and Park Guards.

Typically, responsibilities for the management of natural resources (forest, water, parks and wildlife) rest with the ministries of agriculture and departments of forestry. An exception is Venezuela with its ministry of environment and renewable natural resources. Again, Peru illustrates the numbers of personnel involved in managing public natural resources: 101 professionals are responsible for forestry, wildlife, water and soils; 542 technician-level personnel work in

these fields. The department operates 21 conservation areas.

Each country has a variety of other public agencies to cover resource evaluation and mapping, remote sensing, personnel development, colonization and water resources development. Regional development corporations have been established to manage river basins and key regions requiring restoration or regulation.

Several selected development projects in the Andean countries suggest excellent opportunities for relating research and management to training. The Interandean Valley Rural Development project in Bolivia is supported by the Instituto Frances de Estudios Andinos and the Centro Internacional de Cooperacion para el Desarrollo Agricola. A forestry plantations program is being supported by private interests.

In Colombia, a non-governmental organization, ACUA, together with the World Wildlife Fund/US is supporting the Merenberg Project designed to study and promote reforestation with native species, ecodevelopment and appropriate technologies.

The Centro de Investigaciones de Zonas Aridas (CIZA) and the Universidad Nacional Agraria of Peru have a project for arid zone management, research and training. The Oficina Nacional de Evaluacion de Recursos Naturales (ONERN) is defining the optional use of the nation's natural resources.

The Projecto Especial de Utilizacion Racional de la Vicuña of the Dirección General Forestal y de Fauna is working to reestablish the vicuna in the high-altitude valleys of the Andes. Through management of the wild species, meat, wool and hides are being

produced to provide economic benefits to the local rural peoples without degradation to soils and vegetation as is typical of domestic grazing in the same areas.

The Fundacion para la Defensa de la Naturaleza (FUDENA) of Venezuela promotes the protection of habitats, the conservation of endangered species, and environmental education. The Instituto Venezolano de Investigaciones Cientificas (IVIC) is involved in research on important ecosystems in various biomes and collaborates in several projects of UNESCO's Man and the Biosphere Program.

Brazilian Subregion

Training programs in Brazil have been expanding dramatically to cover environmental topics. At the undergraduate level, 36 faculties in Biology, 25 in Agronomy, 8 in Forestry and 6 in Environmental Health are available, along with 5 in Sciences, 3 in Ecology, and one each in Fisheries, Geography, Oceanography, Soils and Water.

Graduate programs are offered in all major fields: (4) Botany, (7) Ecology, (8) Biology, (1) Fisheries, (4) Entomology, (9) Plant Physiology (3) Rural Sociology, (4) Soil Conservation, (4) Animal Husbandry, (2) Biochemistry, (1) Biophysics, (1) Physiology, (1) Water, (3) Microbiology, (13) Agriculture, (3) Zoology, (1) Natural Resources, (1) Oceanography, (8) Forestry, (1) Remote Sensing, (1) Food Science and (1) Rural Economics.

There is one technician-level school in Forestry and Agriculture.

Brazil's largest need for training is at this level.

Responsibilities for renewable natural resource management at the national level are within the Instituto Brasileiro de Desenvolvimento Florestal (IBDF). IBDF has recently completed a Wildlands Strategy for their Amazon territory, and is rapidly and successfully implementing it. Many of the states also have environment-related divisions within their respective Secretaries of Agriculture.

Hundreds of short courses are offered annually at different technical levels including: administration of renewable natural resources, environmental health, water pollution, ecology, and env. nmental education. Over the past five years numerous symposia, seminars and congresses have been held on an array of topics including ecology, botany, fauna, biology, renewable natural resources, national parks and the environment.

Southern Cone Sub-region

Taken together, the four countries of the Southern Cone offer an extensive selection of educational and training opportunities. Many institutions offer both technical and university-level courses as well as general and specialized degree programs. An advanced degree program in ecology is part of the curriculum at the Universidad Nacional de Cordoba, in Argentina. At the technician level, Chile alone has seven institutions that offer training programs. The emphasis in these courses is on silvicultural and harvesting techniques using exotic species. To supply technicians in plantation forestry, the national forestry corporation in Chile offers more

than 100 short courses annually, also aimed at the use of exotic species. Course offerings are extensive at the university level: ecology, conservation of natural resources, natural resource protection, forest soils, forest recreation, wood technology, forestry engineering, industrial forestry, watershed management, wildlife management, wildlands management, fisheries, agroforestry, silviculture, pollution control, environmental education, forest policy, and landscaping are among the subjects offered. The Universidad de Chile has cooperative arrangements with universities in Paraguay and Uruguay. West Germany, Brazil, and Switzerland have bilateral educational agreements to assist Southern Cone Universities.

Argentina's specialized schools within the university system include units dealing with ecology, natural resources, forestry, and forest engineering. The national parks agency operates a training center for park rangers. Among the specialized schools of forest sciences and forestry engineering within the Chilean university system, the forestry school in Valdivia offers specialized laboratory facilities in over a dozen areas of forest studies. Paraguay and Uruguay have a more limited variety of educational and training facilities, each offering one university program in the natural resource area and one at the technician level.

Responsibilities for natural resource management in the countries of the Southern Cone generally are concentrated within the ministries of agriculture. The forest management function is performed by a forest service institute, directorate, or corporation, depending on the country. Argentina has, in addition, separate

agencies for national parks and for wildlife. In Chile, Paraguay and Uruguay, all of these functions are the responsibility of a single institution. Uruguay has established an institute for the preservation of the environment which is an inter-agency coordinating group within the government. Argentina has been in the forefront at the provincial level with the establishment of special departments for natural areas. Legislation and management areas at the provincial level have been prime projects of these departments.

Development projects in natural resources are typically reforestation and plantation programs. Reforestation in Southern Chile has been involving more than 100,000 ha. annually. Smaller-scale projects in Paraguay and Uruguay are in the planning or implementation stages. Argentina has major programs to reforest more than 2 million ha by 1994; to control soil erosion in the Patagonia area; and to manage the Rio de la Plata watershed in a comprehensive multiple-use scheme.

Non-governmental organizations in the Southern Cone sub-region are particularly well represented in Argentina. Such groups are active in environmental education, but they are generally limited by lack of funds.

International Organizations

The United Nations Development Program (UNDP) supports natural resource projects generally in cooperation with FAO. During the period 1974-1983, forestry, fisheries, land and water projects will total $US 69 million, of which 5.4% is for training.

The World Bank has recently (1980) signed a Declaration of Environmental Principles and expects to expand its efforts in afforestation, reforestation, soil conservation, control of desertification, flood control, range management and wildlife conservation. The Bank's Economic Development Institute is now introducing environmental workshops, short courses and seminars into its curriculum.

Regional Organizations

The Pan American Health Organization (PAHO) has established an active program in environmental health in the fields of potable drinking water, water supply, air and water pollution control, sewage technology and solid waste management. The Center for Human Ecology and Health (ECO) in Mexico City works with governments to determine the impact of large scale developments upon human health. Training is offered with cooperating institutions. The Center for Sanitary Engineering and Environmental Sciences (CEPIS) in Lima, offers technical assistance, training, research and information exchange with governments throughout the region. Additionally, PAHO maintains a network of cooperating institutions throughout the region on a wide variety of topics related to health.

The Organization of American States (OAS) has a major program in natural resource management. Approximately $US 300,000 is spent annually in training. In 1979, the Regional Development Program trained 300 professionals as part of development assistance projects. The Centro Interamericano para Desarrollo Integrado de Aguas y Tienas (CIDIAT), at Merida, Venezuela, offers 36 courses

annually to some 30 trainees each. Topics include water management, fauna, remote sensing, reforestation, ecological systems and development planning for renewable resources.

OAS issued 61 fellowships in 1979, 41 of which were in natural resources. The Programa Regular de Adiestramiento provided 484 full scholarships in 1979 of which 79 were in natural resources, agriculture, biology and ecology.

The Inter-American Development Bank has recently initiated work in environmentally related fields. Investments in forestry can be expected to increase, particularly in multipurpose management and rural development forestry.

Private Organizations

The Rockefeller Foundation contributes $US 300,000 to Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia. CIAT concentrates on development and research activities for beef, beans, cassava and rice. Postgraduate training efforts are focused on the preparation of scientists in the production of the four basic commodities.

The Rockefeller Brothers Fund (RBF) has supported environmental training since the early 1970's. They pioneered the Regional Wildland Management Project together with FAO through the FAO Regional Office in Santiago. The Project included activities in the training of university professors and planning in critical areas and systems of areas. Training manuals and a textbook on wildland planning were supported. RBF subsequently supported projects in Central America through CATIE and the Caribbean through the Caribbean

Conservation Association. Currently, RBF is funding a project on Strategic Management of Wildland Resources for Ecodevelopment through the University of Michigan which has major field components in Central America and the Caribbean.

The World Wildlife Fund (WWF) supports short-term training where specific skills are needed in field projects. A broad range of projects are supported in selection and management of critical natural areas and species management.

International Center for Environmental Science Training (CIFCA)

CIFCA is a joint effort by the United Nations Environmental Program (UNEP) and the government of Spain to train professionals involved with environmental issues. More than 2,000 participants have attended some 60 courses--one half of them held in Spain. Rising travel costs are encouraging the planning of more courses in Latin America, or perhaps moving the base of operations, or regional offices, to the New World.

Principal objectives of CIFCA include training and institution building, cooperative programs, and preparation of information and materials about the environmental sciences. Basic courses are designed for professionals and decision-makers involved in development or environmental protection. Special seminars are designed to promote the exchange of information and experience among professionals in areas of environmental management. CIFCA collects information and data including a specialized library and bibliographies, conference and seminar notes, and textbooks.

Consulting services, higher education programs, and the special development of institutional networks are additional CIFCA programs. Suggested courses for 1980 and 1981 covered 35 subjects. Based on countries' responses, CIFCA plans to present 18 short courses of up to 3 months duration covering environmentally-oriented topics like development, environmental assessment, tourism, land use management, forest resources, economics, extension, human settlements, energy, socio-economics, and biosphere reserves.

United States Government Agencies

The U.S. Fish and Wildlife Service in the Department of the Interior offers specialized training on an individual basis at its offices and refuges. It provides experts for temporary duty in the region which features counterpart training. The Service has one of the best-qualified assemblages of tropical biologists in the world, working through the Smithsonian Institute. That expertise is available for scientific training in a number of specific fields. For example, a USFWS/Smithsonian scientist has collaborated with Ecuadorians in planning an Amazonian scientific research station to support management of the biome.

The U.S. National Park Service (USNPS) of the Department of the Interior, through the International Park Affairs Division offers, in conjunction with Parks Canada and the University of Michigan, the mobile International Seminar on National Parks and Equivalent Reserves. There are 36 participants per year for the 30-day director-level seminar. The Service also offers specialized

training at their facilities on an individual basis. In 1980 the Service participated in 23 technical assistance projects in the western hemisphere for a total of 300 person-weeks. Counterpart training is an important element of these projects. Parks magazine, The International Journal for Park Managers, is published by USNPS.

The U.S. Geological Survey (USGS) of the Department of the Interior provides technical assistance to the region for water resources and remote sensing. This includes instructors for universities to build institutional instructional capabilities. USGS facilitates specialized training at their offices in the U.S. on an individual and course basis. Particularly noteworthy are the in-service training in administrative techniques for managing large technical organizations and the remote sensing course at the EROS Data Center.

The Office of International Cooperation and Development (OICD) of the Department of Agriculture (USDA) coordinates the Department's technical assistance and training in food and fiber production for the region. The disciplines include land and water management, forestry, remote sensing, policy and planning.

The U.S. Forest Service (USFS) operates the Institute for Tropical Forestry in Puerto Rico where it has provided 16 short courses in tropical forestry over the last 20 years. The Institute and OICD have plans to expand significantly the training opportunities. The Service provides specialized in-service training on an individual basis at USFS facilities. They provide technical

assistance which includes counterpart training throughout the region.

The Soil Conservation Service (SCS) of USDA provides technical assistance to the region incorporating counterpart training. The SCS could place personnel in university teaching positions if there were requests and funding. The Service offers in-service training for individual professionals in the U.S. This training served 184 in 1979.

The Agency for International Development (AID) supports the U.S. Man and the Biosphere Program (MAB/US) which has carried out environmental research and training throughout the world. MAB/US sponsors major conferences such as the World Conference on Sea Turtles Conservation, and the U.S. Strategy Conference on Tropical Deforestation. MAB/U.S. is interested in expanding its cooperation with locally based environmental research and training proposals from the region. AID has a major new environmental focus which includes forestry, land use, remote sensing and watersheds management. Training, assessment and management are recurrent themes in all of the projects. AID has a new Forest Resources Management Project designed to help AID missions respond with socially and technically relevant professional expertise in this emerging sector. AID will be supporting a new Peace Corps forestry program both technically and financially, which will involve in-service technical training of both volunteers and their counterparts.

Conclusions

It is clear from a review of the region's present and planned training opportunities in natural resources and the environment that considerable capacity is already in place. All major disciplines and fields are available in the region, although not necessarily in each country.

Within each sub-region, a full range of university-level disciplines is available. An exception is the absence of forestry in the Antilles. At the technician-level, there is a need for greatly expanded capacity in all sub-regions. Brazil is particularly needful in this respect. On the other hand, Brazil has an impressive set of post-graduate programs which are generally deficient in the other sub-regions.

Quantitative data concerning the numbers and types of schools and disciplines by themselves, can not provide the basis for suggesting options for the support of training in the region. Team members invested considerable time with local leaders, educators, researchers and managers in dialogue to explore the *qualitative* aspects of training. The concepts that emerged are difficult to treat objectively, yet they are so often repeated that the team asserts their importance here. The general characteristics of present training in the region are:

- traditional disciplinary orientation
- little contact with practical resource management in the field
- limited support from research and practical experimentation
- lack of specific focus upon key environmental problems
- a primary focus upon tactical issues

These are the characteristics that provide the basis for consideration of the ways and means to support training.

Chapter IV.

Requirements for Training in Natural Resources and Environment.

Chapter IV

REQUIREMENTS FOR TRAINING IN NATURAL RESOURCES AND IN ENVIRONMENT

Introduction

The environmental problems facing the region are of the type and scale that directly challenge the region's social and economic development. Far from a tangential matter, to be left for future decades, these problems warrant frontal attack.

It is people who must take the necessary steps to incorporate environmental considerations into development. People require access to information and skills to manage native forests, halt soil erosion, develop coastal zones adequately, utilize wild fauna sustainably and protect key natural areas. Such an effort relates to training opportunities, which in turn, must be backed by research and experimentaion.

Information and skills for environmental management are needed by people at all levels of life and work, from those responsible for field projects on to department heads and ministers of government. Each level has particular problems to face and responsibilities to fulfill.

Existing and planned educational management institutions possess an installed capacity to provide training opportunities for environmental management. Forestry, agronomy, biology and other disciplines,

as well as regional training centers and ministries of agriculture, already offer the courses and curricula relevant to natural resources. Can these institutions provide training to the number of people required for the 1980's and 1990's? Can they give support to those already on the job to up-date, or to obtain additional information and skills?

This chapter will determine the types of people requiring training and the kinds of training required. The numbers of individuals of each type will suggest the scale of the training effort to be developed. Subsequently, in Chapter V, the various mechanisms or methods for training each type of trainee will be examined; and various alternatives for organizing a training program will be posed.

Target Groups For Training

Training in natural resources and environmentally related problems can be directed to serve four major groups of people *(Target Groups):*

Level I--Senior Policy Level

Level I consists of personnel responsible for making policy decisions in key public and private institutions. The individuals include political leaders, legislators, ministers, corporate executives, and directors general of government departments in charge of resource management, agrarian reform, development, and others which affect or are affected by natural resources. Level I personnel may be educated to various degrees, but they hold their positions principally through the political process.

Responsible leaders and policy formulators need to become aware of the values of living natural resources, the possibility of their irreversible loss, and the advisability of incorporating ecological principles into development. The concept that sustainable development merely limits growth must be firmly repudiated in favor of promoting a program of retaining gains, improving the lot for this generation, and still leaving options for the next.

A basic appreciation of several fundamental ecological concepts is required for personnel at this level: Water catchments, mountain slopes and coastal lands warrant careful management. Where they have been degraded, they must be reclaimed to restore their productivity and avoid downstream losses. Natural resources warrant careful inventory and evaluation prior to the consideration of any development projects. Such evaluation work should step beyond the traditional study of soil potential and provide management guidelines for a full range of land uses while protecting the natural resource base. Remote sensing technology offers considerable opportunities for this work.

The pressures of development appear to leave little time for looking back over past experience. Unfortunately, that procedure carries enormous risks associated with the repetition of mistakes and lack of stimulus, or orientation, to improve the use and management of natural resources. Furthermore, to the extent that native cultures and technologies can be incorporated into the development process, their knowledge and methods can contribute significantly to the reorientation and focus of modern development in ways that are more environmentally sound and sustainable.

Senior policy-level leaders must become aware of the price their societies pay for programs that are unbalanced by the virtual exclusion of natural resource management. Their consciousness must be raised to recognize that planning for extreme short-term needs means that the production capabilities for the future are challenged.

Level II--Senior Professional/Manager

Level II consists of personnel responsible for decisions of a high-level technical nature. These individuals include chief planning officers; the directors of divisions of forestry, fisheries, national parks and other protected areas, wildlife, soil conservation, agricultural development and colonization, water resources, engineering works, sanitation, and energy; and other technical fields. Level II personnel have university education usually including post-graduate studies or the equivalent of specialization based upon past experience.

Senior professionals and managers need to be able to design and implement programs for research, management and development that utilize natural resources on a sustained basis. Techniques need to be designed, tested and implemented to reclaim destroyed or eroded ecosystems. New options for use of natural resources are required which meet today's human needs and keep open tomorrow's options. Management systems must be devised to seek solutions to problems in the field, to utilize sessions from past work and to guide future decisions. Native knowledge and technology must be incorporated into resource evaluation and management and development programs.

Planning and implementation of development programs require interdisciplinary and interagency methods to minimize the conflicts and threats to society and their natural resources.

Senior professionals and managers are already faced with problems whose solutions require social, political and economic considerations. Ecological expertise is key to ensuring productivity of resources and sustainability of development. Moral judgements are inescapable even at the technical level, given the growing impact of technology on living species and native and western cultures.

Level III--Professional Level

Level III consists of personnel responsible for specific technical activities including research, management, inventory, evaluation, education and development work. These individuals are employed in public and private organizations, in universities, ministries, timber companies, fishery corporations, water boards, irrigation districts, engineering firms, conservation organizations, among other fields. They have a university education, and occasionally have had post-graduate studies or the equivalent in experience.

Professionals in the field of natural resources and the environment must be able to communicate and work with professionals from other fields and with rural western and native peoples, to solve common problems. Tools and methods are required for the actual tasks of inventory, evaluation, planning, management and development of natural resources. If monitoring of resources and of management itself is to become a reality, it is the professional who must become equipped to do the work.

Concepts need to be instilled regarding both strategic and tactical planning and action. The one sets the global framework, the other the activities required to meet the overall goals. While partial analysis and reductionist thinking are vital for certain aspects of problem-solving, narrow vision has been responsible for piecemeal approaches to larger and complex problems.

Professionals require better balance in their perspective between social, technical and environmental values. Most technical fields have sadly lacked social content; most social science fields lack technological awareness; and, virtually all fields need greater ecological depth, especially practical ecological guidelines for development (Dasmann, Freeman and Milton, 1973; McEachern and Towle, 1974; Odum, 1976; IUCN, 1972). Economic tools and concepts are invaluable to all professionals, but most training in economics is strictly financial in focus and provides few practical methods for the management of natural resources.

Professionals also need exposure to the tools and methods for the formulation and evaluation of projects and budgets. This will involve familiarization with procedures for the assessment of impacts by alternative development and management options upon ecosystems, society, and future economic and political considerations.

Level IV--Technician Level

Level IV consists of personnel responsible for the implementation of projects in the field; for day-to-day labors with rural farmers, native peoples, forest workers, fishermen, visitors to

protected areas and researchers in natural reserves; and for resource protection. Their preparation generally includes some type of technical school training or short courses focused to provide special skills and field experience.

Technicians, rangers, guards, extensionists, crew foremen and similar personnel need skills related to land reclamation, reforestation, resource utilization and protection. They can usefully assist researchers, planners and other professionals. They should be trained in techniques needed in systematic observation of field phenomena, human behavior, and resource use. Since technicians are generally the personnel who communicate the most with people, it will be useful to provide them instruction in human relations, native peoples and rural sociology.

The technician can also significantly extend ecodevelopment to rural peoples, regardless of his specific line of work. The range of areas in which he can be effective include: methods for handling waste, organic and intensive gardening, low-technology energy production, simple food preservation, minimization and care in the use of chemical herbicides and pesticides.

Finally, the technician requires a clear conceptual framework, both to orient his work, and to explain to rural people the relationship between environment and development.

The future technician level must become a career in its own right. The tendency has been to prepare technicians as mini-professionals. In the curricula of many middle-level schools, one finds a condensation of university career programs. Graduates from

these schools often feel like, or are treated like, "quasi-professionals". Requirements for the coming decades demand a massive cadre of people in possession of skills and tools not available from professionals in a practical way.

It is essential that both western and native cultures should have representatives trained as technicians. This will facilitate communication of native people's knowledge of the environment and technology to resource managers and planners. It will also facilitate meeting the resource and technical assistance needs of native peoples, and it will more effectively harmonize regional development and resource management with native people's resource use. Native people should be trained in resource management skills as part of technical assistance for sustained yield production strategies that utilize indigenous technology.

Gaps in Training Opportunities

The *gaps* in training opportunities in the region can be identified by comparing: (a) the key environmental problems (Chapter II); (b) the characteristics of present training opportunities (Chapter III); and (c) the characteristics of knowledge and skills required by the four target groups.

The key environmental problems are:

- Loss of soil resources
- Desertification
- Destruction of native forest resources
- Destruction of coastal and island resources

- Over fishing and destruction of fresh water and marine habitats
- Deterioration of rural resource base
- Inappropriate development of ecologically fragile and sensitive ecosystems and sites
- Lack of ecological considerations in development planning
- Irreversible loss of key natural areas
- Loss of wild plant and animal resources

In Table 7 the environmental problems are shown in relationship to their causes and the types of solutions suggested in Chapter II.

General characteristics of present training opportunities include:

- Traditional disciplinary orientation
- Little contact with practical resource management in the field.
- Limited support from research and practical experimentation
- Lack of specific focus upon key environmental problems
- Primary focus upon tactical issues

The four target groups require knowledge and skills that will permit them to:

- Grasp the relationships among resources
- Perceive cause and effect relationships in resource use
- Work with specialists from relevant disciplines

TABLE 7

REGIONAL TRAINING PROJECT

KEY ENVIRONMENTAL PROBLEMS, MAJOR CAUSES AND SOLUTIONS

Problem	Major Causes	Solutions
- Loss of Soil Resources	Overgrazing Opening of inappropriate lands Inappropriate grazing and farming practices Unawareness of problem	Employ appropriate soil conservation practices Utilize lands with appropriate characteristics Demonstrate alternative practices Promote awareness
- Desertification	Overgrazing Extensive grazing and farming Opening and use of fragile lands Unawareness of problem	Develop restoration techniques Restoration, reforestation Restriction of use Employment of appropriate practices Demonstrate alternative practices Promote awareness
- Destruction of native forest resources (removal and non-replacement	Extensive grazing and farming Expansion of pasture and agricultural frontier Inappropriate wood harvesting practices Unawareness of problem	Restoration, reforestation Research on silviculture Develop management systems Develop harvesting practices Management of watersheds Demonstrate alternative practices Promote awareness
- Destruction of coastal and island resources (soils, mangroves, wetlands, estuaries, etc.)	Drainage/filling of coastal wetlands Use of continental practices on islands Clearing of coastal vegetation for construction Unawareness of problems	Develop appropriate land use practices for islands Maintain fragile key wetland natural areas along coasts Demonstrate appropriate practices Promote awareness

*based upon information in Chapter II and work of consultants.

TABLE 7, continued

Problem	Major Causes	Solutions
- Over-fishing and destruction of fresh water and marine resources (coral reefs, sea grasses, estuaries, mangroves, pollution)	Concentration of fishing on known species in limited areas Inappropriate fishing techniques Drainage/filling of wetlands Pollution Unawareness of problem	Research on alternative species and areas Protection and management of habitat areas Control of pollution Demonstrate appropriate practices Promote awareness
- General destruction of natural resources in rural areas (soil, forest, water, flora and fauna)	Lack of support to rural peoples on appropriate land use practices and alternative technologies Unawareness of problem	Develop ecodevelopment techniques Extension services on ecodevelopment practices Demonstrate alternatives Promote awareness
- Inappropriate development of ecologically fragile and sensitive ecosystems and sites (stream catchments, slopes, wetlands, centers of endemism)	Lack of information on location of such areas Unawareness of problem	Use of remote sensing to observe and monitor such areas Further development of inventory and evaluation methods to include analysis of ecologically important resources and areas. Demonstration of methods Promotion of awareness
- Absence of ecological considerations in planning	Dependence upon short-run financial economic criteria Little use of ecological principles Unawareness of problem	Incorporation of ecological guidelines in development planning Development of integral rural development techniques Demonstration of alternatives Promote awareness

TABLE 7, continued

Problem	Major Causes	Solution
- Irreversible loss of key natural areas (for genetic resources, water production, research, experimentation and monitoring)	Lack of identification of key areas Limited human and institutional capacity to manage areas Lack of practical alternative practices for key areas where multiple use can be employed Lack of awareness of problem	Identify and select key areas Develop multiple use practices Develop and expand management agencies Manage key areas as network of protected wildlands Demonstrate alternative categories of protected areas Promote awareness
- Loss of wild plant and animal resources (for selection, breeding, improvement, medicinal research, pharmaceuticals)	Destruction of habitat Indiscriminant expansion of pasture and agriculture Lack of known uses and techniques for management of wild resources, especially in rural development Lack of awareness of problem	Research and development of use of wild plant and animal resources Establishment of network of research and experimental stations Demonstration of uses and practices Promotion of awareness

- **Identify and evaluate environmental problems**
- **Envision both strategic and tactical aspects of development and environment**
- **Form and lead teams of specialists to solve environmental problems within the context of local development.**
- **Develop and apply methods for resource management and development which are appropriate to local environmental conditions**
- **Demonstrate, by example, management practices in appropriate land use**
- **Communicate, promote and extend concepts, methods and techniques to users**

The difference between what is currently offered by existing training institutions and what is required to address natural resource and environmental problems--the gap--lies in the orientation, focus and the practical nature of training.

The gap can be closed by taking action to *reorient and modify the characteristics of existing training.* Some new or additional materials and topics will need to be established. *Research, experimentation and demonstration areas* need to be established and operated to deal with the environmental problems and development. Importantly, *information* must be prepared to communicate and promote concepts, methods and practices favorable to sustainable development and environment.

In addition, a major new line of training is needed to provide knowledge and skills on the *integral management and development of*

natural resources. While the solutions suggested in Table 7 may be viable, the difficulty in their implementation lies with obtaining the policy-level decision to move ahead. In fact, many of these solutions are suggested regularly by local professionals to no avail. Realistically, no progress can be expected unless leaders become conscious of the problems, causes and solutions.

The Agenda for Training

Specifically, then, the gaps can be described in terms of one overall general theme on integral resource management, and ten themes derived from the key environmental problems.

Integral Management of Natural Resources

The *problem* is defined as the lack of an integral perspective regarding the development and management of natural resources. It is caused by a general lack of consciousness of the interrelatedness and interdependence among factors of environment and development.

Typically, the work of resource managers is not related to major economic and social development goals. Resource specialists receive little governmental support as reflected by low salaries. Pioneering and practical ideas from professional personnel are seldom given the opportunity for serious trial. What is most critical is that resource management and conservation is generally viewed as anti-development.

The *solution* lies in offering opportunities for training in the integral management of natural resources. Demonstration areas are

needed to show methods and practices, and where experimentation can take place. Information is required to raise consciousness about the problem and to promote and extend solutions.

The *fields and disciplines* related to the problem include agronomy, agricultural engineering, forestry, biology, engineering, economics and architecture.

Of the target groups, *Level I* is to be offered opportunities for training, particularly because it is political leadership which must create the possibility to work on activities designed to solve environmental problems. *Levels II and III* also require training to orient them for integrated, multidisciplinary and practical work on strategically important issues.

Control of Soil Erosion

The *problem* is detined as the uncontrolled loss of top soil. Principally, through over grazing, soils are eroded and transported to streams, estuaries, and the sea. The rapid extension of the agricultural and grazing frontier leads to deforestation and to use of lands which often is inappropriate due to slope, rainfall and soil characteristics. Secondary problems follow including the siltation of rivers, reservoirs, and harbors.

Agriculture and grazing practices are extensive; current practices include fire and open cropping on slopes, and few pastures feature grass species that can bond soils and resist compaction.

Solutions require the application of appropriate soil conservation practices and the use of only those lands suitable for

agriculture or grazing. Alternative practices must be demonstrated and an awareness of the problem needs promotion.

The *fields and disciplines* most related to the problem are agronomy and agricultural engineering with particular emphasis upon livestock, range management and annual crops. Also related are civil engineering for road and bridge design and construction, and forestry for timber extraction.

Levels I and II require training to attain an appreciation of the problem and the implications of soil loss upon food supplies. *Level III* requires major options for training to design and apply solutions in the field. *Level IV* has a key role in application and promotion.

Reclamation and Halting of Desertification

The *problem* is defined as the destruction of vegetation and soils to the extreme where natural regeneration is improbable and the land becomes marginal to agriculture, grazing and forestry. Secondary impacts often affect adjacent areas, streams, and coastal zones through duning, siltation, and soil deposition.

The causes of desertification include deforestation, over grazing and farming practices on inappropriate sites. Typically, the area is denuded of vegetation and the soils are compacted and placed at the mercy of wind and rain.

Solutions include the restoration of areas under accelerated erosion, the restriction of use in susceptible areas and utilization of appropriate land use practices. Research and experimentation are

needed on restoration and reforestation techniques. Demonstration areas are needed to show appropriate practices and restoration methods. Awareness of the problem and the solutions must be promoted.

The *disciplines and fields* most related to this work include agronomy, agricultural engineering and forestry. Particular emphasis should be given to fields associated with grazing and pasture management and land use planning.

Level I must be made aware of the problem and solutions. *Levels II and III* need to deal with the courses of the problem and the implementation of solutions, including research and development of restoration methods and appropriate practices for fragile areas. *Level IV* requires practical work in restoration, reforestation, dune stabilization, watershed management, farm practices and grazing control.

Management and Utilization of Native Forests

The *problem is defined* as the indiscriminate removal and non-replacement of natural forest cover. Native forests are removed to make way for farms and livestock. A few high-value timber species are logged, the remainder are burned. Most species are considered valueless for wood products. Secondary effects include the destruction of wildlife habitat, watersheds and water retention capacity of soils, loss of rural foods from wild species, and extraction of plants and animals.

Solutions include the restoration and reforestation of

denuded lands or of areas which have been opened for agriculture and grazing but are inappropriate for such uses. Research is needed on silvicultural techniques, uses of mixed hardwood forest timbers and harvesting techniques which cause minimum damage to understory and soils. Multiple use practices are required to combine compatibly the production of timber, water, wild meat, forest foods and medicines, and protection of genetic materials.

The *discipline* most related is forestry. However, agronomy and agricultural engineering are part of land clearing and colonization efforts related to deforestation.

Level I requires an awareness of the problem and its affects upon social and economic development. Basic concepts of the forest as a reserve of new land must be changed. *Levels II and III* will have to instrument research and experimentation on reforestation and appropriate management and harvesting methods. New management systems, including the establishment of permanent national forests, need to be considered. The *Level IV* forestry technicians have a major role in the extension of forestry practices to rural peoples and companies, and the promotion of awareness.

Management of Island and Coastal Zone Resources

The *problem is defined* as the destruction of resources peculiar to coastal areas and islands, including mangroves, wetlands and estuaries. Watersheds and soils on islands are generally reduced in scale and carry proportionally higher importance for local people. Secondary impacts fall upon fishery production and water supplies.

The problem is exacerbated by the application of terrestrial techniques from continents to islands and coastal zones. Work to drain or fill wetlands has far-reaching negative implications.

Solutions include recognizing the need for research and development of techniques for the appropriate use of island and coastal areas. Fragile and key areas, such as wetlands, must be maintained in their wild form. Demonstration areas must show appropriate methods, including sustainable mangrove harvesting. Awareness of the problem and solutions must be promoted.

The *fields and disciplines* most related to this work include agronomy, agricultural engineering and forestry. Development planners, from economics, architecture and civil engineering, are largely responsible for project planning and land use.

Level I must become aware of the peculiar nature of island and coastal ecosystems and the need for applying appropriate land use practices. *Levels II and III* need to instrument the research and development of land use practices and the establishment of reserves in fragile areas. *Level IV* must work in the demonstration and extension of practices and techniques.

Management of Freshwater and Marine Resources

The *problem is defined* as the concentrated extraction of selected fish species and the parallel destruction of habitats critical to fishery productivity. Commercial fishing depends upon few species in certain highly productive sites. Coral reefs are dynamited by subsistence fishermen. Sea grasses, estuaries and

coral reefs are destroyed by physical and chemical pollution. The secondary effects of coral extraction, mangrove cutting and industrial development in estuaries include the reduction of fish catch. Various species, such as seals, are killed incidentally because of fishing methods utilized.

Solutions include research and development on alternative species for fishing, and on new and improved fishing techniques. Key habitats for fish need protection and management. Pollution sources require controls and alternatives. Appropriate practices must be demonstrated to fishermen and land use planners, and awareness of the problem and solutions needs to be promoted.

The *disciplines and fields* which can relate to this problem include fisheries and marine biology. However, fisherman and economic planners are directly tied to fishing methods and catch characteristics. Planners, economists, architects and civil engineers are connected with decisions and measures taken on the use of lands and the control of pollution.

Level I must appreciate the relationships between land use practices, pollution and fish catch. *Levels II and III* are key in the research and development work required, the establishment of protected zones and the control of pollution. *Level IV* must work with fishermen to impart improved fishing techniques, implement regulations and avoid incidental take of non-target species (seals, etc).

Environmental Extension

The *problem is defined* as the deterioration of soil, forest, water, plants and animal resources in rural areas. It is due principally to land-use practices which inadvertently remove soil nutrients, reduce productivity, extinguish species, and facilitate erosion, flooding and drought.

Rural people receive little or no support on improved practices and alternative technologies. They are unaware of the relationship between their practices and the destruction of their own resource base. Downstream deterioration is seldom attributed to upstream land uses. Where poverty and landlessness encroach, rural peoples are obliged to push further into inappropriate wild areas in search of new lands.

The *solution* includes research and development of integral rural development models and methods. Such approaches will combine forestry, agriculture and grazing activities into multiple, small-scale practices, taking advantage of particular soils and the attributes of plant and animal species. These techniques need to be demonstrated and promoted.

The *disciplines and fields* which can affect that problem include agronomy, agricultural engineering, forestry, biology and economics. Extensionists play a major role in promoting improved land use techniques. Planners can design and implement colonization projects based upon integral rural development models.

Level I individuals must become aware of the plight of rural

peoples and their inadvertent destruction of the natural resource base. Leaders must push research, development and implementation of appropriate integral development projects. *Levels II and III* will have to design and implement the work. Experimentation in the field is key. Demonstration areas can show results and promote concepts and practices. The *Level IV* individuals will be instrumental in carrying ecodevelopment and appropriate practices to the people.

Inventory and Evaluation

The *problem is defined* as the inappropriate development of fragile and sensitive ecosystems and sites, including stream catchments, slopes, wetlands and centers of endemism. Development projects are designed and implemented without the identification and analysis of environmentally critical areas. Present resource inventory and evaluation practices focus on agriculture, timber or fish resources with little reference to other factors. There is a general lack of awareness of the problem; moreover, if planners were to attempt the inclusion of environmental factors in project design, they would be confronted with a fundamental lack of information.

The *solution* lies in the further development of remote sensing, inventory and evaluation methods and techniques to allow for the identification and analysis of environmentally key sites. Monitoring of key areas through remote sensing would provide a means to improve land use allocation and the maintenance of important wild areas. Such techniques need to be demonstrated and promoted.

The *disciplines and fields* associated with this problem include remote sensing, agronomy, forestry, geology, soils, ecology and watershed management. Planners must learn to utilize information that contains ecological guidelines, and to ask questions that focus upon environmental concerns for sustainable development.

Level I needs to support the further application of remote sensing technology, the research and development of ecologically-oriented methods, and field experimentation and demonstration. *Levels II and III* have to work on an interdisciplinary basis with remote sensing specialists to develop appropriate methods for inventory and evaluation which address the issues. *Level IV* will have a role in field monitoring and data gathering.

Rural Environmental Planning

The *problem is defined* as the absence of ecological considerations in planning. Rural development projects make little use of ecological guidelines in project planning and implementation. The inappropriate selection of sites, design of land uses and practices and the development of roads, drainage, water use and other factors illustrate the problem. Short-run financial analysis still serves to guide planning decisions.

Similar to environmental extension, the *solution* lies in the development of integral rural development methods; however the solution differs with respect to the preparation of ecological guidelines for planners which will affect rural development projects and provide a realistic basis for long-term sustainability.

Demonstration areas must not only show integrated development schemes, but they must also examine the ecological aspects of planning options and use practices.

The *fields and disciplines* most related to the problem are planning and ecology. Agronomists, foresters, economists, biologists, civil engineers and architects are to be involved in the research, development and implementation phases of work. All must participate in the preparation of ecological principles that are meaningful to their respective professions.

Level I must become aware of the problem, which involves the perpetuation of inappropriate use of natural resources and the failure of projects. Support is needed for interdisciplinary work on planning and utilization of ecologists. *Levels II and III* must bring ecology into planning in practical ways. Economics must include ecological considerations. The critical question of sustainability must be asked by all disciplines. *Level IV* will have a reduced role in this problem except to work in the demonstration and extension of ecological principles and to provide information and feedback to planners.

Management of Critical
Natural Protected Areas

The *problem is defined* as the irreversible loss of key natural areas which are important to development and environment because of genetic resources, water production, and opportunities for research, experimentation and monitoring. Important natural areas need to be identified and placed under particular types of management to ensure their maintenance in perpetuity.

While some areas will need absolute protection (preservation), others will support multiple use. Research is needed to develop innovative multiple use practices. The management of networks of protected areas (national parks, forests, sanctuaries and biological reserves, among others) requires the capacity to manage and maintain a major resource enterprise.

The *solution* lies in the identification and management of key sites and ecosystems as protected areas. While most categories of management have been developed, multiple use reserves require additional research and experimentation. Management agencies need to expand their capacity to identify, plan, manage and develop protected areas. Each type of wildland management needs to be demonstrated and promoted.

The *fields and disciplines* most related include forestry, biology and ecology. In most countries, the management of protected areas falls within the responsibilities of the forestry department and the ministries of agriculture. In other countries agronomy supplies the personnel for wildland management.

Level I must support the development of strong public institutions to manage national networks of protected areas, and which are capable of administering between five and 10% of the national territory. Once established, these reserves are to be respected in perpetuity. *Levels II and III* will direct and manage protected areas and the responsible departments. Research, monitoring and planning must be normal parts of wildland management. *Level IV* has the important role of field management as rangers, assistants to scientists, forest, fish and wildlife gurard and as extensionists to visiting public.

Management and Utilization of Wild Plant and Animal Resources

The *problem is defined* as the loss of wild plant and animal resources which are important for breeding, improvement, medicinals, pharmaceuticals and a wide array of chemical products. Indiscriminant clearing of forest and wild lands destroys habitats. Lack of known and familiar uses tends to inculcate and perpetuate low values for wild species.

Given the current importance of wood products, pharmaceuticals and other elements derived from wild species, it is reasonable to infer that hundreds of new products have yet to be developed. The loss of species carries with it the irreversible loss of opportunity. Integral rural development will depend upon the incorporation of wild plants and animals. The cure of diseases, the biological control of pests and other benefits will result from further selection and research.

The *solution* lies in the establishment of programs to study, select and develop wild plants and animals for their potential uses. This work will provide information to management on the role of wildlife in ecosystems. A network of research and experimentation stations on wild species is urgently needed. Demonstrations of management techniques for food production from wild plants and animals can promote the use and perpetuation of wild stocks.

The *disciplines and fields* related to this problem are biology and ecology. In addition, foresters, agronomists, geologists and soils specialists will have related tasks. Economists and planners will need to examine options for management.

Level I must recognize the importance of wild plants and animals for development and the maintenance of ecosystems. Leaders must support the development of research and experiment stations for wildlife. *Levels II and III* will manage and operate wildlife projects and research stations and conduct research and experimentation. *Level IV* will work with researchers and rural peoples to identify species for research and to incorporate management practices into rural development.

Magnitude of Training Needs

The numbers of individuals required for training in each of the eleven themes of the agenda are estimated for 1980, 1990 and 2000 in Table 8.

Data from Brazil are not included in the Table. The information from Mexico was distributed *pro rata* to the themes for training from aggregated data.

Several problems relative to such numbers must be appreciated. The themes are multidisciplinary and do not necessarily correspond directly to specific jobs in public and private enterprise. The themes have some overlap, one upon another. It is thus difficult to assign given employees to specific themes.

While data on Levels II and III was relatively easy to gather and analyze, Levels I and IV were difficult. The numbers of senior policy officers are considered to be underestimated, and Level IV probably needs to be raised by a factor of 10 or even 100.

A further complication is the inability to see into the future. For 1990 the numbers are more significant than for 2000. The Table

TABLE 8

REGIONAL TRAINING PROJECT

ESTIMATED NUMBERS OF PRESENT PERSONNEL AND NUMERICAL REQUIREMENTS FOR TRAINING IN THEMES RELATED TO MAJOR NATURAL RESOURCE AND ENVIRONMENTAL PROBLEMS

Themes for Training	Present 1980 Level				1990 Level				2000 Level				Observations
	I	II	III	IV	I	II	III	IV	I	II	III	IV	
Integral Management and Development of Natural Resources	254	130	540	104	295	817	1059	1332	65	170	444	200	
Control of Soil Erosion	15	26	242	578	8	15	1229	2009	7	110	1080	510	
Reclamation and Halting of Desertification	15	23	70	500	154	506	1493	1493	7	100	912	460	
Management and Utilization of Native Forest	30	179	1184	1488	183	524	737	2607	5	10	25	750	
Management of Coastal Zones and Islands	10	15	30	85	6	12	121	374	4	8	75	175	
Management of Fresh Water and Marine Resources	23	126	873	1619	8	16	1572	1131	7	10	1290	340	
Environmental Extension	7	15	47	150	4	10	122	330	4	5	110	120	
Inventory and Evaluation	10	46	1375	378	4	8	135	274	4	5	130	70	
Rural Environmental Planning	8	12	47	43	4	8	35	60	4	5	10	20	
Undeveloped Sectors													
Management of Critical Natural Protected Areas	30	57	513	2308	175	488	2240	4773	7	40	1920	1722	
Management and Utilization of Wild Species (primarily fauna)	10	74	155	579	178	354	1771	3631	3	30	1575	1382	
TOTALS	412	703	5076	7832	1019	2758	10574	18014	117	493	7571	5749	

NOTE: Data for Mexico are distributed over all themes from aggregated information.
No data are included from Brazil.

TABLE 9

REGIONAL TRAINING PROJECT

ESTIMATED NUMBERS OF PERSONNEL REQUIRED FOR TRAINING IN THEMES RELATED TO MAJOR NATURAL RESOURCE AND ENVIRONMENTAL PROBLEMS FOR 20-YEAR PERIOD, 1980-2000

Themes for Training	Level I	II	III	IV	Observations
Integral Management and Development of Natural Resources	360	987	1503	1532	
Control of Soil Erosion	15	125	2369	2519	
Reclamation and Halting of Desertification	161	606	2405	1953	
Management and Utilization of Native Forest	188	534	762	3357	
Management of Coastal Zones and Islands	10	20	196	549	
Management of Fresh Water and Marine Resources	15	26	2862	1471	
Environmental Extension	8	15	232	450	
Inventory and Evaluation	8	13	265	344	
Rural Environmental Planning	8	13	45	80	
Undeveloped Sectors					
Management of Critical Natural Protected Areas	182	528	4160	6495	
Management and Utilization of Wild Species (primarily fauna)	181	384	3346	5013	
TOTALS	1136	3251	18145	23763	

NOTE: Data is based upon the consolidation of estimates for 1990 and 2000.

gives the impression that following a major training effort in the 1980's, fewer individuals will need to be trained in the decade of the 1990's. This is a reflection of the difficulty in establishing requirements for manpower in future periods.

A more accurate representation of the magnitude of training needs is shown in Table 9 where the data from 1990 and 2000 are consolidated into one 20-year period. It suggests that a major training effort should be initiated in the early 1980's looking toward several decades of activity. The amount of work projected requires that a serious program be launched. Uncertainties concerning future resource trends will make it necessary to re-evaluate the themes and the numerical requirements periodically.

Importantly, the fact that thousands of individuals are trained in key environmental issues and resource management can be expected to influence policy and action. Increasing awareness coupled with the development of viable solutions to key problems will affect the planning of projects, the use of natural resources, and the state of the environment in future periods. Accordingly, it is to be anticipated that both themes and numbers will change.

Chapter V.

Alternatives for Meeting Training Needs.

Chapter V

ALTERNATIVES FOR MEETING TRAINING NEEDS

Introduction

A wide variety of institutions in Latin America already offer training opportunities in fields related to natural resources. Universities, technician-level schools, regional institutes and centers, non-governmental organizations and government departments are active in training efforts.

Training opportunities in natural resources and environmentally related themes can be offered in formal and informal series. These include university and post-graduate degree programs, seminars and workshops specially targeted for particular groups, informal meetings to facilitate interchange of ideas and a broadening of awareness and perceptions, and middle-level technical programs.

By the very nature of the problems associated with natural resources and the environment, training must be treated within practical contexts. Similarly, training must be closely related to the development of science and technology. Thus, training, research and management are linked and can be usefully developed and maintained in close association.

Opportunities for training will need to be designed in response to practical limitations. Higher-level directors and executives may be available for only two or three days at a time

while young professionals can attend full degree programs covering four or six years. Professionals at mid-career may be able to attend a one-month up-dating workshop on leave of absence from their employment. Technician-level people will benefit from in-service training when extensive and frequent periods away from work and the high cost of formal training programs are limiting factors. And, out-reach efforts will have to be focused upon policy-level individuals to help them attain an awareness of the importance of providing training for all levels of employees, in a variety of ways, throughout their careers.

The upsurge in environmental concern has fostered an awareness of the peculiar local nature of natural resource management and environmental problems. Emphasis in training must focus upon the problems and contexts within which individuals will work. Local individuals can find solutions to their own problems, in ways consistent with their cultural values and perceptions. Means for problem solving can be provided through training, and the application of those means can best be practiced in that field where the problems occur.

This chapter will consider the alternatives for offering training opportunities, giving consideration both to the possible methods to adopt and the potential institutions to be involved.

Alternative Training Methods

Training Methods and Participating Institutions

A broad range of training methods have been applied in this region--and elsewhere--which are useful for training in natural resources and related environmental problems. Each training method is presented in Appendix II in a brief generalized form, and common characteristics, advantages and disadvantages are discussed.

The training methods suggested for consideration are:

University Degree Programs
University Post-graduate Programs
Short Courses
Seminars
Workshops
Technician Programs of Study
Conferences
Congresses
Panels and Debates
In-Service Training
Field Visits to Case Study Sites
Informal Meetings
TV and Radio Reports, Press Editorials and Reports

The usefulness of each method for any particular group of trainees depends upon such characteristics as the duration and intensity of the method, theoretical versus practical focus, formality of encounter, and potential impact. In Table 10, training methods are shown according to appropriate target groups of trainees. Senior policy-level individuals can work with methods requiring short duration, low intensities, high formality and high impact. At the other end of the spectrum, technician-level trainees will benefit from long duration, practical, intensive,

informal programs with slow gradual impact.

Given the need to provide training opportunities to senior policy, senior professional/manager, professional and technician-level individuals, it is suggested that the full range of methods is required. This standpoint is further reinforced by considering the diversity of natural resources, environmental problems, cultures and development paths found in the region.

Participating Institutions

Table 10 suggests the types of institutions generally capable of presenting the various training methods to each level of trainees. Universities have a very broad potential role in training, as do government departments and regional institutes and training centers. Technical schools are important for the special training programs needed for the technician-level trainees. Non-governmental organizations, such as professional societies, conservation groups and museums, among others, can provide training opportunities where flexibility in format, funding and operations is critical. And, outstanding personalities, such as former ministers, international officers, visiting dignitaries and controversial researchers are externally useful in short, high-impact encounters to open doors to senior policy leaders and to establish credibility for training efforts.

Thus, the application of the various methods to the four target groups will require the participation of universities, technical schools, regional institutes and centers, non-governmental organizations, government departments and outstanding personalities.

REGIONAL TRAINING PROJECT

SUGGESTED TRAINING METHODS AND PARTICIPATING INSTITUTIONS
ACCORDING TO LEVEL OF TRAINEES

LEVEL	METHODS	PARTICIPATING INSTITUTIONS					
		University	Tech. School	Inst., Reg. Tr. Ctr.	Non-govt. Organ.	Govt. Departments	Key Personalities
I Senior Policy Level	Formal conferences or congresses	x					
	High-level informal meetings						x
	Visits to demonst. sites to observe successful/ unsuccessful cases	x		x	x	x	
	Panels and debates						x
	Public media editorials and reports						x
	Short courses	x		x	x		
	Publication of guidelines, profiles and films on successful/unsuccessful cases	x		x	x	x	
II Senior Professional/ Manager Level	Master's degree program	x		x			
	Doctorate program	x		x			
	Formal up-dating course	x		x	x	x	
	Formal conversion course	x		x	x	x	
	In-service training			x	x	x	
III Professional Level	Create new faculty programs in:						
	a) protected area management	x		x			
	b) fauna resources management	x		x			
	c) marine resources management	x		x			
	Improve curriculum of disciplines related to environment	x		x			

TABLE 10, continued

LEVEL	METHODS	PARTICIPATING INSTITUTIONS					
		University	Tech. School	Inst., Reg. Tr. Ctr.	Non-govt. Organ.	Govt. Departments	Key Personalities
III Professional Level con't.	Improve curriculum of traditional disciplines: economics, biology, agronomy, business	x		x			
	In-Service training			x	x	x	
	Short courses	x		x	x	x	
	Formal up-dating courses	x		x	x	x	
	Formal conversion courses	x		x	x	x	
IV Technician Level	Create new technical fields		x			x	
	Improve technical curriculum		x			x	
	In-Service training		x			x	
	Short courses		x			x	
	Formal up-dating courses		x			x	
	Formal conversion courses		x			x	
Demonstration Sites		x	x	x	x	x	
Information and Publications		x	x	x	x	x	

Relationship of Training to Field Management and the Knowledge Base

Analysis of existing opportunities in the region makes it evident that the majority of training in natural resources and environmentally related problems takes place in the classroom, in relative isolation from field situations. And, the flow of information into training from current experimentation and management work in the field is limited.

The FAO "Regional Project on Wildland Management" (FAO/UNDP/RLAT/028) based at Santiago, Chile, from 1971-76, among several activities, sponsored two workshops for university professors of forestry and agronomy wishing to attain experience in wildland management (FAO, 1972a). The sessions lasted 3 months each and were held under field conditions (Puyehue, Chile and Iguazú, Argentina). The participants studied background materials and management principles, then observed management being practiced in the field and joined in group and individual exercises, and finally, prepared their own notes and materials for the presentation of classes back at their faculties (FAO, 1972b and 1973).

The Dirección General Forestal of Peru and the Universidad Nacional Agraria, La Molina, have provided training for national and international groups and individuals in a variety of ways and at all levels. At the Pampa Galeras National Vicuña Reserve research and management have been applied to vicuña and high Andean habitats for some 16 years. Student groups, protected area guards and managers, international groups of scientists and

managers, and a wide array of individuals have spent from days to weeks at Pampa Galeras to profit from that experience (Dirección General Forestal y de Fauna, 1978).

The Eastern Caribbean Natural Areas Management Program (ECNAMP), a cooperative activity of the Caribbean Conservation Association and the University of Michigan, has sponsored a series of training workshops for Caribbean managers of natural resources since 1977. These sessions, involve participants in field work to prepare management plans for critical natural areas. The Tobago Workshop (1979) centered on the preparation of a management plan for the Bucco Reef area of the Island of Tobago (ECNAMP, 1979). Participants became acquainted with the mountain forests, coastal agriculture, mangroves, and the coral reefs. Each hiked the forests and coastal zone, and dove into the waters of reefs. The local economy was examined and the national development plan was studied. The current state of science for the area was presented including guided visits to the marine resources. A plan was prepared for the area by the participants.

The work of the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE, Turrialba, Costa Rica), exemplifies the above training in several ways. For several decades students have been provided the opportunity to involve themselves directly in field research and management, on a daily basis, as part of their post-graduate training. The forestry and natural resource group have realized annual field study tours through the sub-region and the Southern USA. Currently, the wildlands and watershed management

program features a Mobile Seminar which takes managers from the sub-region to a series of sites under actual management and development.

In common, these and other efforts in the region, link training interdependently with the research and management aspects into a combined program. Here, the terms training, research, and management take on wider significance than that traditionally implied. Training involves the provision of opportunities for individuals to learn the concepts, principles, methods and skills required to fulfill a role in the overall management of natural resources and environmentally related problems. Research deals with efforts to acquire knowledge and develop *techniques* needed for resource management; the research is management-oriented, be it pure or applied. Management covers the human endeavor to orient, organize, husband and manipulate natural resources in combination with man-made capital and the human intellect, to meet specified goals; in its broadest sense, it includes the study, inventory, evaluation, planning and development of natural resources, and embraces a wide spectrum of land use options ranging from total area preservation to the full manipulation and conversion of resources from one use to another.

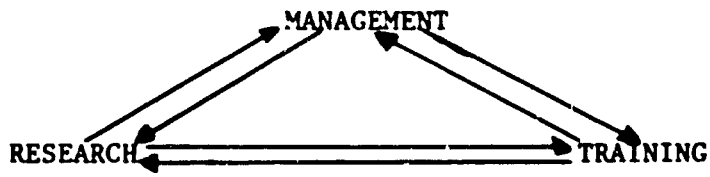


Figure 2 . If the objective of the program is to prepare individuals capable of directing the use and conservation of natural resources, training programs must go hand-in-hand with research and management in the field.

Of equal importance with development of classrooms and laboratories, then, is development of field demonstration sites where trainees can be given the opportunity to immerse themselves in the task of finding new information and methods and applying their techniques and skills to particular problems. Such sites display the results of following one or several paths of technology to meet specified objectives or solve particular problems. With careful maintenance of information and proper communication to visitors through written materials, signs, and guide services (during visits), these sites become living case histories.

Demonstration Areas

Training becomes more pragmatically oriented and focused upon actual problems by relating to field sites where solutions are being sought. Potential experimental/demonstration areas include the multiple cropping and watershed management work of CATIE (Turrialba, Costa Rica), the arid lands reforestation in Northern Peru and the wild fauna management with vicuña at Pampa Galeras National Vicuña Reserve both under the Peruvian Dirección General Forestal, and the national park management at Volcan Poás (Costa Rica). Many forestry schools have field camps utilized for practical exercises as part of the regular curriculum of study.

In addition to experimental work, demonstration sites take care to prepare written documentation, store information, install

instructive signs, and provide some amount of guidance to visitors to share the experience and provide support for those interested in applying similar principles and techniques elsewhere.

Demonstration areas are the most productive when they relate to the types of problems and situations which are representative of the local context faced by rural people. They provide excellent opportunities to illustrate ecodevelopment in action, including appropriate energy systems, waste recycling, low dependency upon chemical pesticides and herbicides, relative self-reliance, community cooperation, conservation practices and cultural identity.

Information Handling and Publications

Information from field experimentation can have impact throughout the region, given that techniques are disseminated for appropriate gathering, storage and retrieval. Demonstration areas can maintain information in ways that will be accessible and of value to an extensive array of users. Through various forms of presentation, the information can be designed to serve and influence decision makers at the policy level, researchers, managers and technical level people.

Experience from resource management and the solving of environmental problems can be published to serve others, to circumvent unnecessary duplication, and speed application of methods where appropriate. To ensure the greatest utility, publications can be designed and distributed so as to reach particular targeted audiences, including policy-makers, professionals and field technicians by general discipline or integrated problem area.

In general, each participating institution will possess a potential role in the development and use of demonstration areas. And, each can contribute to the preparation of information and publications.

Overall, the most appropriate alternative regarding methods for training as well as institutions for participation is a combination of a range of both. Training, moreover, must be supported with a network of practical demonstration areas and a supply of information and publications.

Alternative Organizational Approaches

A range of organizational alternatives warrant consideration. At one extreme of the spectrum is the possibility of a single centralized institution. At the other extreme is a decentralized set of institutions. In the continuum between lie a number of alternatives which blend the characteristics of the two extremes.

The advantages and disadvantages of the first organizational alternative are presented in Table 11. A single training facility could be conveniently located, designed and built to meet current and future needs. The program of work could be highly coordinated and focused, and the training could be integrative. A global perspective could be developed and maintained for the entire program.

However, it would be difficult to adapt training given at a single facility to meet local needs and perspectives from throughout the region. The management and administration of a large facility would be complex. And the need for a single facility to work in several languages would further complicate the effort.

TABLE 11

REGIONAL TRAINING PROJECT

ORGANIZATIONAL ALTERNATIVE #1:
CENTRALIZED SINGLE FACILITY

Advantages

- Can provide a highly coordinated program
- Can provide training with a global overview
- Ease of providing integrated training
- Ease of investment in a single project
- Can enjoy certain financial benefits from large scale operation
- Can focus efforts on regional needs, future requirements, and avoid duplication and overlap

Disadvantages

- Difficult to adapt training to local conditions
- Complex administration and management of large scale facility
- High risk on investment in a single facility/country
- High risk to regional training efforts from political influences
- Low regional support for creating new institutions, or single centralized training facility to serve whole region
- Difficulty of working in several languages
- Long start up time (long lead time)

Perhaps of greater deterrence to this alternative is the lack of support in the region for establishing a new regional institution. Existing regional organizations all face challenges to improve their efficiency, expand their outputs and justify their expenditures. The risk to regional training opportunities of political influencing and financial insecurity within a single facility raises further doubts about the value of this alternative.

The second possibility, presented in Table 12, also presents a set of advantages and disadvantages. On the positive side, an existing set of training institutions can be identified, and training services for the region could be supported among them. Each facility would offer training which is adapted to local needs and conditions. The managerial scale of each facility would remain within existing competence. Training would be provided in the local language.

Financial insecurity and political influence would affect only individual, local facilities of the set and not the whole training program. Finally, there is considerable support in the region for an alternative which builds upon existing institutions.

On the other hand, there are important disadvantages to this alternative. It would be difficult to provide a global overview in a training program where the facilities are scattered across the region. Integrated development concepts could not be realized in practical terms. Duplications and overlap would be an ongoing problem.

Essentially, a loose set of facilities would hardly be expected to meet regional needs other than for a short run perspective. Planning and implementing investments would be difficult, and the inefficiencies considerable.

TABLE 12

REGIONAL TRAINING PROJECT

ORGANIZATIONAL ALTERNATIVE #2:
DECENTRALIZED MULTIPLE SET OF FACILITIES

Advantages

- Can provide training which is adaptive to local requirements and conditions
- Ease of management due to small/medium scale
- Low risk to training effort due to geographic scattering
- Ease of working in single language
- Fast start up/short lead time
- Low risk of political influence, except locally
- High receptivity by region to support existing institutions

Disadvantages

- Difficult to provide global overview in training coverage
- Difficult to provide integrated training
- Little advantage of scale from large investments in single site
- Difficult to plan and implement investment in many scattered facilities
- Difficult to coordinate training activities
- Difficult to focus efforts on regional needs, future requirements and avoid overlap duplication and omission

Clearly, each polar alternative offers important advantages upon which to build a solution, and each has negative values to be avoided.

The third alternative, in Table 13, suggests a promising modification. The use of a central office provides the means for developing and implementing a unified regional strategy for training. The strategy can be implemented incrementally in a coordinated manner to take advantage of existing facilities, talents and opportunities, and the interest of potential donors. The program can be managed as a discreet *project* yet operate as an institutional *process*, incorporating new ideas as they evolve, and correcting activities as experience is gained from field implementation.

The existing facilities in the region presently provide a set of institutions from which to build a training network. Leaders of these organizations have expressed emphatically their interest and availability to join such an effort. Each facility can focus on particular levels, such as technician, professional, professional/manager or senior policy personnel. Local perspectives and problems can be stressed in the local idiom. Methods and techniques can evolve and adapt rapidly as warranted.

The risks inherent in the first two alternatives are minimized by this combination of a central headquarters and a network of facilities. Each individual facility maintains its peculiar political and institutional status. Few facilities would suffer from adverse political or financial influences at any one time. Each facility would receive support for the improvement and

TABLE 13

REGIONAL TRAINING PROJECT

ORGANIZATIONAL ALTERNATIVE #3:
CENTRAL REGIONAL HEADQUARTERS AND
MULTIPLE SET OF TRAINING FACILITIES

Advantages

- Can develop a unified strategy for regional training
- Can enjoy the synergistic benefits from maintaining relations among facilities
- Can develop a regional overview on training needs and keep it dynamic
- Can initiate a regional training program as a *process* rather than a discreet finite activity
- Each facility can be adaptive to local needs and situations
- Each facility will offer low risk to investment
- Each facility can work in own language
- Fast start up/low lead time, per facility
- Low risk of adverse political influence to more than a few facilities of the network
- Management/Administration scale is kept low in each training facility
- Highly focused investment in regional office program will provide multiple spin-off project opportunities
- Increased linkages to existing national/regional facilities and projects
- Maximum use of existing capabilities and infrastructure

Disadvantages

- Requires establishing a central regional office and the payment of related costs
- Non-conventionality of project design and operation

enhancement of its capability to offer those training services which are needed locally and, at the same time, fit within a regional perspective of requirements for the next several decades--and the point is an important one--but the scale of each facility increases incrementally to avoid the dangers of rapid and excessive demands upon management and administrative capacity.

Options remain open to work with various funding institutions. Donors to the regional training effort can provide support to the central headquarters for planning and programming work, training of instructors for other facilities, advising governments on the preparation of project requests, and other services having regional impact. Alternatively, donors may wish to work directly with governments through normal channels for technical and financial cooperation. Still other cases will involve support to non-governmental institutions and regional centers.

Thus, donors can collaborate with a central office in the implementation of a balanced and consistent program of investments to meet high-priority training needs in the region. Each donor can work with recipients in a variety of ways convenient to the wishes of donor and recipient. Importantly, each donor can maintain the identity of its work yet share in the advantage, and image, of regional collaboration.

Alternative 3 with its central headquarters and network of training facilities can provide the organizational framework for a regional training effort. Few disadvantages to this combination are evident. However, there remains the difficulty that the

establishment of a central office implies the payment of management and administrative personnel, which can appear, or even become, bureaucratic and excessive. Such an organizational layout may appear non-conventional for technical and financial assistance projects.

While it is true that all activities of the program other than direct training services could be centralized, there are important reasons to consider the alternatives to such a plan. If the central office is to (a) develop, promote and catalyze activities for all four levels of training (as shown in Table 10), (b) prepare and periodically update the program documents on training needs in the region, and (c) provide services to donors and recipients in the development of project ideas, then the central office staff will have to retain a number of individuals sufficient to meet these needs. Furthermore, they will be on duty travel away from headquarters most of the time.

Alternatively, these same activities and services could be performed directly by the personnel of the training facilities. This would place demands upon each individual facility for new managerial/administrative staff. Cooperation with other facilities would require travel support. Subsidies to each facility would be needed if each is to participate fully in the promotion, programming and planning of projects for the entire network. Furthermore, considerable emphasis has been assigned to the importance of working with senior policy-level officers (Level I). In fact, without the awareness and support of ministers, department directors and other leaders and high-level decision makers, substantive action for

training can hardly be expected: this work must be done on location in capital cities, and it is opportunistic insofar as it requires considerable flexibility in schedule and time dedication.

An intermediate level of organization can be included to carry the responsibilities related to training of senior policy officers, and the promotion, programming and planning of projects for the individual training facilities. A modest office in each major country, or group of countries, could fulfill these functions. The use country, or sub-regional offices, would permit the central headquarters to focus on those functions demanding centralized management, such as formulation and promotion of a regional training program, and at the same time allow the headquarters to remain small in scale.

Granted the addition of country or sub-regional offices suggests the costs or images associated with bureacracy. Moreover, it raises questions about the duplication of existing offices of FAO, the Inter-American Institute of Agricultural Sciences (IICA) and OAS. Such concerns are valid. The functioning of these offices may influence the choice of institution by which a regional training effort could efficiently and appropriately be implemented.

It is important to stress that the existing country and sub-regional offices of FAO, IICA and OAS are occupied with program and project responsibilities. It is reasonable to observe that there are no uncommitted resources. Additional tasks, especially of the type and amount needed for a regional training effort, would require new funds.

The point needs to be emphasized that FAO, IICA and OAS have personnel highly skilled and experienced in training on aspects of natural resources in Latin America. But, the types of skills and experience required to meet Level I training and to promote, program and plan training projects, are *not* necessarily to be found in any existing country or sub-regional offices. It is only the installed administrative capacity of the existing offices that offers advantages to a regional training effort. Consequently, new personnel would have to be employed for specific training functions whichever alternative is chosen. The establishment of modest country or sub-regional offices appears to be an efficient alternative.

In sum, the most appropriate alternative for organizing a regional training effort on natural resources and environmentally related problems involves three elements: 1) a headquarters will centralize program functions; 2) several country or sub-regional offices will cover high-level training and local program and project promotion and planning responsibilities; 3) a network of facilities will provide training opportunities for senior professional managers, professionals and technicians.

Chapter VI.

Strategy for Regional Training Project in Natural Resources and Environment.

Chapter VI

STRATEGY FOR REGIONAL TRAINING PROJECT IN NATURAL RESOURCES AND THE ENVIRONMENT FOR LATIN AMERICA AND THE CARIBBEAN

Introduction

The peoples of the Latin American and Caribbean *region* are facing a complex and varied set of problems with respect to their natural resources and environment. Heading the list are the loss of agricultural soils, desertification, loss of water retention capacity in watersheds, and the destruction of natural grasslands--as well as the contamination by solid and chemical wastes of soils, estuaries, rivers and inshore marine ecosystems.

Among the environmental problems associated with natural resources is the elimination of entire sets of wild plant and animal resources which are only cursorily harvested in favor of the demands of international, commercial land uses. This is leading to irreversible losses of resources which actually offer proven or promised returns often of far greater potential importance to local and world communities than their current commercial uses. Particular sites, such as watersheds, wetlands, coral reefs, lagoons, selected rainforest areas and mountain slopes and high altitude valleys, are being converted to conventional uses of lesser productivity without cognizance of their unique ecological

functions in maintaining agriculture, livestock, fisheries, forestry and human health.

The region in question requires a particularly close look in terms of how solutions are to be sought. Outstanding in most countries of the region are the already-existing institutions for the management of natural resources, as well as the universities and schools for educating and training researchers and managers, and the field action projects which are building resource utilization activity.

Work on natural resources and the related aspects of the human environment is well under way. Pre-colombian peoples already managed technologically-advanced food production and water handling systems to feed millions of inhabitants. Elaborate and technologically subtle systems of multiple-cropping, domesticated and wild animal management, and diversified cultivar management were common throughout the region and are only recently being acknowledged and re-discovered.

An examination of in-place management of natural resources, the educational and training programs and the work on research and development of knowledge and techniques for field application indicates that on-going efforts are considerable. The central issue is not one of inaction, but rather, of focus and orientation. Individual political leaders, planning directors, department heads and professionals are concentrating on the production of certain crops, are building dams, or otherwise programming narrowly defined sectors, and teaching others to do likewise. The net effort,

basically, is that problems are reduced to single causes and direct effects.

A quite crucial point is that the approach to solve the natural resources and related environmental problems in the region lies in the orientation of directors and professionals to a more comprehensive view of the human environment, and the function of natural resources in development processes. This requires the provision of certain additional tools to the existing stock of local techniques for management and development. Importantly, it involves the development of new tools and the adaption of pre-existing ones to meet the needs of people facing their daily problems.

Two exceptional cases warrant special attention where current relative inaction together with improper orientation is leading to ever-growing environmental imbalance and challenges to development: 1) wild plant and animal resources are being mined, treated as non-renewable, and assumed to be limitless in supply and ever-resilient to abuse; 2) key sites which are linked ecologically to food and water production, pest and disease control, human health, energy, environmental equilibrium and human spiritual/aesthetic/cultural values and identities, are altered, converted and destroyed in search of so-called production at the expense of greater short- and long-term gains to people.

There is, in addition, the lack of a broad range of technician-level people capable of supervising and implementing development and management projects in the field. The pyramid of trained personnel is top heavy such that a large number of highly

prepared professionals is working with a very small number of field implementors. The hiatus between theory, concept and plan, on the one hand, and practice, on the other, is extensive and it remains basically unspanned. The bridge that is to be enhanced and developed is the technician in forestry, wildland management, agriculture, livestock, wildlife, fisheries, and rural ecodevelopment.

The solution, thusly, comes down to training—a combination of efforts to orient, to provide and create tools and to extend concepts, tools and approaches to people. Specifically, action is targeted to:

1) generate an awareness in *political leaders* of the role of natural resources in human development, the implications of environmental instability, the risks involved in destroying wild plant and animal resources and the multiple benefits to be gained by their appropriate utilization;

2) provide information and tools to *senior policy officers, planners and department heads* concerning the significance of natural resources to development, the environmental implications of various choices of resource use, and suggested means to avoid resource destruction and to gain augmented benefits from appropriate resource use;

3) offer *professionals* opportunities to value and understand natural systems and how these relate to and sustain development, to appreciate the needs of humans and the perceptions of diverse social groups, to understand and obtain tools that facilitate work on an integrated basis with other disciplines to solve common problems;

4) develop *technician-level people* with broad generalist abilities in major fields, with primary focus upon the implementation of field action, working with rural (and urban) people, and extending the principles and techniques of ecologically sustainable development.

Existing training activities and facilities are numerous, but gaps do exist between the needs and the opportunities currently available. This Regional Training Project is proposed to fill these gaps.

The ends sought are ambitious. Needed are political leaders convinced and prepared to initiate programs and support professionals to reverse existing trends in soils loss, desertification, deforestation, freshwater and marine contamination, destruction of critical natural areas and the incidental elimination of wild plant and animal resources. Needed is receptivity to the special and unique role to be played by native peoples in the attainment of full and sustainable resource utilization for development. Heads of planning offices, government departments and resource-using companies must turn from environmentally unsound practices and search for integrated solutions to conflict. Professionals require perceptions of the whole problem of humans as the raison d'être, as well as of the relevance of wild species and areas; and they must have tools to create the new, locally valuable solutions. People out-on-the-ground must receive benefits in ways that are culturally sensitive, can be expected to continue year after year, and provide the basis for rounded human development.

While the task is great, the means are very much more subtle. Facilities for training do exist. Professionals are already working in many of the related fields throughout the region. A Regional Training Project need not involve spectacular large-scale investments in developing new centers for training -- this

would only duplicate and draw talent from one place to another. What becomes clear from the foregoing chapters is that the already-existing institutions can be assisted to refocus their efforts, to add new materials and to become more integrative. The field survey of the region tells of the enthusiasm on the part of teachers, ministers, field managers and researchers to participate in such an effort. The needs are recognized.

Description of the Regional Training Project

This Chapter presents a proposed Regional Training Project on Natural Resources and Environment (for Latin America and the Caribbean). The first section will describe the Project

Goals and Objectives
Organization and Management
Program Activities and Schedule
Finance
Outputs of the Project

Subsequently, a section on Project Strategy will consider the ways and means by which the Project can be implemented. A closing section will offer suggestions for allied and follow-up work which stands in relation to the proposed Regional Training Project.

Goals and Objectives

The goals and objectives of the proposed Regional Training Project in natural resources and the environment in Latin America and the Caribbean are:

GOAL — Create the capacity to manage and utilize natural resources and the environment sustainably as basic elements of overall social and economic development in the region.

OBJECTIVES

1) Create an awareness, on the part of high-level senior policy officers, of the role of natural resources and the environment in the development process.

2) Develop professional capabilities for inventorying, evaluating, managing, utilizing and developing natural resources in ways consistent with meeting short-term human needs *and* longer-term environmental sustainability.

3) Develop professional capabilities for utilizing the full potential of wild plant and animal resources on a sustainable basis.

4) Develop professional capabilities for selecting and managing natural areas which are critical to enhance and sustain development and to the maintenance of the human environment.

5) Develop a cadre of field technicians capable of implementing action projects, including reforestation and stabilization work in coastal zones, mountains, deserts and watersheds; the production of wild fauna, timber and fuelwood products; conservation of genetic resources and the management of protected natural areas.

6) Support the development of demonstration areas to illustrate successful resource management schemes and to serve as training sites from which extension may be realized.

7) Support the development of literature, publications and teaching materials to communicate advances in knowledge and methods for inventory, evaluation, planning, management, utilization and development of natural resources.

Organization

The proposed Regional Training Project consists of two functional levels of organization: Project Headquarters and Sub-regional/National Offices, each with specific responsibilities to fulfill, yet interrelated one to the other. See Figure 4 on page 161.

PROJECT HEADQUARTERS

The *function* of Headquarters will be to: (a) manage and administer the Regional Training Project, (b) review and assess requirements for training in natural resources and environment in the region, (c) maintain a current set of priorities for action to guide technical and financial cooperation, (d) coordinate cooperative efforts among national activities where regional colaboration is warranted, (e) stimulate activities and facilitate support to the sub-regional/national offices, as necessary, (f) organize and participate in training activities, the development of demonstration areas and literature and training aids, and (g) establish liaison with international, regional, and bilateral programs to ensure appropriate coordination and cooperation.

The *personnel* of headquarters will include a *regional training officer, program planner* and an *administrative officer,* in addition to the appropriate secretarial support. The regional training officer will serve as *project manager.* The regional training officer will be a senior person with training and experience in natural resources education as well as management, research and/or development. He shall have had experience in project management, in working with international, regional or bilateral organizations and be respected in the region. The program planner can be senior or relatively junior, with training and experience in natural resources. He shall have had experience in planning and programming with national and international institutions, and be respected in the region. He should be qualified to take over from the regional training officer when the latter is absent. The administrative officer shall have the training and experience to handle the administrative and accounting tasks of the project.

The *modus operandi* of the headquarters for the Regional Training Project is to work within the policy and institutional framework of the host institution to collaborate with the sub-regional/national offices to carry out project activities. The headquarters will serve as a secretariat for the compilation and integration of information on training activities, needs and priorities in the region. Importantly, the role

of headquarters is not to determine priorities per se, but to preside over the *process* of priority determination by sub-regional/national officers. Headquarters will receive, disburse and account for funds related to the work of the project. The headquarters will relate to existing regional training centers (CATIE, CIAF, CIDIAT, INPE, Bernabe Mendez, ECO, etc.), and international, regional and bilateral institutions regarding the program of work. The status and progress of sub-regional/national officers will be monitored to ensure that viable and active programs are maintained in each.

SUB-REGIONAL/ NATIONAL OFFICES

The *function* of the sub-regional/national officer will be to: (a) manage and administer local activities of the Regional Training Project, (b) review and assess requirements for training within the sub-region, nation or territory, (c) maintain a current set of priorities for action to guide technical and financial cooperation, (d) stimulate and sponsor activities to meet the training, demonstration and informational objectives of the project, and (e) bring together potential donors and recipient institutions to catalyze investment in training.

The *personnel* of the sub-regional/national offices will consist of *sub-regional* or *national coordinators* and secretarial support. The coordinators will generally be individuals active in natural resource education, training, management, research or development, with considerable prestige in their sub-region, country or territory.

The *modus operandi* of the sub-regional/national offices is to work within the policy framework of the Regional Training Project and under the overall direction of the regional training officer/project manager to carry out the activities of the project. The coordinators will supply headquarters with information on current training opportunities and future needs, and collaborate with other coordinators in the determination of priorities for action. Coordinators will relate to existing training centers in their respective territories. The coordinators are expected to develop and maintain close working relations with educational,

management, research and development natural resource institutions to aid in the design of the needed training activities to enhance manpower qualities and strengthen their institutions. It is envisioned that the coordinators search for potential donors for training projects and develop ways and means to bring together possible donors and recipients.

It is expected that the coordinators will form sub-regional or national-level technical committees *(ad honorum)* to advise on training needs, priorities and in the evaluation of ongoing or completed activities.

Activities

The activities of the Regional Training Project will be focused upon the levels of the recipients and specific target groups. Project activities will be implemented through existing institutions, and only where these are absent will new facilities be developed. Existing regional centers will be supported by the Project, as appropriate, to avoid duplications or conflict, and to enhance regional training opportunities.

TYPES OF ACTIVITIES

See Table 14, "Types of Activities Suggested by Level and Target Group", on page 141.

SCHEDULE OF PROJECT ACTIVITIES

Project activities are to be implemented in four time periods: *immediate*, *short-term*, *medium-term*, and *long-term*. These steps proceed concomitantly with the recruitment and training of Project personnel, and through Project evaluation and decisions for follow-up and future evolvement over a five-year period.

The activities of the Project are shown by (the four) time periods, in Table 15, "Schedule of Activities", on page 143.

TABLE 14

REGIONAL TRAINING PROJECT

TYPES OF ACTIVITIES SUGGESTED BY LEVEL AND TARGET GROUP

LEVEL	TARGET GROUP	ACTIVITIES
I Senior Policy Level	Personnel responsible for decisions at high institutional levels including executives, political leaders and directors, generally possessing university education, but who are in their positions of responsibility through the political system Ministers Vice-ministers Corporate Executives Department Directors (Directors General)	- Develop formal congresses and conferences. - Promote informal high-level meetings. - Organize visits by target group to successful examples of resource management in the field (local/foreign). - Promote public information and debates on the media (radio, TV, newspapers, to be observed by target group). - Prepare publications on guidelines, summaries on successful and unsuccessful cases, films geared for target group. - Develop brief, formal courses and workshops for target group.
II Senior Professional/ Manager Level	Personnel responsible for technical decisions at the high institutional level, generally possessing university-level education and post-graduate specialization or equivalent work experience Directors of Planning Directors of Technical Divisions and Projects (forestry, fisheries, wildlife, wildlands and parks, agrarian reform, public works, public health, remote sensing, sanitary engineering, valley or regional corporations, etc.)	- Promote graduate degree programs at the masters and doctorate level. - Provide formal courses and workshops to "update" technical knowledge and skills, and to provide new perspectives. - Provide formal courses and workshops to "convert" the knowledge and skills base from that of a narrow focused specialist to a more open generalist or holistic worker. - Organize in-service training, by joining the work of projects or organizations for periods sufficient to learn new techniques or perspectives.

TABLE 14, continued

LEVEL	TARGET GROUP	ACTIVITIES
III Professional Level	Personnel responsible for projects, research, management, development and education, having university education and, typically, some specialized training or equivalent experience Project Leaders Researchers Managers Professors Development Officers	- Develop (amplify, reorient, complement, expand) curriculum of existing faculties related to natural resource and the environment (forestry, agronomy, marine sciences, etc.). - Improve curricula of traditional faculties (economics, biology, business, agronomy) to include natural resources and environmentally related problem analysis. - Develop new faculties or professions where necessary to deal with the management of wild plant and animal resources and the management of wildland resources key for development. - Provide formal courses to "up-date" and "convert" existing professionals regarding natural resources and environmental problems. - Offer in-service training opportunities, particularly in relation to field projects where new and innovative methods can be demonstrated.

IV
 	
Technical Level
	Personnel with special training in skills needed to meet requirements of particular tasks
	
	Forestry Technicians
	Forest Rangers
	Park Rangers
	Agricultural Technicians
	etc.
		- Improve curriculum of existing training schools to include natural resources and environmental problems.
		- Develop new opportunities for preparation of technical-level individuals, including:
		  - Reforestation Technicians
		  - Protected Area Technicians (wildlands)
		  - Fauna Utilization Technicians
		  - Rural Extensionists (with ecodevelopmental skills).
		- Offer in-service training opportunities in projects of successful resource management.
		- Offer short courses to "up-date" and "convert" existing technical level officers.

TABLE 15

REGIONAL TRAINING PROJECT

SCHEDULE OF ACTIVITIES

ACTIVITIES	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Immediate Action					
1. Establish the Regional Training Project.	——				
2. Recruit regional training officer, program planner, administrative officer and sub-regional/national officers and support staff.	—				
3. Implement Workshops for Project Personnel.	—				
4. Establish Sub-regional/National Offices.	——				
Short-term Action					
5. Implement Training Activities for Level I		——	----------	----------	
6. Promote and Catalyze Plans for Cooperative Action and/or Implement new Projects for Levels II, III and IV.		——			
Medium-term Action					
7. Sponsor Workshops for Personnel of Training Facilities for Levels II, III and IV.			——	----------	
8. Promote and Catalyze Implementation of Action on Levels II, III and IV to fill out network.			——	----------	
9. Promote and Catalyze Development of Demonstration Areas.			——	----------	

TABLE 15, continued

ACTIVITIES	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
10. Promote and Catalyze Publications, Teaching Materials, Films, etc.		----------	----------	----------	----------
Longer-term Action					
11. Sponsor a 5-day Regional Seminar to Review Work of Training Project.				---X---	----
12. Evaluate Regional Training Project and Prepare Follow-up Recommendations.				---X---	----

per Errata

Finance

The funding of the Regional Training Project is considered as three separate but interrelated elements: *core funds, special grants* and *development projects*. The core funds and special grants will be assigned directly to the Regional Training Project for disbursement and accounting. The sum of both financial elements constitutes the budget to be managed by the Project itself.

Funds for development projects will be granted directly by donor institutions to recipient public or private organizations, through normal established channels for international technical and financial cooperation. These funds will be managed by local institutions, independently of the Regional Training Project.

The budget for the proposed Regional Training Project is shown in Table 16, "Estimated Budget", on page 146. Note the separate presentations for core funds, special grants and development projects. Also, note the sub-totals for the budget of the Regional Project per se, and the development projects to be managed outside of the Project.

CORE FUNDS

The core funds are designed to cover the salaries of the headquarters personnel, office expenses, travel and perdiem and the costs related to activities implemented by headquarters directly.

Also, the core funds will cover the salaries or honoraria to compensate sub-regional/national coordinators for full or partial time commitments to the Project. Their office expenses and cost of promotion and catalytical endeavors will be covered from core funds.

TABLE 16

REGIONAL TRAINING PROJECT
ESTIMATED BUDGET

ITEMS	FUNDS EXPENDED THROUGH HEADQUARTERS, PER ANNUM $(000)	REGULAR DEVELOPMENT PROJECTS $(000)	TOTAL PROGRAM BUDGET, 5 YEARS $(000)
A. CORE FUNDS			
Headquarters			
1. Salaries			
Regional Training Officer	$ 30		
Program Planner	25		
Administrative Officer	20		
2 Secretaries	20		
Staff benefits @ 20%	19		
2. Office Expenses			
Rent and Utilities, $500/mo. x 12	6		
Supplies, $500/mo. x 12	6		
Equipment, $5,000/5 years	1		
Communications, $500/mo. x 12	3.6		
Travel and Perdiem	30		
3. Activities			
Activities of program	70		
4. Technical Backstopping			
4 months consultants, $4,000/mo. x 4	16		
	$ 246 p/a		$1,230

TABLE 16, continued

ITEMS	FUNDS EXPENDED THROUGH HEADQUARTERS, PER ANNUM $(000)	REGULAR DEVELOPMENT PROJECTS $(000)	TOTAL PROGRAM BUDGET, 5 YEARS $(000)
Subregional/National Offices			
1. Salaries			
8 Coordinators, $20,000 average	$ 116		
8 Secretaries, $10,000 average	80		
Staff Benefits @ 20%	39		
2. Office Expenses*			
Rent and Utilities, $200/mo. x 12 x 8	19.2		
Supplies, $200/mo. x 12 x 8	19.2		
Equipment, $2,000 x 8/5 yrs.	3.2		
Communications	14.4		
Travel and Perdiem	40		
3. Activities			
Activities of Program, $10,000 x 8	80		
	$ 411		$2,055
SUBTOTAL CORE FUNDS, per annum	$ 657		$3,295 (5 years)
B. SPECIAL GRANTS			
Workshops for Project Personnel and Instructors, 3 sessions, 3 months each, 25 participants each. $100,000/workshop x 3	$ 60		$ 300
SUBTOTAL SPECIAL GRANTS, per annum	$ 60		$ 300

TABLE 16 , continued

ITEMS	FUNDS EXPENDED THROUGH HEADQUARTERS, PER ANNUM $(000)	REGULAR DEVELOPMENT PROJECTS $(000)	TOTAL PROGRAM BUDGET, 5 YEARS $(000)
C. DEVELOPMENT PROJECTS			
Technical and financial assistance to develop 50 training facilities, ranging from $10,000 to $1,000,000 each, with $200,000 average; $200,000 x 50 facilities		$2,000	$10,000
SUBTOTAL DEVELOPMENT PROJECTS, per annum		$2,000	$10,000
TOTALS	$ 717 per annum	$2,000 per annum	$10,000 (5 years)

SPECIAL GRANTS

The personnel of headquarters and the sub-regional/national offices will require training immediately on Project launch. An intensive workshop, such as that outlined in Table 17, on page 150, will enable the staff to compliment and supplement personal education and experience, gain insights and skills in various aspects of environmental management, and establish a holistic environmental perspective. The workshop experience will provide the opportunity for the staff to form a team, enabling them to apprehend common principles underlying the goals and means of the Project.

In addition, courses will be provided to instructors of the training facilities to be supported by the Project. Such courses will enable individuals at the existing facilities to offer training along the lines espoused by the Project.

Special grants will be extended to one or more institutions presently capable of providing these training workshops and courses for Project staff and instructors. Workshops may be required throughout the Project, to prepare instructors for new training activities.

TABLE 17

REGIONAL TRAINING PROJECT

CURRICULUM, TRAINING WORKSHOP FOR
PROJECT PERSONNEL AND
INSTRUCTORS
(duration 3 months)

THEMES	TIME PERIOD (days)	CLASS/FIELD	
The Regional Training Project Objectives, program development, implementation	2	x	
Administration, accounting, project operations	3	x	
Ecodevelopment: principles and application in rural extension	5	x	x
Applied Anthropology; relationship of native peoples, their knowledge, needs, and role in management	5		
Ecology; principles, guidelines for development, special biomes	10	x	x
Planning and economics, project formulation and evaluation, public budgeting, impact assessment	10	X	
Management of Natural Resources Utilization, protection, genetic materials, multiple-use	15	x	x
Communications, environmental perceptions, techniques	5	x	
Institution building	2	x	
Demonstration areas	3	x	x
Working days	60		

DEVELOPMENT PROJECTS

The actual development of individual training facilities will be achieved through normal technical and financial cooperation projects. The already-existing mechanisms for arranging development projects between donor and recipient organizations will serve the goal and objectives of the Regional Training Project.

A very general estimate for the potential investment required for developing the needed training facilities in the region is shown in Table 16, on page 146.

Outputs from the Project

The Regional Training Project can be expected to deliver seven specific outputs:

1) Periodic (annual) reports on the status of training in natural resources and the environment in Latin America and the Caribbean, showing priorities for action and investment in training.

2) Services to governments, and public and private educational, research, management and development organizations to assist in the preparation and presentation of project requests to potential donors.

3) Services to donor institutions (international, regional, bilateral, private, non-governmental, etc.) in the identification of priority opportunities for technical and financial cooperation in training.

4) Preparation of instructors for training facilities.

5) Development of demonstration areas on examples of key resource management problems and opportunities.

6) Preparation and distribution of teaching materials, films and literature.

7) Promotion and follow-up support for 50 existing and new training facilities in the region.

Implementation of the Project

The Regional Training Project which has just been described can be placed into action immediately. Conceptually there are no impediments to early implementation. The idea of the proposal has the enthusiastic support of individuals and institutions visited by the consultants during the field work of the study.

The forthcoming section elaborates on key items to be considered in the proposal implementation. Criteria and guidelines are given to help facilitate several important choices.

Selection of Sponsor/Host Institution

An appropriate institution must be selected to sponsor and host the Regional Training Project. A range of alternative organizations can be considered:

Interamerican Institute of Agricultural Sciences (IICA)
International Center for Training in Environmental Sciences (CIFCA)
International Union for the Conservation of Nature and Natural Resources (IUCN)
Organization of American States (OAS)
UN Educational, Scientific, and Cultural Organization (UNESCO)
UN Environment Program (UNEP)
UN Food and Agriculture Organization (FAO)

Aside from the possibility of selecting one of these, or other governmental or non-governmental, international or regional organizations, there is the option of establishing a new body specifically for the purposes of this Project.

The Regional Training Project must be able to:

a) work with both governmental and non-governmental institutions and with private individuals. A wide array of organizational structures will be involved to cover the range of training needs.

b) be responsive to opportunities. Project activities will require catalytic and opportunistic action.

c) be flexible in the delivery of funds and support. Funds must reach recipient institutions and individuals in ways that are tailored to their particular requirements.

d) work with a high degree of independence from political and institutional constraints. Project activities will deal with innovative and creative concepts and methods.

Experience suggests little support in the region for the creation of new institutions that depend upon the political and financial support of governments. The ideal solution is perhaps to establish a new institution specifically for training in natural resources and related environmental problems. Such an alternative warrants consideration to the extent that basic operating expenses are assured from grants and donations.

The UN organizations, OAS, and IICA can meet the criteria theoretically where funds are provided on a "trust fund" basis. These organizations could establish a special office, or reinforce existing offices, to manage this Project for a finite period. Alternatively, they could manage it as an expanded regular program activity. These organizations have the advantage of possessing existing country offices and sub-regional centers.

CIFCA and IUCN, although differing markedly in objectives and methods of operation, have the characteristics needed to

meet the criteria. They have demonstrated their capacity to work in training and to manage projects. Neither is established institutionally in the region, in the sense of headquarters facilities and country offices.

Thus, if the Regional Training Project is to be envisioned as an effort with a finite (5 year) duration, each of the mentioned existing institutions could conceivably manage the proposed project. The character of the Project would differ according to the work styles of each. Alternatively, if the Project is envisioned to set the stage for a permanent regional training program, then the option of a new specialized institution has merit.

Because of the need for exploration and flexibility in project management, and the difficulty at predicting the follow-up action to be required after the initial 5-year period, *it is suggested that the Project be sponsored and hosted by an existing organization.*

A review and evaluation of progress in the last year of the Project might propose: (a) continuation of the Project for another finite period, (b) the termination of the project, (c) the incorporation of the Project as a regular program element of an existing organization, (d) the establishment of a new specialized institution. A posture that maintains open options will conserve energies from the challenge of launching a new organization at the initiation of work.

Location of Headquarters and Subregional/National Offices

Location of the Headquarters and subregional/national offices of the Project can be guided by considerations both of site and affiliation with local organizations. Headquarters can be placed at a site which is (a) central within the region to minimize travel costs; (b) easily accessible by efficiently routed air travel throughout the year; and which has (c) relative political stability to insure the continuity of the program and its independence from internal political developments.

Several locations meet these criteria, including: Bogotá, Lima, Panama City and Quito. The Project headquarters could be located at any of these cities within either (a) the offices of the sponsoring/host institution, or (b) an office rented specifically for this purpose.

The location of the subregional or national offices will depend upon the circumstances in each case. As shown diagramatically in Figure 3 , eight offices are suggested. National offices could be added to provide greater, more specific attention when warranted. Conversely, national offices could be assimilated into subregional offices to reduce specific activities: similarly, activities could be launched in a limited subregion during an initial phase, delaying action elsewhere until funds become available.

The reasoning for the choice of eight sub-regional or national offices is as follows: First, in cases like Brazil and

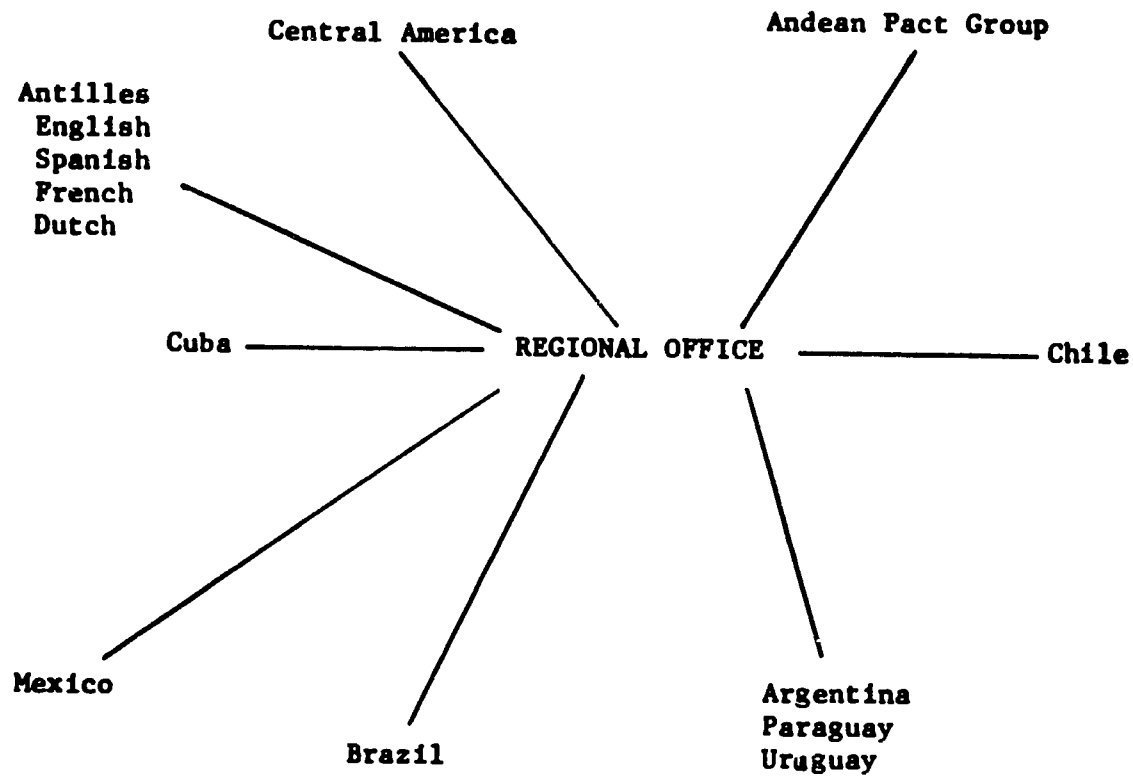


Figure 3 . Sub-Regional and National Offices of the Regional Training Program in Natural Resources and Related Environmental Problems.

Mexico, because of the size and complexity of these countries, the uniqueness of the work to be done, and the availability of outstanding local individuals and organizations with which to work, it would be at once imperative and feasible to work directly at the national level.

Second, in cases like Central America (including Panama and Belize) and the Lesser Antilles*, the small size of the countries/territories, and the relative similarity of natural resources and environmental problems, training needs and types of action required, suggest critical economies in working at the sub-regional level.

Third, nations like Bolivia, Colombia, Ecuador, Peru and Venezuela share problems and environments, and similar types of training are required. Because of the scale, the action programs would not necessarily lend themselves to shared activities, and there is a wealth of active individuals and institutions to collaborate in the program. However, there is also the Acuerdo de Cartagena which could serve to coordinate the regional training program at the Andean Pact level to economize on the number of national offices to be supported during the initial stage. This carries the additional advantage of involving the Pact in work on natural resources and the environment. Subsequently, national offices

---

*(In this case, it is suggested that the Dominican Republic and Puerto Rico be treated with Central America, Haiti with francophone Antilles, and Cuba as an individual nation.)

can be opened. In any case, national coordinators can be organized into a working committee within the Andean Pact at the subregional level.

Finally, countries like Argentina, Chile, Uruguay and Paraguay could ideally work together through subregional activities, there being no established subregional institution or framework. At the initial period of the program, it is suggested that Chile be treated as a subregion, and that means be explored to coordinate Argentina, Paraguay and Uruguay as a subregion under one office.

Recruitment and Preparation of Project Personnel

The sponsoring host institution will employ individuals in the positions of regional training officer, program planner, administrative officer and two secretaries. The regional training officer will function also as project manager: these officers are expected to be dynamic individuals with appropriate academic preparation and field experiences.

Currently in the region, outstanding individuals in a wide spectrum of institutions are devoting time and energy to promotions and developing the appropriate management of natural resources. Some dedicate personal time to these efforts. Others are employed by organizations that are committed to some area of natural resources.

The challenge for the Regional Project is to harness the talent, energy and vision of these individuals. Local institutions

similarly, can be supported to focus parts or all of their efforts towards the objectives of the Project. In Appendix III a list is presented showing possible institutions to collaborate with the Regional Project.

One key institution in each of the eight subregions or countries can be selected to cooperate with the Project by serving as a local office. Ideally, an outstanding resource specialist, educator, researcher, scientist or public servant is already employed by the institution. Alternatively, the institution can recruit an appropriate individual.

The eight local organizations will formalize their relationship with the Regional Project--vis-a-vis the sponsor/host institution--through contracts or appropriate legal and administrative instruments. Individual coordinators for the subregions or countries will be employees of the local institution, which assigns the individual to work on the cooperative regional program.

A training workshop will be offered for the headquarters and subregional or national personnel. The workshop is designed to provide exposure to the range of knowledge requested for holistic environmental management, and importantly, to bring the individuals together to form a team with clear understanding of the Regional Project, its objectives and methods.

The workshop for project personnel can be offered under the auspices of a university in the region, CIFCA or other local institution. The curriculum, as suggested in Table 17, will be under the direction of the Project and financed by it. Consultants

may be employed as necessary to serve as instructors for the workshop.

Establishment of Advisory Board

An Advisory Board will be established to orient and guide the work of the Project. As suggested in the diagram in Figure 4 , the Advisory Board is attached to the office of the Regional Training Officer/Project Manager. The individual members of the Board are named by the sponsoring host institution, to serve for specified periods. Individuals are sought who possess knowledge and experience in natural resources management, education, research and development.

It is suggested that the Advisory Board consist of 12 individuals, six from interested donor organizations, (including international, regional, bilateral and private institutions) and six from the region. The representatives from potential donor organizations should be free to act in personal capacities, yet be in a position to advise on policies and objectives of the organization. The individuals from the region should be outstanding in fields related to natural resources. Notably, the 12 individuals should be representatives of the donor organizations and the countries of the region.

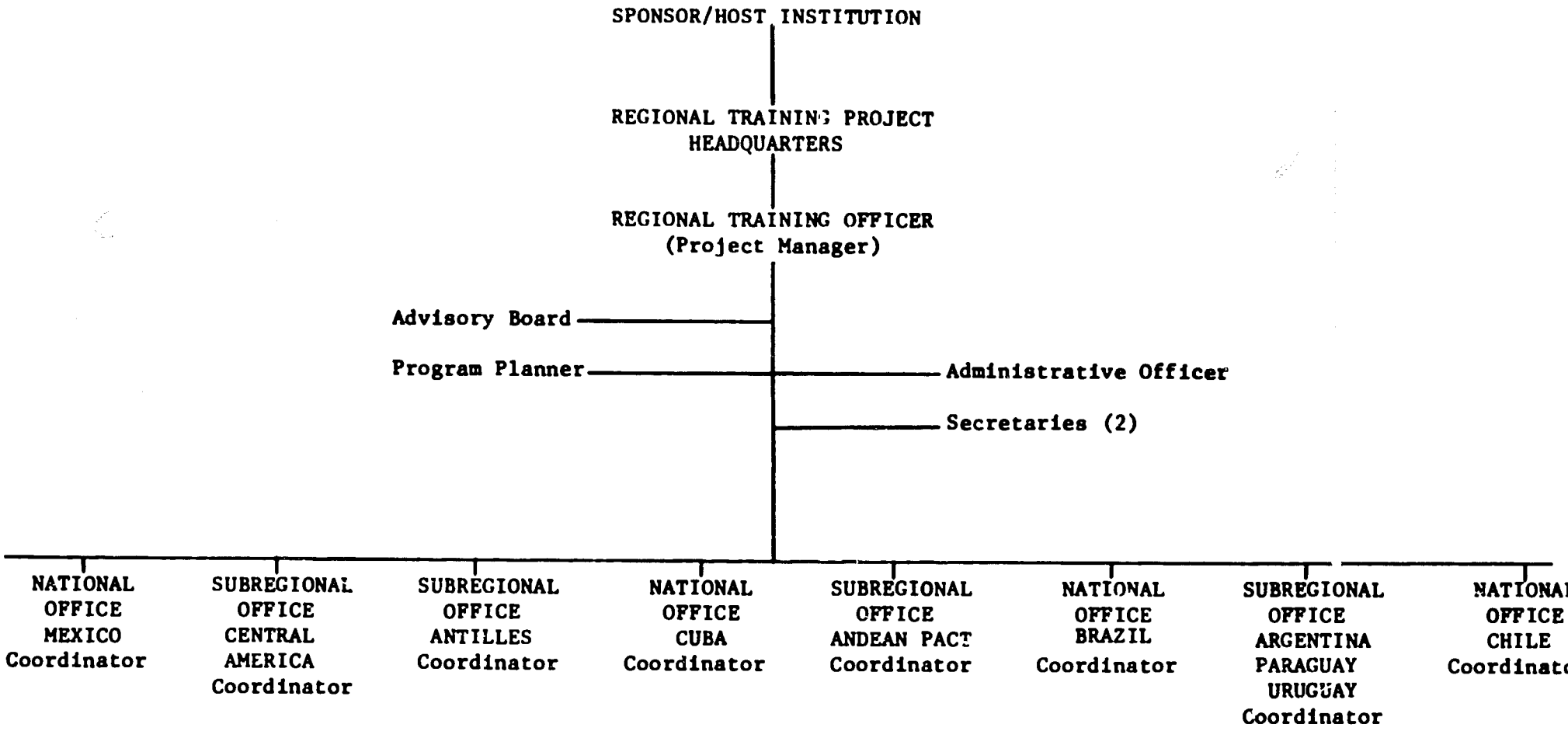


Figure 4 . Suggested organization diagram for the Regional Training Project in Natural Resources in Latin America and the Caribbean.

Development of Detailed Work Program

The detailed program of work will be developed from analyses of the status of existing training opportunities, the trends in the use and status of natural resources, and the gaps between supply and demand for training opportunities. The reports prepared by the consultants to this study provide the basis for the further development and up-dating of that information.

The coordinators will gather and analyze data for their respective areas of responsibility. That information will be integrated by the program planner. The entire team of coordinators and headquarters staff will meet periodically to determine the priorities for action according to four target groups to receive training opportunities:

I. Senior Policy Level
II. Senior Professional/Manager Level
III. Professional Level
IV. Technician Level

Furthermore, the priorities will be presented according to themes, such as:

Integral Natural Resource Management
Control of Soil Erosion
Reclamation and Halting of Desertification
Management and Utilization of Native Forests
Management of Fresh Water and Marine Resources
Management of Coastal Zones and Islands
Environmental Extension
Inventory and Evaluation
Rural Environmental Planning
Management of Critical Natural Protected Areas
Management and Utilization of Wild Species

To the extent possible, the requirements for training by level and theme will be stated in numerical terms. That information, together with guidelines on the most appropriate training methods for each level and theme, will orient the design of activities to be realized. It is to be expected that the themes will change as individual fields are covered and new problems identified.

Implementation of Activities

Immediate Action -- The first step is to establish the institutional arrangements for the Project. This involves the selection of the appropriate sponsor/host organization and the realization of appropriate agreements. An advisory board is named. See Table 15 on page 143.

Second, the regional training officer (project manager), program planner, administrative officer and secretaries are recruited and employed by the sponsor/host institution.

Third, the eight local institutions to work at the subregional or national level are selected and agreements between them and the sponsor/host institution are established.

Fourth, subregional and national coordinators are selected and employed or assigned by the eight local organizations. A workshop is next realized in order to prepare the headquarters staff and the coordinators. Personnel from existing institutions will be invited to participate in the workshop in an effort to begin training instructors in key organizations.

At this point, the Project is installed and attention turns to the main action priorities.

Short-term Action — The fifth step involves provision of opportunities for senior policy-level leaders (Level I) to become oriented and informed about natural resource development options and problems. This step has been given the highest priorities by the consultants and by individuals contacted during the field study. Only with the support and commitment of ministers, university presidents and parliamentarians can department heads, professors, professionals and field technicians proceed to work, ci ıte and innovate new approaches and start to meet local needs. Working with political leaders of the countries will absorb considerable time of the local coordinators and will extend over the duration of the Project.

Sixth, with the Level I activities under way, the local coordinators will work with relevant organizations to catalyze detailed plans and projects to build the activities for the senior professional/manager level (II), professional level (III) and technician level (IV) aspects of the Project, including curriculum improvements in existing faculties, new faculties in existing universities, development and construction of new schools and facilities, demonstration areas, and other elements. The coordinators will promote productive relationships between local institutions and potential donors interested in technical and financial cooperation.

Medium-term Action — Seventh, workshops will be implemented to prepare personnel from cooperating institutions to direct and work as trainers in the facilities to address levels II, III and IV. These will involve work in various themes and languages throughout the region. The Project will cooperate with regional centers where feasible.

Eighth, the development of training activities for the senior professional/manager level (II), the professional level (III), and the technical level (IV) will be promoted and catalyzed. This will be the period of actual construction, installation and the greatest activity.

Ninth, demonstration areas will be promoted and catalyzed to ensure that sufficient study areas are made available for training and extension purposes as well as to catalyze management-oriented research.

Tenth, publications, teaching materials, films, journals and other communication and information aids are promoted and catalyzed.

Long-term Action -- Eleventh, in the 5th year, a regional seminar will be held, involving Project personnel, political leaders, resource directors and international organizations, amongst others, to review the achievements of the Project and make recommendations concerning its future role in the region.

Twelfth, and finally, the sponsor/host institution, headquarters and subregional/national personnel will prepare an evaluation of the Project, based in considerable part upon the

regional seminar. Alternatives for follow-up action will be suggested.

Strengthening Existing Institutions

By these means, the Regional Training Project will focus its activities within the existing universities, schools and other national and regional institutions, both public and private. The Project will support new or modified curriculum on natural resources and related environmental problems within faculties of forestry, agronomy, biology, engineering or other units, as well as within research and training institutes, regional centers, and private organizations concerned with natural resource management. This will require the preparation of teaching personnel, the purchase of supplies and equipment, the development of teaching materials, and the implementation of demonstration/extension areas in the field.

Four criteria are suggested for use in selecting the institutions to be supported by the Project: (1) academic strength in related fields -- existing and demonstrated capability in scientific and technical fields related to priority problems, including, reclamation of marginal lands, watershed management, wild plant and animal resource development, protected area management, etc; (2) representativeness of major ecological region -- location and work experience in a major biome of priority concern, such as andean, patagonian, pampean, rainforest, desert, savannah/

caatinga/cerrado, marine, island, etc.; (3) institutional strength -- demonstrated capacity in administration, project management and a history of local impact and respect among peers; (4) coverage of training levels -- capacity to provide post-graduate, university, and/or technician-levels, that is, ensure that all the levels of training required are offered at one or several locations throughout the region.

Creation of New Training Facilities

The Regional Training Project may support the construction and development of a new institution where viable alternatives to meet the enumerated criteria are not found. Such a situation would involve the development of a new faculty on an existing campus or a new technician school in conjunction with an established university, natural resource management agency or private resource conservation organization. It can be expected in addition that several institutions that meet the criteria for support may require the construction of additional classrooms or laboratories including field demonstration/research sites, and perhaps the remodeling of existing structures or the construction of new buildings.

Linkages with Existing Regional Centers

Several regional centers provide training opportunities in natural resources and related environmental problems. The Project

should work closely with these organizations to ensure the most efficient use of services and facilities, avoid duplication and promote complementary activity where possible.

Among the several institutions that warrant special collaboration, are:

Bariloche Foundation, Bariloche, Argentina
Caribbean Fisheries Training and Development Institute, (CFTDI) Chaguaramas, Trinidad
Eastern Caribbean Institute of Agriculture and Forestry (ECIAF), Ceteno, Trinidad
Eastern Caribbean Natural Areas Management Program (ECNAMP), West Indies Laboratory, St. Croix
ERTS/LANDSAT Center, LaPaz, Bolivia
Interamerican Center for the Integrated Land and Water Development (CIDIAT), Merida, Venezuela
Interamerican Photo Interpretation Center (CIAF), Bogota, Colombia
Pan American Center for Human Ecology and Health (ECO), Mexico City
Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS), Lima, Peru
Space Research Center (INPE), San José dos Campos, São Paulo State, Brazil
Tropical Agricultural Center for Research and Training (CATIE), Turrialba, Costa Rica

Phasing of Project Activities

The activities of the Project can be phased over a 5-year period. A shorter period would be of little utility because of the time required to catalyze and realize action on the ground. Lead time periods from identification to implementation of formal development projects may run from 2 to 4 years.

While the proposal suggests initiation of work throughout the region simultaneously, other alternatives warrant consideration. The Project may focus on one or a few subregions or countries

which are highly receptive to the Project and anxious to initiate work: thus geographical scope during phases of the Project can be limited to permit a concentration of efforts and funds.

Alternatively, a program may be implemented simultaneously across the region on a limited scale, focusing on the highest priority activities in each sub-region or countries.

Funding

Ideally, a single funding organization will support the sponsoring/host institutions with $657,000 per year, to cover the core costs of project activities implemented by the headquarters and subregional/national personnel. Similarly, a single donation of $300,000, or $60,000 per year, will cover the costs of three training workshops for personnel of the Project and instructors for the training facilities.

With these inputs, seven specific types of outputs can be anticipated:

- A unified and integrated annual report on the status of training in the region and priorities requiring action
- A service to governments and local institutions in project identification and preparation, and the establishment of linkages with potential donors
- A service to potential donors to identify important project ideas
- The preparation of Project Staff and 60 instructors for training facilities and regional centers
- The production of teaching aids, films and literature for use throughout the region

- The establishment of demonstration areas to serve for experimentation, training and extension on important methods and potential solutions to local problems
- The design and implementation of some 50 training facilities around the region, specifically focused upon aspects of natural resources and related environmental problems, at important levels

Behind these expected accomplishments lie the unseen but constant efforts of Project staff in orienting senior policy leaders to support the development of human resources and institution building. This work is considered by local resource experts to be the most critical part of the Project.

It is expected that these efforts and expenditures can achieve a spin-off of some 50 development projects for training facilities. Such projects would be supported by international, regional and bilateral institutions for amounts ranging from $10,000 for faculty development to $1,000,000 to develop complete middle-level (IV) training schools. In total, spin-off projects can be anticipated to run near $10,000,000 as a result of the 5-year Regional Training Project.

Evaluation and Evolution

In year 5 of the Project, an evaluation will be made through a regional seminar. Peers from training facilities, interested organizations, sponsors and Project staff, will examine progress and problems associated with the Project. Recommendations will be provided to sponsors regarding the future role of the Project, suggesting termination, extension, or transformation into a

regular activity of a regional body.

Of considerable interest will be the examination of the results of the Regional Training Project's efforts which have been designed and focused to meet specific needs for the region. This is in contrast to the traditional training work of individual academic institutions, management departments or narrowly-focused development projects. While difficult to evaluate, it should nonetheless be expected that this focused and integral approach to manpower development will affect change in the design of future development projects relating to natural resources and the environment. Expanded attention can doubtless be expected for key local environmental problems and government officers can be expected to be more sensitive to ecological considerations and alert to the need for well-trained employees.

Suggested Follow-up and Recommendations

A number of elements of the Study on Training Needs for Natural Resources and Environmentally Related Problems require further exploration before entirely definitive decisions can be made. Some guidelines can be set however as a result of the precursive work. A series of recommendations for future considerations are presented next to share with the reader those ideas which the team had but was unable to develop in detail during the period of study.

1. The Strategy suggests the importance of providing *demonstration areas* as part of the overall Training Program. It was noted that training can most usefully be linked with direct

field work in resource management-oriented research. A practical way to achieve this end is to associate the Training Project with the field activities of the Man and the Biosphere Program (UNESCO) where these have already initiated active field work, particularly biosphere reserves (MAB-Project 8). It is of mutual interest that biosphere reserves be made practical and management-oriented to guide social and economic development within the associated biome in an ecologically sustainable manner. It would be useful, therefore, that the sub-regional/national coordinators be associated with the local MAB Committees.

Further, it is suggested that where possible and convenient, the demonstration areas that are required for carrying out field work in training, and which serve extension purposes for exemplary ways to manage natural resources, be established in association with the Man and Biosphere Program of each country, particularly biosphere reserves.

2. The Strategy suggests that a series of *associated themes* and problems be given further exploration. Such fields as environmental health, sanitary engineering, applied anthropology, economic and social sciences for integrated rural development, architecture, environmental impact assessment, livestock production, irrigation, drainage, fisheries, marine sciences, among others, are of great significance to the study of training needs and the achievement of environmentally sound development. Due to various constraints upon this present study, these themes were only partially examined. But their importance is paramount.

Furthermore, centers are already established in the region where training opportunities in most of these fields are offered.

It is suggested that further study be initiated immediately to examine these fields and explore the ways in which they can be related to the core natural resources aspects of the Strategy. Ideally, there can be extensive integration, for example, in environmental health and the management of wetlands; fisheries and the management of estuaries; firewood energy and the management of tree plantations; coastal zone stabilization and the management of mangrove forests, among others. Where suitable integration can occur, existing regional centers in these allied fields can become related formally to the Regional Training Project.

3. At least *one other study of training needs* is currently under formulation and consideration in the region. The "Anteproyecto de Programa de Actualización y Entrenamiento de los Recursos Humanos Forestales del Istmo Centroamericano y del Caribe" (Preliminary Program for Training and Updating Foresters of Central America and the Caribbean), was prepared by Ing. Jose R.E. Bucarey B., of the Siguatepeque Forestry Training Center in early 1980. Should this proposal receive interest in the Central American and Antillean sub-regions, it may be presented to FAO, UNEP and possibly IICA for operation. It is interesting to note that the proposal supports many of the same objectives of this present training needs study, namely, to provide opportunities for up-dating and conversion of professionals and technicians in the field, and to offer ways for continuing studies that are flexible and require minimum periods away from home employment. The scope of the proposal by Bucarey is

somewhat less broad than this present Strategy, concentrating more upon traditional forestry.

It is recommended that the sponsors maintain a close dialogue with FAO, UNDP, IICA and other institutions with the purpose of ensuring adequate coordination in the preparation of alternative projects. Potentially, these projects could support one another. Alternatively, they could be integrated.

4. The field work of the consultants for the training needs study has made evident once again the marked lack of knowledge and methods for the *utilization and management of wild plant and animal resources* for sustainable development. Required is the establishment of a network of "research and development centers for biotic resources" (Centro para el Desarrollo y la Investigación de Recursos Bióticos) (CDIRB) to study the ecological role of species, ecological processes, potential uses of plant and animal materials, options for domestication and semi-domestication, guidelines and demonstration for the management of critical habitats, and the maintenance of living wild resources. Patterned after CIAT and the other tropical agricultural development centers, such a network could assume roles of importance to human welfare along with those of highest importance.

It is recommended that the sponsors, and other interested organizations, consider this opportunity, and provide a mechanism for its thorough exploration in the near future.

REFERENCES CITED

Bucarey, J. 1980. Anteproyectos de Programa de Actualización y Entrenamiento de los Recursos Humanos Forestales del Istmo Centroamericano y del Caribe. ESNACIFOR, Siguatepeque, Honduras.

Castronovo, A., Barres, H. and Miller, K.R. 1968. Informe de la Comisión de Estudio de las Escuelas Universitarias Forestales de la Zona Sur. IICA, Oficina de la Zona Sur, Montevideo y Turrialba, Costa Rica (mimeo).

CATIE. 1977. Report of the Meeting on Regional Cooperation in the Management of Central American Natural Areas. Held at the Altos de Campana National Park, Panama. Turrialba, Costa Rica.

CEPAL. 1978. Los Recursos Hidráulicos de América Latina. Informe Regional. Santiago. CEPAL/ILPES, Cuadernos de la CEPAL ST/CEPAL/Conf. 57/L.2/Rev. 2.

CIT. 1976. Primera Reunión del Comité Intergubernamental Técnico para la Protección y Manejo de la Flora y Fauna Amazónica. Iquitos, Peru, 28 June-2 July 1976.

CIT. 1977. Segunda Reunión del Comité Intergubernamental Técnico para la Protección y Manejo de la Flora y Fauna Amazónica. Brasilia, Brazil, 4-9 July 1977.

Dasmann, R.F., Milton J.P. and Freeman, P.H. 1973. Ecological Principles for Economic Development. Wiley and Sons, N.Y.

Dirección General Forestal y de Fauna. 1978. Proyecto Utilización Racional de la Vicuña. Ministerio de Agricultura y Alimentación. Lima, Peru.

Dourojeanni, M.J. 1980. Estado de los Recursos Naturales Renovables de América Latina y el Caribe y sus Tendencias. University of Michigan/World Wildlife Fund. Washington D.C.

ECNAMP. 1979. Draft Management Plan for Proposed Bucco Reef National Park. Eastern Caribbean Natural Areas Management Program, May 23, 1979. St. Croix.

Fahrenkrog, E. 1978. Final Report: Study for the establishment of an Interamerican training center for management and operations personnel of national parks and similar areas. World Wildlife Fund, U.S. Washington D.C.

FAO. 1967. Proceedings X Meeting of the Latin American Forestry Commission, Port-of-Spain, Trinidad and Tobago. Rome, Italy.

FAO. 1972a. Primero Taller Internacional sobre el Manejo de Areas Silvestres. Proyecto FAO/TF-199 y el Gobierno de Chile, Parque Nacional Puyehue. 10 Jan-4 March 1972. FAO Regional Office, Santiago, Chile (mimeo).

FAO. 1972b. Documentos del Seminario Internacional sobre la Planificación de Parques Nacionales. Parque Nacional Puyehue, 10 January-4 March 1972. Proyecto FAO/RLAT/FORD/199. FAO Regional Office, Santiago, Chile (mimeo).

FAO. 1973. Segundo Taller Internacional sobre el Manejo de Areas Silvestres. FAO/TF-199 y el Gobierno de Argentina. Parque Nacional Iguazū. 22 Jan-9 March 1973. FAO Regional Office, Santiago, Chile (mimeo).

FAO. 1974. Wildland Management - A Programme for Environmental Conservation in Latin America. Technical Working Document No. 4, FAO Project RLAT/TF-199. Santiago, Chile.

FAO. 1978a. Evaluación de las Necesidades en el Campo de Enseñanza y Capacitación Forestal en Argentina, Bolivia, Chile, Paraguay y Uruguay. Por M. Contreras Salas, Roma, Italia.

FAO. 1978b. Análisis de la Situación y Necesidades de Educación Forestal en Hispano-Centroamérica y el Caribe. Por F. Hartwig, Roma, Italia.

FAO. 1978c. Forestry for the People. Eighth World Forestry Congress, October 16-28, 1978. Jakarta, Indonesia.

FAO. 1978d. Anuario FAO de la Producción. Rome, Italy.

FAO. 1979a. Evaluación de las Necesidades en el Campo de Enseñanza y Capacitación Forestales en Brasil, Colombia, Ecuador y Venezuela. Por Georg Eisenhauer, Roma, Italia.

FAO. 1979b. Summary Record, Ninth Session. FAO Advisory Committee on Forestry Education, October 29-31, 1978, Jakarta, Indonesia. Rome, Italy.

Holdridge, L. 1978. Ecología Basada en Zonas de Vida. IICA. San José, Costa Rica.

IUCN. 1972. Conservation for Development: Papers and Proceedings of Twelfth Technical Meeting IUCN. IUCN new series No. 28. Gland, Switzerland.

IUCN. 1980. World Conservation Strategy: Living Resource Conservation for Sustainable Development. IUCN-UNEP-WWF, Gland Switzerland.

McEachern, J. and Towle, E. 1974. Ecological Guidelines for Island Development. IUCN New Series No. 30, Morges, Switzerland.

Miller, K.R. 1980. Planning National Parks for Ecodevelopment. Instituto de la Caza Fotográfica y Ciencias de la Naturaleza, Centro Iberamericano de Cooperación. Madrid, Spain.

OAS. 1978. Final Report. Technical Meeting on Education and Training for the Administration of National Parks, Wildlife Reserves and other Protected Areas. Regional Scientific Technological Development Program, OAS. Sept. 25-29, 1978. Mérida, Venezuela.

Odum, W. 1976. Ecological Guidelines for Tropical Coastal Development. IUCN, Gland, Switzerland.

Pan American Union. 1940. Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere, 12th of October 1940. Organization of American States Treaty series, No. 31. Washington D.C. 1964.

Smith, W. 1979. Final Report Draft. Latin American Regional Remote Sensing Centers. AID, Washington D.C. (mimeo).

Udvardy, M.D.F. 1975. A Classification of the Biogeographical Provinces of the World. IUCN Occasional Paper No. 18, Morges, Switzerland.

United Nations. 1976. World Demographic Yearbook. United Nations, New York.

UNEP. 1980. Revised Draft Action Plan for the Caribbean Environment Programme. January 28-February 1, 1980. Caracas, Venezuela.

UNESCO. 1973. Expert Panel on Project 8: Conservation of Natural Areas and the Genetic Material They Contain. MAB Report Series No. 12, UNESCO, Paris.

UNESCO. 1974. Task Force on: Criteria and Guidelines for the Choice and Establishment of Biosphere Reserves. MAB Report Series No. 22, UNESCO, Paris.

USNPS. 1972. Second World Conference on National Parks, Yellowstone and Grand Teton National Parks, 18-27 Sept. 1972. IUCN, Morges, Switzerland.

World Bank. 1976. World Bank Atlas, Washington D.C.

World Bank. 1978. Forestry: sector policy paper. World Bank, Washington D.C.

Appendices.

APPENDICES

The appendices which follow contain detailed information to complement the text.

The first 9 provide material to complement Chapter III on the current and planned training opportunities in the region. These lists are condensations of the extensive reports from team members and pretend to give a brief overview. Missing from these lists is a proper presentation of the work of FAO. Clearly, FAO has given tremendous support which would dwarf the work of most all other non-local organizations. Because of this magnitude, it has been impossible to include an adequate summary at this time.

The last two appendices complement Chapters V and VI, on Alternative Training Methods and Potential Institutions for Collaboration, respectively.

APPENDIX IA

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

MEXICAN SUBREGION

A. Educational Institutions (currently functioning)
I. The following list of universities includes those Mexican institutions of higher learning that offer curriculum and programs related to natural resource management.

1) Centro de Investigaciones Biologicas de Baja California
2) Escuela Superior de Agricultura "Hermanos Escobar", Ciudad Juarez Chih
3) Instituto Tecnologico y de Estudios Superiores de Monterrey
4) Instituto Technologico Regional de Tijuana (SEP)
5) Universidad Autonoma Agraria "Antonio Narro"
6) Universidad Autonoma de Aguascalientes
7) Universidad Autonoma de Baja California Sur
8) Universidad Autonoma de Baja California Norte
9) Centro de Investigacion Cientifica y Educacion Superior de Ensenada Baja California Norte (CICESE)
10) Universidad Autonoma de Chiapas
11) Universidad Autonoma de Chihuahua
12) Universidad Autonoma de Ciudad Juarez
13) Universidad Autonoma del Estado de Mexico
14) Universidad Autonoma del Estado de Morelos
15) Universidad Autonoma de Guerrero (Escuela de Ecologia Marina)
16) Universidad Autonoma de Nayarit (Escuela de Ingenieria Pesquera)
17) Universidad Autonoma de Nuevo Leon
18) Universidad Autonoma de San Luis Potosi
19) Universidad Autonoma de Tamaulipas
20) Universidad de Guadalajara
21) Universidad de Guanajuato
22) Universidad Juarez Autonoma de Tabasco
23) Universidad Juarez del Estado de Durango
24) Universidad Michoacana de San Nicolas de Hidalgo
25) Universidad de Sonora
26) Universidad Veracruzana
27) Universidad de Yucatan

II. Scientific Research Institutions

The institutions listed below have developed programs which address to some degree natural resource themes.

1) Centro de Ecodesarrollo, A.C.
2) Centro de Estudios Economicos y Sociales del Tercer Munco, A.C.
   Departamento de Tecnologia Apropiada
3) Centro de Investigaciones Biologicas de la Paz, Baja California, A.C.
4) Centro de Investigacion Cientifica y de Educacion Superior de Ensenada (CICESE)
5) Centro de Investigaciones Ecologicas del Sureste
6) Centro de Investigaciones de Quintana Roo, A.C.
7) Centro de Investigaciones Superiores del Instituto Nacional de Antropologia
8) Colegio de Postgraduados de Chapingo
9) Comision de Aguas del Valle de Mexico
10) Comision Intersecretarial de Saneamiento Ambiental
11) Comision del Lago de Texcoco
12) Comision del Plan Nacional Hidraulico
13) Comision Nacional de Zonas Aridas
14) Comision Tecnico Consultiva para la Determinacion Regional
15) Consejo Nacional de Ciencia y Tecnologia
16) Consejo Nacional para la Ensenanza de la Biologia, A.C.
17) Departamento del Distrito Federal
    a) Asesoria de la Jefatura del Departamento para Asuntos del Medio Ambiente
    b) Coordinacion Agropecuaria del Distrito Federal
18) Gobierno del Estado de Durango
19) Gobierno del Estado de Mexico
    Direccion General Promotora de Mejoramiento del Amiente y Servicio Social Voluntario
20) Gobierno del Estado de Veracruz
    Direccion General de Asuntos Ecologicos del Estado
21) Instituto de Ecologia, A.C. (Museo de Historia Natural)
22) Instituto de Historia Natural de Chiapas
23) Instituto de Investigaciones Electricas
24) Instituto Mexicano de Recursos Naturales Renovables, A.C.
25) Instituto Nacional de Investigaciones Agricolas
26) Instituto Nacional de Investigaciones Forestales
27) Instituto Nacional de Investigaciones Pecuarias
28) Instituto Nacional de Investigaciones Sobre Recursos Bioticos
29) Instituto Nacional de Pesca
30) Instituto Politecnico Nacional
    a) Escuela Nacional de Ciencias Biologicas
    b) Direccion de Investigacion Cientifica y Desarrollo Tecnoloqico
    c) Centro de Investigacion y de Estudios Avanzados
    d) Centro Interdisciplinario de Ciencias de la Salud (Ciudad de Ciencia y Tecnologia)

31) Petroleos Mexicanos
    Oficina de Proteccion Ambiental
32) Secretaria de Agricultura y Recursos Hidraulicos
    a) Direccion General de Conservacion del Suelo y Agua
    b) Direccion General de Divulgacion Forestal y de la Fauna
    c) Direccion General de la Fauna Silvestre
    d) Direccion General de Proteccion y Ordenacion Ecologica
    e) Direccion General de Reforestacion y Manejo de Suelos Forestales
    f) Direccion General del Programa Nacional de Aprovechamiento Forrajero (Subsecretaria de Ganaderia)
33) Secretaria de Asentamientos Humanos y Obras Publicas
    a) Direccion General de Aprovechamiento de Aguas Salinas y Energia Solar
    b) Direccion General de Ecologia Urbana
34) Secretaria de Programacion Y Presupuesto
    Direccion General de Geografia del Territorio Nacional (previously Detenal y Cetenal)
35) Subsecretaria de Mejoramiento del Ambiente
36) Unidad Industrial Forestal Loreto y Pena Pobre
37) Universidad Autonoma Chapingo
    a) Departamento de Bosques (Forest ecology career under development)
    b) Departamento de Zonas Aridas
38) Universidad Autonoma Metropolitana
    a) Unidad Azcapotzalco: Division de Ciencias Basicas e ingenieria
    b) Unidad Iztapalapa: Division de Ciencias Biologicas y de la Salud (Ecology and Biology
    c) Unidad Xochimilco: Division de Ciencias Biologicas y de la Salud (Departamento del Hombre y su Ambiente: Terrestrial ecosystems and ecology. Division de Ciencias y Artes: Land settlement design and solar energy).
39) Universidad Iberoamericana
    Division de Ciencias del Hombre - Departamento de Desarrollo Humano - Rural development
40) Universidad Nacional Autonoma de Mexico
    a) Instituto de Biologia
    b) Facultad de Ciencias - Consejo Departamental de Biologia - Ecology laboratory
    c) Centro de Ciencias del Mar y Limnologia - Benthic ecology laboratory, ichthyology, estuarine and coastal lagoon ecology, coral reef ecology
    d) Centro de Ciencias de la Atmosfera - Depto. de Contaminacion Ambiental
    e) Instituto de Geografia
    f) Instituto de Ingenieria (Environmental and sanitation engineering, solar energy, bioenergetics, and hydrology)
    g) Centro de Investigacion de Materiales (solar energy)

B. Environmental and Natural Resource Agencies (currently functioning)

The general orientation concerning training and research in private and governmental institutions includes these topics:

1) Determination and classification of the ecological areas of the country.

2) Regional ecological studies which have as their principal objective the maintenance of the environmental integrity of target areas. Studies will focus on these activities:
a) Determination of soil characteristics, actual use, productive possibilities and alternative uses;

b) Water resource evaluation for ecological maintenance, and agricultural and industrial use;

c) Define and quantify the flora and fauna resource used as food or basic materials for industry, including species threatened with extinction.

3) Integral regional ecological management, including food production; watershed protection and flora and fauna conservation will be stressed. Utilizing appropriate technology for preservation, utilization and integral management of Mexican natural resources is an important component of this goal.

4) Anthropological studies that consider man as part of the ecosystem are another major theme stressed by these institutions.

5) Studies to determine, quantify and conserve marine resources for wise management and utilization is of major importance to several Mexican agencies.

6) Several research projects aimed at solving specific pollution problems, given the limits of the socioeconomic reality of the country, are being carried out.

7) Development and implementation of new technologies to improve the productivity of ecological systems without damaging their integrity is also occurring.

8) Study and development of methodologies for the administration and management of ecosystems to favor conservation and environmental quality are being promoted.

9) A major goal is to conserve threatened species.

C. **Development projects related to renewable natural resource management**

1. Agricultural Nematological Study of the Low Areas influenced by the Rio Coatzacoalcos.
2. Animal Behavior Program.
3. Biology of Vegetative Reproduction in two tropical communities.
4. Commercial Scale Wild Animal Ranching.
5. Development of a New Methodology for Forest Inventory in Veracruz.
6. Development of Small and Meidum Sized Industries based on Renewable Natural Resource Research.
7. Ecodevelopment Strategies for Coffee Regions.
8. Ecological Study of Laguna Verde Area, Veracruz.
9. Ecology of Fungi of Interest to the Forest Industry in the Rio Papaloapan and Uzpanapa Region.
10. Elaboration of a World Index of Tropical Ecology Projects.
11. Establishment of Integral Management Reserve Mapimi, for Protection and Development of Wildlife Resources.
12. Ethnobiology Study of a Rural Settlement Balzapote, Veracruz.
13. Ethnobiology Study of the Region of Coba, Quintana Roo.
14. Evaluation of Past and Formulation of New, Colonization Policy for Development of Mexican Humid Tropical Forest.
15. Experimental Agroindustrial Development Projects.
16. Floral and Ecological Research on Continental Algae.
17. Interaction between cattle and pasture.
18. Inventory of Ecotechniques for the Mexican Humid Tropics.
19. Michilfa Biosphere Reserve.
20. Montes Azules de la Sierra Lacondona Reserve.
21. Plan and Execute Reforestation Programs in Valle de Mexico.
22. Pollution Study of the Lower Rio Coatzacoalcos.
23. Productivity Program and Management of Agroecosystems.
24. Program for Domestication of Wild Plants and Animals of Economic Value.
25. Program for Plants and Animals Threatened with Extinction.
26. Program of Infrastructural Assistance for Decentralized Ecological Research Centers.
27. Regulation of Populations of Valuable Tropical Forest Species.
28. Research on Industrial Production Exploitation of Crocodiles.
29. Research on Tissue and Cellular Damage in Animals and Humans by Lead and Mercury Pollution in the Lower Rio Coatzacoalcos.
30. Study of Birth Defects Produced during Embryonic Development by Mercury and Lead in the Lower Rio Coatzacoalcos.
31. Study to Define the Methodology to Evaluate and Utilize Tropical Biological Resources.
32. Study of the Effects Lead and Mercury have on Enzyme Systems.
33. Study of the Effect of Pollution on the Ecology of the Aquatic Vegetation and Vertebrate Fauna in the Rio Coatzacoalcos Region.
34. Study of Histological and Cytological Changes in Animals and Humans Caused by Lead and Mercury in the Lower Rio Coatzacoalcos.

35. Studies on the Phytochemistry - Ecology of Tropical Plants.
36. Study of the Regeneration of Humid Tropical Forest.
37. Study on the Vegetation of Tropical Aquatic Ecosystems.
38. Toxicology Study of the Affected Population from Mercury and Lead Pollution in the Lower Rio Coatzacoalcos Region.
39. Utilization of Mexican Tree Species.
40. Vegetation Study of Tamaulipas State.

APPENDIX IB

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

CENTRAL AMERICAN SUBREGION

BELIZE, COSTA RICA, EL SALVADOR, GUATEMALA HONDURAS, NICARAGUA, PANAMA

I. Regional Organizations

A. Regional Educational Institutions

1. Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE) - Turrialba, Costa Rica

a) A master degree is offered in management of renewable natural resources. The program is jointly sponsored with the University of Costa Rica. Within this program three fields of specialization are available.

i) Wildland and Watershed Management

ii) Agroforestry

iii) Tropical Forestry, Production and Management

These are two year programs with a thesis required. Approximately 9 students graduate annually. Faculty averages 10 full time staff members. The majority of the students are Latin Americans with about 50% being from Central America.

2. Organization of Tropical Studies (OTS) - San Jose (and several field stations), 8-12 faculty members

a) Several field courses for university students in tropical ecology are offered. Three to six courses per year are offered for graduate students (usually in English) with one or two undergraduate courses in Spanish annually.

B. Regional Development Projects

1. Centro Agronomico Tropical de Investigacion y Ensenanza - Turrialba Costa Rica

a) The Natural Renewable Resource Program of CATIE is currently implementing a fuelwood and alternative energy source project. This is a joint project between CATIE and ICAITE in Guatemala. It is oriented principally towards the Central American countries and is funded by AID-ROCAP.

b) The Wildlands Management Project of CATIE focuses its efforts on the management, protection and development of the regions wildland areas. The unit is currently in its fourth year of development and is staffed by two professionals.

2. Western and Central Man and Fisheries Project - Colon, Panama
   a) This general fisheries development project for the Western and Central Caribbean is managed by a small staff of FAO professionals.

IV. Costa Rica
   A. Educational Institutions (currently functioning)
      1. Universidad Nacional - Heredia, 32 faculty members.
         a) The Escuela de Ciencias Ambientales offers 4 programs related to natural resource management. These are:
            i) A Licenciatura in Forestry Sciences will be available beginning in 1981. This will be a 5-year program with 4 lines of specialization: forest reproduction, watershed management, wildlands, and wildlife management. A thesis is required.
            ii) A bachelors of science in forestry which is a 4-year program and does not require a thesis is also available. The 4 fields of specialization mentioned above also apply to this program. Although the program is new this department has averaged 23 graduates per year.
            iii) In the field of environmental education a bachelors of science program has recently been implemented. This is a 4-year program oriented towards preparing educators for the secondary school levels.
            iv) A diploma for primary school teachers is presented in a special 2-year undergraduate environmental education program. Forty students are currently involved in the program.
      2. Instituto Tecnologico de Costa Rica - Cartago - 15 faculty (most part time)
         a) A degree is offered in Forest Engineering which is equivalent to a bachelors. One semester out of the 4 years of course work must be at the graduate level. There were 35 students in last years graduating class.
         b) A bachelors program in wood technology which also results from a 6 year curriculum graduates about 40 students per year.
      3. Universidad de Costa Rica - San Jose
         a) A Licenciatura in Biology which includes 5 years of course work and a thesis is available. Marine biology is featured in an undergraduate program in the School of Biology.
      4. Universidad Estatal a Distancia/Centro de Informacion y Documentacion Ambiental - San Jose - 10 part time professionals.
         a) This joint program which is still in the formation stage, is developing several short term educational

programs aimed at different target groups: decision makers, teachers, and students.

B. Environmental and Natural Resource Agencies
   1. Servicio de Parques Nacionales - Ministerio de Agricultura y Ganaderia, San Jose
      a) Principal activities revolve around the management of several different categories of protected wildland areas, 26 in total. At the director level there are 4 professionals, 60 other specialists man the central office and wildland units and are supported by 150 technicians.
   2. Direccion de Recursos Pesqueros y Vida Silvestre, Ministerio de Agricultura y Ganaderia, San Jose
      This agency manages marine and wildlife resources including one wildlife refuge. There are 2 persons at the directors level, 15 other professionals and 40 technicians.
   3. Direccion General Forestal - Ministerio de Agricultura y Ganaderia - San Jose
      Control and management of natural forests plantations, watersheds and reforestation comprise the mandate of this organization. Three professionals are at the directorship level and 100 foresters.
   4. Instituto Costaricence de Electrificacion (ICE) - San Jose
      This agency is charged with the management and development of hydroelectric resources. They manage several major watersheds.
   5. Instituto Costaricence de Turismo (ICT) - San Jose
      ICE directs tourism development in the country and has related several activities within the national parks.
   6. Instituto de Tierras y Colonizacion (ITCO) - San Jose
      Although involved principally in colonization projects this agency has also become active in reforestation efforts.
   7. Comision Nacional de Asuntos Indigenas (CONAI) - San Jose
      CONAI manages Indian affairs and approximately 12 Indigenas Reserves.

C. Development Projects Related to Renewable Natural Resource Management (currently functioning)
   1. Natural Resources Management Project - AID/Costa Rican Government
      This plan will be implemented in 1981. It will cover a broad range of activities including watershed management programs, forestry research, and training.
   2. Osa Peninsula Integral Management Plan - FAO/World Bank
      Though still in the planning stage this regional development project will include protection, development and management activities in both the national forests and parks of the Osa region as well as the surrounding area. This may result in the development of a biosphere reserve.

III. Nicaragua

A. Educational Institutions (currently functioning)

1. Universidad Centro Americana (UCA) - Managua - 13 faculty

This University offers 3 educational programs related to natural resource management:

a) A licenciatura in ecology and natural resources which includes fisheries management is available.

b) Another program focuses upon forestry sciences.

c) The other program features a licenciatura in environmental education.

All of these fields of specialization are 4 year programs with a thesis. The level is undergraduate.

2. Universidad Nacional Autonoma de Nicaragua - Managua

This school will soon offer a 4 year program in forest engineering.

B. Environmental and Natural Resource Agencies

1. Instituto de la Naturaleza y el Medio Ambiente - Ministerio de Agricultura - Managua

This agency administers virtually all natural renewable resource activities. There are 2 persons at the director level, 109 professionals and 86 technicians. Half of the professionals are university students. There are no other governmental natural resource management agencies.

2. The Instituto de Pesca - Managua

This corporation manages the commercial fishing industry.

IV. Belize

A. Educational Institutions (currently functioning)

1. There are no specialized university programs in natural resource management. Professionals are sent out of the country for training.

B. Environmental and Natural Resource Agencies

1. Forestry Department, Trade and Industry Ministry - Belmopan

Forest management and utilization and wildlife conservation are important aspects of this program. There are 2 professionals at the director level, 4 at the specialist level and 10 technicians.

2. Fisheries Administration, Trade and Industry Ministry - Belize City

This organization manages marine resources and aquatic wildlife. There are 3 professionals and 4 technicians in this department.

3. Belize Audubon Society - Belize City

This nongovernmental group is directly involved in the management of several wildlife reserves and in a variety of environmental education programs.

C. Development Projects Related to Renewable Resource Management (currently functioning)
   1. Half Moon Cay Reserve, Forestry Department/Audubon Society
      Includes the establishment and management of the Half Moon Cay natural reserve.

V. Honduras
   A. Educational Institutions (currently functioning)
      1. Escuela Nacional de Ciencias Forestales ESNACIFOR Seguatepeque - 2 full time professors
         The current program focuses on the training of forest technicians, however in 1981 new lines of specialization will be added to the current curriculum. These are: advanced silviculture, wood technology, forest production and watershed management. Programs will last 3 years with an average of 30 graduates per year.
      2. Centro Universitario Regional Literol del Atlantico, Universidad Nacional Autonoma de Honduras, (UNAH) La Ceiba - 12 faculty
         This branch of the UNAH includes a program in forest engineering with three fields of specializations: planning and management, forest industries, and forest taxonomy. This is a 5 year program without a thesis followed by 1 year of social service on a related project. About 10 to 12 students will graduate yearly.

   B. Environmental and Natural Resource Agencies
      1. Direccion General de Recursos Naturales Renovables (RENARE), Ministerio de Recursos Naturales, Tegucigalpa
         This institution is involved in management of fisheries, wildlife, wildlands and environmental quality. There is one director, 30 professionals and approximately 80 technicians.
      2. Corporacion Hondureno de Desarrollo Forestal (COHDEFOR), Tegucigalpa
         COHDEFOR manages all forest resources and commercialization of these resources in Honduras. There are 8 persons at the director level, 60 professionals 230 technicians.
      3. Instituto Hondureno de Antropologia y Historia, Ministerio de Cultura - (IHA) Tegucigalpa
         The IHA manages national cultural sites including the Copan National Historical Park.
      4. Direccion de Recursos Hidrolicos, Ministerio de Recursos Naturales - Tegucigalpa
         Planning and management of watersheds is an integral part of this institutes mandate.

   C. Development Projects Related to Renewable Natural Resource Management (currently functioning)
      1. El Cajon - AID

This large hydroelectric project includes an extensive watershed management component.

2. COHDEFOR/FAO Watershed Management Project - Lago Yojoa and Omoa

Several experiments in social forestry and watershed management are being carried out in these two sites.

VI. Panama

A. Educational Institutions (currently functioning)

1. Universidad de Panama - Panama City

There are 3 university programs which relate to natural resources management. These are:

a) A two and one half year program for forestry technicians which includes practical experience is offered.

b) Another field of study of the same duration prepares marine technicians.

c) Biologists are trained in a 4 year program which includes a thesis.

2. Centro Regional Universitario de David, Universidad de Panama - David

a) A biology degree is obtainable after 4 years of study in this field.

b) Plans are being implemented for a 2 year course in natural resource management and another in environmental education.

B. Environmental and Natural Resource Agencies

1. Direccion General de Recursos Naturales Renovables (RENARE) - Ministerio de Desarrollo Agropecuario - Panama City

a) This institution is in charge of forests, wildlands, wildlife and watershed management. Personnel includes 6 at the director level, 56 professionals and 196 technicians.

2. Instituto de Recursos Hidrologicos y Electrificacion (IRHE) - Panama City

a) IRHE administers hydroelectric resources, which include in some cases watershed management.

3. Direccion General de Recursos Marinos, Ministerio de Industrias y Comercios - Panama City

a) This agency deals with the management of marine resources.

C. Development Projects Related to Renewable Resources (currently functioning)

1. Watershed Management, AID/RENARE

a) This $17,000,000 project involves protection and management programs for 3 major Panamanian watersheds.

2. Program to Strengthen RENARE Forestry Management Capabilities - FAO/RENARE
   Some training activities will be related in conjunction with this program.
3. Development of Alternative Energy Sources - IRHE/AID
   This program addresses energy needs and possible technologies for meeting these needs.

VII. El Salvador
   A. Environmental and Natural Resource Agencies (currently functioning)
      1. Direccion General de Recursos Naturales Renovables (DIGERENARE) - El Salvador
         Forestry, Fisheries, Wildlife and Watersheds all fall under the jurisdiction of this agency.

VIII. Guatemala
   A. Educational Institutions (currently functioning)
      1. Universidad de San Carlos - Guatemala City
         a) The School of Pharmacy and Chemistry offers a 4 year program in biology with a small element of wildland and wildlife management.
         b) A program in agronomy has been implemented with a specialization in renewable resources management. This is a 4 year program.
      2. Centro Universitario del Nor-Occidente, Universidad de San Carlos - Huehuetanango
         A three year program in silviculture and forest management for technicians was offered until this year. The program is now being converted to a 4 year forest engineering curriculum.

   B. Environmental and Natural Resource Agencies (currently functioning)
      1. Instituto Nacional Forestal, Ministerio de Agricultura - Guatemala City (INAFOR)
         INAFOR is the principal agency involved in management of forests, watersheds, fauna and wildlands. Thirty professionals and 130 technicians carry out these programs.

APPENDIX IC

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

CARIBBEAN SUBREGION

I. Dominican Republic

A. Educational Institutions (currently functioning):

1) Biology School, Autonomous, Universidad Autonoma de Santo Domingo

A university level laboratory in biology is operating, however, there is little field emphasis. Approximately 12 students graduate per year.

2) Instituto de Agronomia, Universidad Catolica Madre y Maestra

Thirty students per year graduate in this program, 4 of whom receive some specialization in forestry.

3) General Forestry Directorate Training Center

Provides training at secondary school level in forest management.

B. Environmental and Natural Resource Agencies (currently functioning)

1) Environmental Commission

a) This independent commission was established to evaluate the impact of proposed industrial developments and to regulate pollution from industry. Eight professionals are working part-time on this project.

2) Environmental Unit, Technical Secretariat of the Presidency

This agency defines national policy relating to environmental matters. Staffing includes 5 professionals and 1 secretary.

3) National Directorate of Parks, Technical Secretariat of the Presidency.

a) The Directorate plans, establishes and manages the system of national parks and protected areas. Presently there are five established national parks. National strategy for development of a representative system of national parks and protected areas and environmental education are high priority projects.

b) Staffing in the park system includes 4 professionals and 1 technician in the central office and 4 professionals and 3 technicians working within protected areas.

4) General Forestry Directorate, Armed Forces Administration

a) This Directorate manages the forest resources of the country. Programs include fire suppression, reforestation,

authorization of timber harvest and law enforcement.
b) One forester supported by 15 additional specialists (agronomists, lawyers and architects) make up the professional staff.

5) Subsecretariat for Natural Resources, Secretariat of Agriculture
a) The Subsecretariat is divided into the following Directorates: the Department of Fisheries Resources, manned by 10 professionals and 250 inspectors and the Wildlife Department which is concerned with inventory and management of wildlife resources. There are 10 professionals, 5 technicians and 10 inspectors staffing this department. Additionally there is the Department for Soils and Water which is charged with watershed management.

C. Development Projects related to renewable natural resource management
1) A National Strategy for Wildland Management initiated by National Parks is in the developmental stage. It offers an opportunity to coordinate and integrate the activities of all natural resource agencies.

II. CARICOM COUNTRIES

Introduction

The countries known as the CARICOM countries include Antigua/Barbuda, Anguilla, Bahamas, British Virgin Islands (BVI), Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts/Nevis, St. Lucia, St. Vincent, Trinidad & Tobago, Turks and Caicos Islands and Barbados.

A. Educational Institutions (currently functioning)
1) College of the Virgin Islands (CVI)
CVI offers a regular B.Sc. Biology degree and a specialized B.Sc. degree in Marine Biology. The College considers its B.Sc. Marine Biology graduates fit to work as "... marine technicians, park naturalists, and scientific aides ..." They also could work as fisheries officers. Personnel in the Natural Science Departments number 12, including 6 in biology and marine biology. Graduates number about 6 per year.

2) The Forestry School of the Eastern Caribbean Institute of Agriculture and Forestry (ECIAF)
ECIAF offers a two year Diploma course in Forestry. The first year provides general preparation and the second year concentrates on technical forestry subjects, including: Silvicultural Systems, Forest Management, Forest Protection, Forest Egnineering, Forest Utilization, Forest Policy and Law, Forest Administration and Management, Forest Botany and Ecology and Forest

Influences. Personnel include 5 to 6 staff members on the faculty with graduating students averaging 10 per year. Facilities include a herbarium, museum, drawing office and workshop.

3) University of Guyana

The University of Guyana offers B.Sc. and M.Sc. degrees in Biology. However, except for an ecology course with both terrestrial and aquatic components, the program does not concentrate on management. The University has placed students in Guyana's Fisheries Division. Graduates are estimated at 15 per year.

4) University of the West Indies (UWI).

UWI offers general training to B.Sc. and occasionally M.Sc. degree levels in Zoology (Mona Campus, Jamaica), Biology (Cave Hill Campus, Barbados) and Biological Sciences (St. Augustine Campus, Trinidad). Persons obtaining such degrees can work in Fisheries. Jamaica's 12 Professional Fisheries Officers were trained at least to the B.Sc. level at UWI, Mona.

At the Cave Hill campus there are 7 staff members in the Biology department. Graduates in zoology and biology average 30 per year.

Courses that specifically address management of wildland resources are: Animal Ecology, Marine Ecology, Coastal Management, Fisheries I and II, Aquatic Sciences, Ecology, Marine Biology, Applied Ecology and Environmental Studies.

5) Inservice training varies among CARICOM territories in content, structure, and regularity. Most, it would appear, are informal. In Jamaica, some formal training is done, but it generally is periodic rather than ongoing: The College of Arts, Science and Technology (CAST) in Jamaica, runs a 6 weeks course in surveying for the islands' Forestry Technicians; Texas A & M University, under a special arrangement, also ran a short course for Forestry Technicians in Manchester, Jamaica; the University of Aberdeen ran a Professional level course on the island; and [illegible] in a two year project, has started the training of 12 to 16 UWI graduates (mainly with B.Sc. Botany degrees) in watershed management.

6) Marine Laboratories

The marine laboratories in the CARICOM area provide some opportunities for training, mostly from research projects, which can make it possible for students to work towards M.Sc. degrees. The Discovery Bay Marine Lab in Jamaica is one example. Other labs are in Bellairs Institute, Barbados and Fairleigh Dickens, St. Croix.

7) Extra-Regional Training

Information is supplied for Jamaica to show how one country attempts to meet its training needs, not addressed regionally.

a) Professional. Foresters in Jamaica's Forestry Division have been trained in the universities of New Brunswick (Canada) and North Carolina State, Washington State, Syracuse and Yale (USA).
b) Technical. Technicians have been trained at the Dorset and Maritime Forest Ranger School, New Brunswick, Canada, the British Columbia Technical Institute, Canada and the Timber Industry Training Centre, Rotoro, New Zealand.

8) Projections for the Future.
a) Plans and projections for the future call for a general strengthening of the capacity to train persons in the management of marine wildland resources, at UWI and the University of Guyana.

The Biology Department at the UWI, Cave Hill Campus proposes to offer courses in fisheries biology and aquaculture for 1980-81. This could affect some thirty B.Sc. students graduating yearly, though not all would pursue careers in wildland resources management. It is hoped also, that four students per year will obtain M.Sc. degrees working on fisheries and aquaculture projects.

Approval has been given to the Zoology Department at UWI's Mona Campus to begin an M.Sc. Fisheries degree program in September 1981. The program will cover marine fisheries, inland fisheries and water bodies management and is expected to train fifteen (15) persons annually. The Department also hopes to run a M.Sc. course in coastal zone management.

The University of Guyana hopes to offer three (3) new courses, beginning September 1980, in fisheries biology, marine biology and applied fresh water biology.

B. Environmental and Natural Resources Agencies (currently functioning)
Public and private institutions responsible for managing wildland resources.

1) Fisheries Divisions - Located in the Ministry of Agriculture of most of these countries.
a) Responsibilities and ongoing work programs include: extension services to fishermen, organizing cooperatives, recording fisheries statistics, administering closed season and minimum size catch regulations, managing marine reserves (e.g., Antigua/Barbuda) and marine sanctuaries (e.g., Jamaica), and issuing licenses.
b) In relation to personnel, several of the territories, including Antigua/Barbuda, Anguila, Barbados, Cayman Islands, Grenada, Montserrat, Dominica, St. Lucia, St. Vincent, St. Kitts/Nevis and Turks and Caicos Islands have established positions for at least one professional fisheries officer. In several cases, international fisheries advisors or workers have been made available to territories.

For the other territories, Jamaica has twelve (12) fisheries professionals, including 6 working in a special Inland Fisheries Unit, and 30 technicians: Guyana has 4 professionals; Trinidad/Tobago, 5 professionals and 4 technicians; and the Bahamas 8 professionals and 5 technicians.

Projections on future staffing of Fisheries Divisions include recruiting at least one (1) professional for islands without any professional staff; twelve (12) professionals and thirteen (13) technicians for Trinidad and Tobago.

2) Forestry Departments or Divisions - Located in the Ministry of Agriculture of most of these countries. Where no Department or Division exists, the responsibility for Forestry falls elsewhere within the Ministry.

a) Responsibilities and Ongoing Work Programs

These activities include: reforestation, general forest management, legal administration of forest reserves, patrol and enforcement, extension services to owners of forest lands, guided tours, environmental education in some cases, soil conservation, wood utilization and wildlife protection.

b) Personnel.

The professional and technical personnel of existing Forestry Departments or Divisions are given below:

Country	Professional	Technical
Bahamas	n/o*	n/o*
Dominica	1	6
Grenada	-	-
Guyana	3	55
Jamaica	9	49
Montserrat	-	-
St. Lucia	-	3
St. Vincent	-	2
Trinidad & Tobago	4	96

Projections for future staffing include: four (4) persons being trained as professionals to return to Guyana in 1982, and four (4) to be sent to ECIAF this year to be trained as technicians.

3) National Parks Trust and Park Offices.

Legislation passed in several territories allows the establishment of a National Parks Trust as a statutory authority.

a) Ongoing Work Programs or Responsibilities.

These include limited patrolling and small reforestation efforts, but little management.

*n/o = information not obtained.

b) Personnel.

National Trusts or Park Offices are usually without professional staff, and occasionally found with technicians, e.g. 2 in Dominica and an undisclosed number in the Bahamas.

4) Other Institutions.

These include institutions unique to the islands or territories.

a) Parks and Beaches Commission -- Barbados.

i) The Commission is responsible for the control of beaches and the management of local and national parks.

ii) The Parks and Beaches Commission has three (3) technical staff persons, and periodically hires consultants for short term professional work.

b) Natural Resources Conservation Department (NRCD), Ministry of Mines and Natural Resources -- Jamaica.

i) Responsibilities cover the following areas: studies, inventories and ecological assessment, planning and design of parks and other protected areas; systems; habitat and wildlife protection; beach protection; watershed protection; river stream and gully control; coastal and nearshore protection; hydrological and oceanographic engineering works; data collection and public environmental educational training.

ii) NRCD currently employs 11 professionals and 27 technical staff persons.

c) Institute of Marine Affairs -- Trinidad and Tobago.

i) Activities concern. marine research, advice on coastal zone management, marine data collection, data collection, data dissemination and education.

5) Analysis of Present Institutions and Projections

Institutions in charge of managing wildland natural resources are usually public including statutory bodies such as National Trusts. Concerned private organizations exist such as naturalist clubs and conservation societies but these provide mostly public environmental education and advisory services to public institutions. Public institutions are frequently handicapped because of a shortage of staff, lack of adequately trained personnel, lack of clearly defined responsibilities, and a general lack of capacity to enforce management regulations.

C. Development projects related to the renewable natural resource management.

1) A project has been agreed to by the Government of Anguilla and the joint Caribbean Conservation Association (CCA)/University of Michigan's Eastern Caribbean Natural Area Management Program (ECNAMP) for undertaking a marine resources development plan for that island.

2) Reforestation and forest utilization for timber production by the Forest Industries Development Corporation of Jamaica.
3) Jamaica's Fisheries Division with FAO's assistance is currently re-surveying the fishery resources of the Pedro Bank, located 70 miles south of the island and in another project is studying the biology of the spiny lobster in two declared marine sanctuaries.
4) St. Lucia's Fisheries Division has erected an artificial reef habitat and has been involved in planning for a marine park.
5) Grenada's Fisheries Division has provided environmental education on fishing methods.
6) Policy, national planning and interinstitutional cooperation are in most cases not clearly defined. In some, national intentions are translated into the establishment of institutions such as the Natural Resources Conservation Department of Jamaica, which provides for an integrated approach to managing wildland resources. A similar effort is being made in Barbados to set up a Department of the Environment. Some islands have agreed to develop national conservation strategies.

Wildland natural resource management is still largely ad hoc and piecemeal. It is generally not fully integrated into National Planning, where targets are usually set for the rate of resource exploitation.

Interinstitutional Cooperation is frequently lacking, while at the same time, serious overlapping of responsibilities occurs.

II. Puerto Rico
A. Educational Institutions (currently functioning)
1) Colegio Regional de Aguadilla
a) A 2-year technician program featuring protection of natural resources and contamination control is currently offered by the school.
2) Universidad de Puerto Rico, School of Public Health
a) Masters degree program in Environmental Health coursework includes: contamination of water bodies by solid wastes, laboratory techniques, field practice, environmental legislation, administration of environmental systems, human ecology, ambient radiology, urban planning, preparation of environmental impact statements and atmospheric contamination.
3) Universidad de Puerto Rico, Graduate Planning School
a) A degree in environmental planning is available. Curriculum focuses on environmental problem study, environmental information, internalization of environmental costs, and decision making.

4) Universidad de Puerto Rico, Department of Marine Sciences
Marine resources management is stressed in the school's marine sciences program.

B. Environmental and Natural Resources Agencies (currently functioning)
1) U.S. Forest Service
Institute of Tropical Forestry
Facilities and personnel at the Institute lend themselves to periodic training activities in either English or Spanish.
2) U.S. Fish and Wildlife Service
Cabo Rojo Refuge
Facilities and personnel would be available for periodic training activities in either English or Spanish.

IV. Netherlands Antilles (Aruba, Bonaire, Curacao, Saba, St. Maarten and St. Eustatius) and Suriname.
A. Educational Institutions (currently functioning)
1) University of the Netherlands Antilles (Curacao)
At present no programs in natural resource management, the environment or biological sciences has been implemented.
2) University of Suriname
Currently, natural resource and environmental management programs are not available in this school.
3) Caribbean Marine Biological Institute (Curacao)
Training opportunities are offered here for graduate students on research projects. However, students are generally not from the Netherlands Antilles, 65% being from Holland and 35% from South America. The Institute also provides research assistance to STINAPA.

B. Environmental and Natural Resource Agencies (currently functioning)
1) Netherlands Antilles
a) Netherlands Antilles National Parks Foundation (STINAPA)
STINAPA is responsible for managing 4 national terrestrial parks of close to 13,000 hectares, located on Curacao, Bonaire and Aruba; a marine park surrounding the island of Bonaire and a 55 hectare Flamingo sanctuary. Work programs cover general patrol and enforcement studies, minor interpretation and environmental education, research and reafforestation. Personnel includes: 3 professionals and 7 technicians. Periodic assistance is given, mainly in research, by graduate research students at the Caribbean Marine Biological Institute in Curacao.
b) Fisheries Department (Local Curacao Government)
Responsibilities of the Fisheries Department are: to provide extension services to fishermen,

promote research and other general management functions not specified. Work programs include, limited extension advice, some investigations and ongoing efforts to "re-establish" the Queen Conch. Personnel consists of 2 professionals (one part time) and 1 technician.

2) Suriname
   a) The Foundation For Nature Preservation in Suriname (STINASU).
      i) STINASU is responsible for scientific research in legally established nature reserves, public awareness of nature preservation, and the proper utilization of nature reserves for tourism. Work programs include: research, the preparation of films and "field guides" for interpretation and public education, occasional seminars and construction and management of facilities for use by tourists and researchers.
   b) Forest Service.
      i) The Forest Service is responsible for managing 8 nature reserves and a nature park in Suriname. It also has the responsibility for managing forests outside of the nature reserves.

3) Analysis of Present Situation and Projections
   a) The present institutional infrastructure for managing wildland resources is inadequate for the Netherlands Antilles. Curacao, for example, has the only Fisheries Department, and there is no legal management of forests or parks being undertaken in either St. Maarten, Saba or St. Eustatia. Suriname is in a better position because the basic infrastructure already exists. Additional strengthening might be necessary. The country's intentions in this respect are not known.

C. Development projects related to renewable natural resource management
   1) Netherlands Antilles
      a) A project, based on research data, which aims to reduce the rate of use on Bonaire's coral reefs to allow recovery time is being implemented. Reforestation of selected areas within the national parks is also being attempted.
   2) Suriname
      a) STINASU's ongoing eco-developmental project of cottage construction and management in Suriname's nature reserves for the use of tourists and researchers is an important activity in Suriname.

V. Caribbean French Departments in the Caribbean: Guadeloupe, Martinique, and French Guyana.
   A. Educational Institutions (currently functioning)
      1) Le Centre Universitaire des Antilles et de la Guyane

(CUAG) (The University Center of the Antilles and Guyana)
This university offers courses in Ecology at the undergraduate level. Professors of ecology and marine biology can direct graduate students from French universities on local projects. Research by CUAG in collaboration with other institutions can provide some basis for training.

2) Institute National de la Recherche Agronomique (INRA), (National Institute of Agricultural Research)
This facility may be available to support training activities.

B. Environmental and Natural Resource Agencies (currently functioning)

1) Ministry of Agriculture

a) Office National de Forest

i) This is a national public establishment with an economic and commercial orientation, responsible for most natural zones (forests, mangroves, wild littoral zones), including both land management and law enforcement. Martinique has one reserve, and Guadaloupe is creating one.

ii) Service Forestier (Forest Service)

iii) Parcs Nationaux et Reserves Naturelles (National Parks and Natural Reserves)

iv) Personnel in forest and park agencies at the Superior level include 11 professionals and 80 technicians.

b) Direction Departementale de L'Agriculture. (Departmental Headquarters for the French Ministry of Agriculture)
This agency is responsible for soils, watersheds and reservoirs. In Guyana management of protected areas may be delegated to this agency in the future.

2) Service des Affaires Maritimes. (Maritime Affairs Service)
Responsibility for marine areas of the territory falls within the realm of this agency.

3) Museum d'Histoire Naturelle (Paris) (Natural History Museum)
Management of some reserves currently at the study stage in Guyana may be delegated to this organization.

4) Delegue, Regional a l'Environnennement (Regional Delegate to the Environment)
This agency is charged with the coordination of actions concerning protection and development of the environment.

C. Other Development Projects
Mangroves and Coastal Zone Program (CUAG & INRA).

VI. Haiti

A. Educational Institutions (currently functioning)

1) Faculte d'Agronomie et de Medecine Veterinaire, l'Universite

d'Haiti: (Faculty of Agronomy and of Veterinary Medicine of the University of Haiti)

a) There two educational levels taught by the faculty are:

i) Agronomic Engineering is a 4 year generalist program, with limited ecology, forestry, zoology, botany, and rural sociology. It includes one course on conservation of soils and of natural resources. All students have a field training period at the center of Madyan Salagrac. There has recently been a project to create a fifth year specialization in natural resource management (financed by USAID).

Professors of courses in soil conservation, natural resources, forestry, rural sociology, etc., are generally civil servants of the Department of Agriculture working as part-time faculty. Few research activities have been initiated.

The training of specialists is provided through scholarships offered by francophone regions (Quebec, Belgium, France) or by international cooperation agencies. Although graduates average 40 per year, demand for agronomists by the Department of Agriculture exceeds supply.

ii) Technician training lasts two years. It prepares assistants on site, which have a minimum of general training in agronomy, including a course on soil conservation. All the technician students complete part of their field training at the Center of Madyan-Salagnac. Graduates average 50 technicians per year.

2) Le Centre de Formation en Amenagement de Bassins Versants (The Center for Training in Watershed Management)

This training center, financed by the Swiss Agency for International Development at the Limbe watershed is part of a UNDP/FAO project. The center is scheduled to begin teaching activities in July 1980, with three engineers and two technicians. Seven hundred and thirty trainees are expected during the first year.

The objective is short-term (15 days to 3 months) field technician training, using the watershed demonstration areas and experiments. Later this center will be used to improve trained agronomy engineers, as well as to facilitate activities to sensitize administrative personnel and politicians. Eventually the center may become regional in scope.

B. Environmental and natural resource agencies (currently functioning)

1) Le Conseil National de l'Environment et de Lutte centre l'Erosion (CONAELE) (National Council of the Environment and of the Fight Against Erosion)

CONAELE is a consulting agency created in 1978, comprised of a Permanent Committee at the Ministerial level, and a Technical Committee including high-ranking civil servants from relevant ministries. A new law is being elaborated that will reinforce CONAELE in the following ways:

a) Obligate government consultation with CONAELE on development projects which are liable to have a significant effect on the environment;

b) Grant CONAELE the responsibility to do environmental impact studies;

c) Provide the necessary means to realize such studies.

2) Le Departement de l'Agriculture, des Resources Naturelles et du Developpement Rural (The Department of Agriculture Natural Resources, and Rural Development)

This department is organized into four divisions:

The Division of Natural Resources

This division is divided into 5 services:

- Le Service d'Irrigation et de Controle des Rivieres (Irrigation and River Control Service). The Service is responsible for rural water engineering, excluding watershed management and pollution control.

- Le Service de la Conservation des Sols, des Forets et de la Protection de la Faune (The Soil Conservation, Forests, and Wildlife Protection Service).

Concerning soils the Service collaborates with several international organizations on watershed management projects (7 presently). The Service also has a forestry police force. They propagate tree seedlings for public and other institutions and have a limited number of reforestation works in conjunction with the international watershed projects.

In relation to Fauna, the Service has exercised hunting control in some areas, and some studies have been done in conjunction with the University of Vermont. The personnel of this Service includes 3 at the senior level, 10 at the professional level and twenty technicians.

- Le Service des Pecheries (The Fisheries Service). The Service has one professional coordinating the administration of marine resources.

- Le Service de Meteorologie Nationale (The National Meteorology Service).

- Le Service de Chimie et d'Utilisation des Terres (The Chemistry and Land Utilization Service).

3) Le Departement du Plan (The Planning Department)

Activities include: land management through the Direction de l'Amerragement des Terres et de la Protection de l'Environnement (Direction of Lands Management and of Environmental Protection)/and chairing the secretariat of CONAELE.

4) Le Departement des Mines (The Department of Mines)
   This Agency is involved in rehabilitation of selected mining zones.
5) L'Institut du Patrimoine National (World Heritage Institute)
   Responsibilities include protection and development of historical sites and monuments. Personnel is limited to one professional (architect) as director. There are no field personnel.
6) Operation Koumbite (Operation Koumbite)
   This private organization works on reforestation projects, including public awareness, seedling production, and planting on public or private lands. Activities are essentially handled by volunteers.

C. Development projects related to renewable natural resource management
1) Madyan-Salagnac Rural Development Project
   This is an autonomous program, financed by the French Government (Ministere des Affaires Etrangeres) the Haitian Government (Departement de l'Agriculture, and Faculte d'Agronomie) the U.S. Government (Inter-American Foundation), the French l'Institut National de la Recherche Agronomique (IRRA), and the French Delegation Generale a la Recherche Scientifique et Technique (DGRST).
   Activities revolve around four main areas: the study of traditional systems of agricultural production, in order to bring out the dynamics and to understand these systems in their totality (social organization, human ecology, pedology, etc.), the experimentation of techniques which are aimed at improving these management and production methods, the diffusion of some methods adapted to local environmental conditions that reinforce traditional systems, and the training of individuals responsible for agricultural techniques and administration, essentially in the Faculty of Agronomy.
2) Watershed Management Projects
   Currently there are seven important watershed management projects: Limbe project (UNDP & FAO); four projects financed by U.S.A.I.D.; Plaine du Cul de Sac/Blanche River Project (Inter-American Development Bank); and Riviere Baret a Petit Goave (ACDI). These are integrated, combining research/project/ and training, as well as interdisciplinary projects.
3) Rehabilitation of some Mining Zones
   The Societe d'exploitation des mines de bauxite (Society for the Exploitation of Bauxite Mines), Reynolds Aluminum Co. and the Haitian Government have agreed that the Company will rehabilitate abandoned mines by planting pines (Pinus occidentalis).

APPENDIX ID

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

ANDEAN SUBREGION

BOLIVIA

A. Educational Institutions (currently functioning)
   1. Universidad Juan Misael Saracho (Tarija)
      a) Forestry Program
      b) Agricultural Engineering Program

   2. Universidad Boliviana Mayor de San Simon (Cochabamba)
      a) Facultad de Ciencias Agricolas y Pecuarias

      Departamento de Ingenieria, Suelos y Riego. Academic concentrations in soils and irrigation, active in special projects such as geomorphology mapping, mathematical modeling of water and salt movement through soils, design and construction of tensiometers, soil classification and mapping, soil and water testing. The department has its own building complete with laboratory. It is receiving assistance from France to develop a Centro de Pedologia in the Facultad de Ciencias Agricolas. This currently involves two Bolivians and two French soil experts; in the next two years a French expert in hydrology and watershed control, and soil chemistry will be added.

      USAID assists the department with vehicles and laboratory equipment. West Germany assists the department with laboratory equipment and photointerpretation lab. FAO has a 2 year 4 month project planned in soil management and conservation. COTESU of Switzerland has a 2-year project planned in forestry and watershed management. The department is working closely with the Belgian Fundacion Universitaria Luxemburguesa to structure an environmental education program in the Facultad which is expected to set the stage for a Centro sobre Ciencias del Medio Ambiente. The department has 20 teachers, 2 with M.Sc. and 1 with Ph.D. The staff of the Facultad totals 63 and graduates number 30-35 per year, with a total of 575 students in the faculty programs with 250 in pre-university preparatory courses.

b) Facultad de Ciencias y Technologia

Departamento de Biologia. Offers a course in ecology and in national zoogeography, and a program in zoology. Research projects include: Pre-study of the fishing of Puerto Villaroel; reproduction, management and fish production of important food species in the rivers of the Cahpare watershed; evaluation of the feasibility of utilizing bivalves for food; age determination of important fish species for food; the importance of fish to supplement protein-deficient diets; feasibility study to take advantage of the fish protein in the Chapare; determination of fishing seasons; hematology, histology, and microbiology of fish species important for food. The Department would like to do research in Andean ecosystems, and sociobiology. Begun in 1976, the Department has 80 students with no graduates as of 1980.

c) Facultad de Ciencias de la Salud

Active in integrated rural development programs. Cooperates actively with Instituto Indigenista and the Pan American Health Organization (PAHO) to develop a pilot project in native medicine, in conjunction with la Asociacion Boliviana de Medicos Nativos. The objectives are: understand traditional medicine; gain knowledge of the rural populace's attitudes towards native medicine; and investigate the possibility of integrating as much as possible native medicine with academic medicine.

d) Facultad de Arquitectura

Currently there is no program in landscape architecture, but there is interest to create a program in landscape architecture and rural planning.

3. Universidad Boliviana Gabriel Rene Moreno (Santa Cruz)

a) Facultad de Ciencias Agricolas includes departments of Agronomia, Recursos Naturales Renovables, Fitotecnia, Desarrollo Rural, Ingenieria Agricola, Tecnologia Agroindustrial. The faculty is trying to begin a forest engineering program. The staff includes 20 professors, 10 of which are part time; 450 students are enrolled in the five-year curriculum.

b) Facultad de Ciencias Puras y Naturales includes the Departamento de Biologia.

There are 18 professors, 60 students in biology and 85 in pre-university studies for the program.

4. Universidad Mayor de San Andres (UMSA) (La Paz)

Departamento de Biologia, Instituto de Ecolog .

The institute was developed by agreement between UMSA and the Universidad de Gotingen of West Germany. Institutional

fields of study include: microclimatology, soils (physiology, chemistry, soil biology), phytosociology, entomology, small rodents. The institute maintains three field stations in the Altiplano, one in sub-tropical forest and one in premontane humid forest. It is staffed by four Bolivian and four German specialists in geography, ecology, botany, and zoology. Objectives of the institute are to reinforce biological instruction, research, and public education on ecology and natural resources. Currently the institute is retraining public school teachers.

5. Escuela Tecnica Forestal (Cochabamba)

Technical forestry school under the Centro de Desarrollo Forestal within the Ministerio de Asuntos Campesinos y Agropecuarios. It is designed to train forest technicians (3 years) and forest guards (1 year). The school facilities include: 4 classrooms each for 50 students, a library, 2 labs, a workshop for forest mechanics, a dormitory and food service facilities.

It began operation in May of 1980. The school is the result of an agreement between West Germany and Bolivia. The Germans are contributing 4 professionals, SDM 500,000 for equipment, and training for 6 Bolivian professionals. The Bolivians contribute 5 professionals, land, buildings and operating expenses. The school will have a maximum capacity of 150 for students in the 3-year program, or 50, 3-year students per year. 50 one-year students per year will be admitted. In August of 1979 a 4-week short course in forest fiscalization was offered for the staff of the Centro de Desarrollo Forestal as the first educational activity of the school.

6. Escuela Tecnica de Agricultura (Cochabamba)

Technical agricultural school is independent but closely related to the Facultad de Ciencias Agricolas y Pecuarias of the Universidad Mayor de San Simon in Cochabamba. Enrollment includes 160 students at maximum capacity with up to 50 graduates per year.

B. Environmental and Natural Resource Agencies (currently functioning)

1. Ministerio de Asuntos Campesinos y Agropecuarios

a) Centro de Desarrollo Forestal

The forestry development center is responsible for the management of forest resources and lands, wildlife, protected natural areas and water resources. It is organized operationally a central national office and 10 regional decentralized offices which are responsible for the administration of areas and implementation of policy at the local level.

Within the Centro there is a Departmento de Bosques, containing a Division de Conservacion de Suelos y Aguas y de Proteccion Forestal. Responsibilities include: study and determinate appropriate methods and techniques for soil and water conservation; implement the above methods; ensure coordination with other agencies connected with this field; administer watersheds classified under the general forest law.

This division administers 9 forest areas of some 10,516,000 ha, with 90 guards.

The Division de Investigacion Forestal includes three sections: Forest Ecology, Silviculture and Forest Products.

The Division de Capacitacion y Educacion Forestal is responsible for national policy on forestry education.

The Departamento de Vida Silvestre, Parques Nacionales, Caza y Pesca has a staff of 14 professionals, 4 technicians, and 36 guards. It has three divisions. The Division de Tribus Selvicolas has responsibilities to delimit reserves for native peoples (in the Oriente Boliviano); provide legal assistance, health protection, and socio-economic aid to native peoples; and protect their subsistence base.

The Division de Vida Silvestre y Parques Nacionales has responsibilities which include: supervise the enforcement of the Ley General de Vida Silvestre except for the fishery sections; administer wildlife resources, national parks and reserves; study areas appropriate for national parks and reserves; and formulate and promote policy relevant to its responsibilities.

The National Parks and Reserves of Bolivia number 16, covering approximately 2,084,171 ha. These areas are managed by some 36 guards and 3 professionals. Two new areas are planned which will cover over 500,000 ha.

The Division of Pesqueria has responsibilities which include: supervise enforcement of the Ley General de Vida Silvestre, as it relates to the fishery resource; administer fishery resources; carry out research on the fishery resource; and organize and implement educational programs about the fishery resource for both producer and consumer.

Projects in the Division de Pesqueria include a preliminary diagnostic study of the Bolivian fishery resource to be completed in April of 1980; proposed establishment of a fish hatchery in the Altiplano, using trout and pejerrey; proposed establishment of a fish hatchery for the lowlands, using native species, tilapia and carp;

proposed demonstration food-producing fish projects; and, proposed Villamonte research station in Tarija.

Guardia Forestal. The responsibilities of the forest guards include: prevention of illegal and unwise exploitation of forest, wildlife and other natural resources; control the industrialization, transport and commercialization of forest and wildlife resources; prevent and control forest fires; and police and control national parks and forest reserves.

2. Regional Development Corporations--decentralized regional development corporations, organized by departmental boundaries.

a) Corporacion de Desarrollo de La Paz (CORDEPAZ)

Departamento Forestal y de Vida Silvestre, of the Unidad Agropecuaria, whose responsibilities are: study the forests of the department to determine their potential and ecological classification; recuperate marginal soil areas by reforestation; organize sustainable forest production; research on wood technology; protect natural areas as representative ecosystems, and maintain productivity of the watersheds.

Current ongoing projects include: reforestation; in altiplano using 2 nurseries each with annual production of 200,000 seedlings, in the Yungas using 2 nurseries each with annual production of 50,000 seedlings; research to identify native forest species; research on wood technology of native species; study and work towards establishment of Parque Regional de Caquiahuaca (1,300,000 ha); protection campaign for the avifauna of the altiplano to diminish cattle and sheep infection by Fasciola hepatica. A project for establishment of a training and environmental education center in Tarila is being planned.

Staff of Departamento Forestal y de Vida Silvestre includes: 3 professionals, 2 technicians, and 27 workers.

Departamento de Piscicultura has a fish hatchery project under construction at Hichukkota-Penas for producing trout and native species.

b) Corporacion de Desarrollo de Santa Cruz (CORDECRUZ)

Departamento de Recursos Naturales is within the Unidad de Programas Rurales y Agropecuarios (UPRA). Currently the department is under study for promotion to the Unidad level. The responsibilities of the departament include: evaluation of the natural resources of the region; integrated planning for departmental utilization of natural resources; intersectorial coordination relative to natural resource development.

Planning projects for natural resource inventories in conjunction with ERTS Programa of GEOBOL is a high priority for the department, with six major inventories planned for the next two years.

The Seccion Forestal in the department is promoting the organization of the Corporacion Forestal para Santa Cruz (CORFOCRUZ). Institutions involved are: Centro de Desarrollo Forestal,(CORDECRUZ), Universidad Boliviana Gabriel Rene Moreno, and Camara Forestal (Private sector). The proposed objectives are to strengthen efforts for reforestation and forest research, and maintain a line of credit for forest users by acting as a forest financial institution.

3. Programa del Satelite Tecnologico de Recursos Naturales (ERTS).
   ERTS is within the Servicio Geologico de Bolivia (GEOBOL). It maintains active working agreements with agencies in the Ministry of Agriculture, the departmental development corporations, the national institutes for geography and petroleum resources, and some universities. ERTS features a complete cartographic and photographic laboratory for processing images from different satellite programs, as well as radar images and airphotos. The focus is on inventory and monitoring in the fields of mining, geomorphology, edaphology, forestry, land use and vegetative cover.

   Future ERTS programs are planned for a data bank, desertification project, climatological project for agriculture, and an agricultural inventory project.

   The staff includes 18 professionals (3 geologists, 5 geographers, 3 agricultural engineers, 2 soil scientists, 2 sociologists, 2 civil engineers, and 1 cartographer) and 10 technicians.

4. Instituto Nacional de Fomento Lanero (INFOL) is responsible for research and management of altiplano range. The Direccion de Infraestructura Agropecuaria y Social presented a 5-day course for wildlife refuge guards of the national Vicuna program.

C. Development projects related to renewable natural resource management

1. Proyecto de Desarrollo Rural Integrado de los Valles Interandinos

   This project is within the Programa Nacional de Desarrollo Rural Integrado. Its objectives are to: develop a staff of 4 professional agronomists and 2 professional sociologists;

increase the standard of living by increasing production and productivity, introducing appropriate technology, and offering credit programs to organized groups; achieve the complete development of the campesino farmer through his participation in research and development planning of his region; improve and establish services that elevate the standard of living from that of self sufficiency.

Assistance to this project is provided by Instituto Frances de Estudios Andinos and the Centro Internacional de Cooperacion para el Desarrollo Agricola, in: studies of the ecosystem, bioclimatology, soils, agricultural capacity, range management, introduction of new species, and the socio-cultural study of the rural society and its relationship to the natural environment.

Forest Plantation Program (Santa Cruz). This silvi-cultural and plantation project is organized by the private Camara Forestal. It is funded by a fixed voluntary contribution per cubic meter from timber extracting companies. Projects of the Programa Plantaciones Forestales include: research covering native and exotic species in the Chore humid forest reserve, recuperation of degraded soils by planting exotic pines and eucalyptus, and protective pine plantations for the Rio Pirai watershed. There is an experimental forest of 180,000 ha and an experimental station at Chore. Experiments have also been run to eliminate weed species on abandoned agricultural levels and to return them to productive use.

Man and Biosphere Program (MAB). The Direccion de Ciencia y Tecnologia is within the Ministerio de Planamiento y Coordinacion. The MAB Bolivia program is within this Direccion and participates in three MAB projects: Project #1, Ecological effects of human activities on tropical and subtropical ecosystems; Project #6, impact of human activities on mountain ecosystems; Project #8, Conservation of natural areas and the genetic material they contain.

APPENDIX ID

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

ANDEAN SUBREGION

COLOMBIA

I. Educational Institutions (currently functioning)

In 1978 there were 254,896 university undergrads enrolled in the Colombian program for higher education. This includes both public and private universities as well as public and private technological institutes. Another 23,402 students were involved in graduate programs. Universities with undergraduate programs related to natural resources are listed below:

A. Undergraduate Programs

1. Colegio Mayor de Nuestra Senora del Rosario - Bogota
   Economics
2. Corporacion Autonoma del Occidente - Cali
   Economics
3. Corporacion de Estudios Superiores
   Biology and Chemistry
4. Corporacion Educativa Mayor de Desarrollo "Simon Bolivar" - Barranquilla
   Economics
5. Corporacion Universidad Piloto de Colombia - Bogota
   Economics
6. Corporacion Technologica de Bolivar - Cartagena
   Economics
7. Corporacion Unicosts - Barranquilla
   Economics
8. Escuela Militar de Cadetes - Bogota
   Economics
9. Escuela Naval de Cadetes "Almirante Jose Prudencio Padilla - Cartagena
   Physical Oceanography
10. Fundacion Educacional Autonoma de Colombia (FEAC) - Bogota
    Economics
11. Fundacion Educacional Interamericana - Bogota
    Economics
12. Fundacion Universidad America - Bogota
    Economics
13. Fundacion Universidad de Bogota "Jorge Tudeo Lozano - Bogota
    a) Economics
    b) Agronomy
14. Fundacion Universidad Central - Bogota
    Economics

15. Instituto Colombiano "Jaime Isaza Cadavid" - Medellin
    Agricultural Techniques and Technology
16. Instituto Docente de la Cooperativa para el Fomento de la Educacion Superior - Manizales
    Economics
17. Instituto Tecnico Universitario de Cundinamarca "ITUC" - Fusagasuga
    Agricultural Techniques and Technology
18. Instituto Tecnico Universitario de Cundinamarca - Girardot
    Biology and Chemistry
19. Instituto Universitario de Economia Social y Cooperativismo (INDESCO) - Bogota, Bucaramange, Medellin, Barancabermeja
    Economics
20. Pontificia Universidad Javeriana - Bogota
    a) Biology
    b) Economics
21. Universidad de Antioquia - Medellin
    a) Veterinary Medicine
    b) Zootechnology
    c) Biology and Chemistry
    d) Economics
22. Universidad del Atlantico - Barranquilla
    a) Biology and Chemistry
    b) Economics
23. Universidad Autonoma Latinamericana - Medellin
    Economics

    Universidad de Bogota "Jorge Tadeo Lozano" - Bogota

24. a) Geographic Engineering
    b) Marine Biology
    c) Sea Sciences
25. Universidad de Caldas - Manizales
    a) Agronomy
    b) Veterinary Medicine
    c) Biology and Chemistry
26. Universidad de Cartagena - Cartagena
    Economics
27. Universidad Catolica de LaSalle - Bogota
    Veterinary Medicine
28. Universidad Catolica Popular del Risaralda Pereira
    Economics
29. Universidad de Cauca - Popayan
    a) Geotechnology
    b) Biology
30. Universidad de Cordova - Monteria
    a) Agronomy
    b) Zootechnology and Veterinary Medicine
    c) Biology and Chemistry
31. Universidad Distrital "Francisco Jose de Caldas" - Bogota
    a) Forest Engineering
    b) Biology
32. Universidad Externada de Colombia - Bogota
    Economics

33. Universidad Francisco de Paula Santander - Bochalema
    a) Agricultural Techniques and Technology
    b) Biology and Chemistry
34. Universidad Francisco de Paula Sandander - Cucuta
    a) Agronomy
    b) Economics
35. Universidad Independiente de Colombia "Antonio Narino" - Bogota
    Biology and Chemistry
36. Universidad Industrial de Santander - Bucaramanga
    Biology
37. Universidad Incca de Colombia - Bogota
    a) Veterinary Medicine
    b) Economics
38. Universidad La Gran Colombia - Bogota and Armenia
    Economics
39. Universidad Libre de Colombia - Cucuta
    Biology and Chemistry
40. Universidad Libre de Colombia - Pereira
    Economics
41. Universidad de Los Andes - Bogota
    Biology
42. Universidad Nacional de Colombia - Bogota
    a) Agricultural Engineering
    b) Zootechnology
    c) Biology
    d) Geologic Engineering
    e) Forest Engineering
    f) Agronomy
    g) Economics
43. Universidad Nacional de Colombia - Medellin
    a) Agricultural Engineering
    b) Zootechnology
    c) Agronomy
    d) Forest Technology
    e) Agricultural Economics
44. Universidad Nacional de Colombia - Palmira
    a) Agronomy
    b) Zootechnology
45. Universidad de Narino - Pasto
    a) Agronomic Engineering
    b) Biology and Chemistry
    c) Economics
    d) Zootechnology
46. Universidad de Pamplona
    Biology and Chemistry
47. Universidad Pedagogica Nacional - Bogota
    Biology
48. Universidad Pedagogica y Technolgica - Tunja
    a) Agronomic Engineering
    b) Biology and Chemistry
    c) Economics

49. Universidad del Quindio - Armenia
    Biology and Chemistry
50. Universidad San Buenaventura - Cali
    Economics
51. Universidad Santiago de Cali - Cali
    Biology and Chemistry
52. Universidad Santo Tomas - Bogota
    Economics
53. Universidad Santo Tomas - Bucaramanga
    Economics
54. Universidad Social Catolica de La Salle - Bogota
    a) Biology
    b) Chemistry
55. Universidad Sur Colombia - Neiva
    Agricultural Engineering
56. Universidad de Sucre - Sincelejo
    Agricultural Engineering
57. Universidad Technologica del Magdalena - Santa Marta
    a) Agronomic Engineering
    b) Fisheries Engineering
    c) Biology and Chemistry
    d) Agricultural Economics
58. Universidad Technologica de los Llanos Orientales - Villavicencio
    a) Agronomy
    b) Zootechnology and Veterinary Medicine
59. Universidad de Tolima - Ibague
    a) Agronomic Engineering
    b) Forest Engineering
    c) Zootechnology and Veterinary Medicine
    d) Biology and Chemistry
60. Universidad del Valle - Cali
    a) Biology
    b) Chemistry
    c) Economics

B. Postgraduate Programs Related to Natural Resources
1. Fundacion Educacional Autonoma de Colombia
   Natural Resource Economics - 5 semesters
2. Universidad de Bogota "Jorge Tadeo Lozano"
   Masters in Marine Biology - 8 semesters
3. Pontificia Universidad Javeriana
   Masters in Biology - 4 semesters
4. Universidad Distrital Francisco Jose de Caldas
   There is currently a move to restructure the forestry program at this school to provide more field experience for students as well as broadening their professional expertise. This new curriculum will include not only traditional forest management courses but also wildlands and wildlife management concepts.

5. Universidad de Los Andes
   a) Natural Resource Economics - 2 semesters
   b) Biology - 4 semesters
6. Universidad Nacional de Colombia - Bogota
   a) Masters in Agricultural Sciences - 8 trimesters
   b) Masters in Marine Biology - 4 semesters
   c) Masters in Hydrologic Resources - 3 semesters
   d) The well-developed Forestry program also includes related fields such as wildlife and forest recreation

C. "Mando Medio" - Technician Programs
   1. Universidad Nacional de Colombia - Medellin
      a) The Escuela de Technologia of the UNC is managed by INDERENA. Course work is divided into 6 periods of intensive study in all aspects of forest management.
      b) Escuela "La Suiza" - Departmento de Risaralda. "La Suiza", supported by INDERENA, is oriented principally to train protection and control inspectors for this agency. Courses usually have a duration of 5 or 6 weeks with 30 participants per course. Although several courses have been realized, the facility has been idle for the last 18 months.

II. Environmental and Natural Resource Agencies (currently functioning)

A. Instituto Nacional de Desarrollo de los Recursos Naturales Renovables y del Ambiente (INDERENA)

Created in 1968, INDERENA has as its principal objectives the regulation, administration, conservation and development of Colombia's natural resources including: fresh and salt water fisheries, water resources, national parks, and equivalent reserves. There are 4 sub-gerencias: 1) Administration and finances, 2) Fish and Wildlife, 3) Forests, water and soils, and 4) Project development.

1. Sub-Gerencia de Bosques, Agua y Suelos

This component of INDERENA includes the departments of natural forests, reforestation, soils, water and national parks. In total there are 35 professionals and 25 technicians working in the central offices. The Division of National Parks currently manages 24 National and Natural Parks and 6 Flora and Fauna reserves. There are 7 professionals, 3 technicians and 2 others work in the central office of this division and 25 professional, 17 technicians and 138 guards in the field. Projected future staffing include an immediate need for an additional 58 professionals, 47 technicians and 368 inspectores. Several courses for inspectores are proposed for this year.

2. Sub-Gerencia de Pesca y Fauna Terrestre

This sub-gerencia is divided into 4 divisions;

wildlife, salt-water fisheries, fresh-water fisheries and aquaculture. There are 13 professionals, 3 technicians and 6 others working in these programs. A minimum of 15 professionals (biologists or foresters) and 20 technicians are needed immediately to manage effectively the current workload.

3. Proteccion y Control

   This division focuses its efforts upon protecting natural resources and enforcing natural resource legislation and laws. Twenty professionals, 337 inspectores and 85 others make up this unit.

4. Sub-Direccion de Desarrollo

   Within this agency functions a department of eco-development which is currently realizing several pilot projects. Approximately 114 professionals work in this sub-direction.

5. Programa de Educacion Ambiental

   The Environmental Education Program of INDERENA has become involved in training and education activities for both personnel of the agency and the general public. Twelve professionals carry out these projects. INDERENA has developed a joint program with the Universidad de Antioquia which focuses upon the training of "peritos forestales" for this and other agencies. The Environmental Education Program also collaborates with the Ministry of Education in an effort to incorporate environmental concepts into student curriculum at a national level. This includes correspondence courses for forestry and wildlife inspectors. Progress has recently been made at organizing a center for environmental education information.

B. Servicio Nacional de Aprendizaje (SENA) Regional Office in Popayan

1. This community development unit presents natural resource courses regularly which focus upon reforestation with native species, forest nurseries, and fish culture. Ecology and environmental considerations are being introduced into other courses in the rural sector such as agriculture, horticulture, livestock, rural mechanics and lesser known species. In fact, SENA has adopted a new policy that will integrate conservation into all their national activities. The Popayan regional office presented a one week course during the first week of July in ecology to instructors from other regional offices.

2. SENA has preliminary plans for 1981 to begin a technician level school of conservation for the nation. This would include nursery management and allied reforestation fields, training for forest technician positions as well as park guards.

3. They have negotiated a contract with the Compania Forestal del Cauca (COMFORESCA) which will permit SENA to train workers for the industrial forest sector at their facility. Additionally, COMFORESCA will fund research and development of native forest species and fruit trees.
4. This service is also working closely with La Reserva Forestal Merenberg which has five years of experience with native species nurseries and reforestation. SENA instructors make regular field study trips to Merenberg.

C. ACUA is a nongovernmental conservation organization based in Popayan. The group has signed an agreement with World Wildlife Fund U.S. for the development of an integrated rural ecodevelopment project based in the Reserva Merenberg region. ACUA publishes an ecological bulletin covering renewable natural resources, appropriate technology and related themes, as well as conducting conferences and radio programs concerning the same topics.

Future ACUA projects pending financial and institutional support include:

1. A post-graduate course for lawyers and biological science professionals being developed in the area of environmental law.
2. Training courses for school teachers, civic leaders, executives, and union representatives related to environmental issues. The program will use audio-visual presentations to show local communities practical actions they can take to solve regional problems.
3. Special summer school courses are being designed to use outdoor education teaching methods on an experimental basis.
4. The Ministry of Educacion has ordered the inclusion of an ecology course in all academic programs, but material is lacking. ACUA plans to develop programs, train teachers and provide them with adequate teaching aids.

D. Centro Interamericano de Fotointerpretacion (CIAF)

Among other activities this agency is dedicated to training personnel in the use and utility of remote sensing techniques. Several detailed courses on this topic are offered annually.

E. COLCIENCIAS

This institute is supported by the Ministry of Education and has become involved in promoting the application of science into national development. Recently a document was prepared which describes a strategy for the scientific and technological development of Colombia. This document includes plans for:

the training of personnel to carry out these programs, a national information network, development of relevant programs at a university level, and development of scientific-technological programs for national priority areas.

F. Fundacion para la Educacion Superior - Cali

This non-profit foundation functions principally to establish effective collaboration between the public and private sector in the promotion, improvement and financing of national educational programs. It is involved in securing funding for activities and investigations related to both science and the humanities. Several textbooks have been published and distributed. The Fundacion is currently planning a high level seminar on the topic of preservation and utilization of Colombia's forest resources.

G. Instituto Geografico Agustin Codazzi

Besides preparing national maps this agency also provides an information service on topics related to maps, national statistics, catastro nacional, and other related data. There are 2,400 employees in this institute of which 750 are professionals. These include 250 cartagraphers.

H. Ministerio de Agricultura - Oficina de Planeamiento del Sector Agropecuario (OPSA)

This office carries out the following functions: agricultural planning and programing, supervision of projects and activities, distribution of funds and execution and evaluation of projects. Within this agency functions the "Grupo de Estudios de Recursos Naturales" made up of one forester, one fisheries biologist, one agronomist and an economist. This group has been responsible for promoting environmental considerations in high level national planning activities.

I. Rasol Ltd. - Medellin

This small, private company has been developing plans and projects for alternative energy utilization (solar, wind, etc.) in Colombia.

APPENDIX ID

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

ANDEAN SUBREGION

ECUADOR

A. Educational Institutions

In Ecuador there are 12 state operated universities staffed by a total of 8,122 (1979) faculty members and attended by over 196,000 students. There are also 5 private schools with 2,213 (1979) staff members and a student body of 34,591 students. In addition to these universities there are 3 polytechnic schools.

1. Faculties offering university and post-graduate opportunities:

a) Pontificia Universidad Catolica del Ecuador

4-year degrees in biology and biological education, 202 faculty and 2,752 students.

b) Universidad Catolica de Cuenca

5-year degree in agronomy and a 4-year degree for agricultural technician, 27 faculty and 220 students.

c) Universidad Central de Ecuador

A five-year degree in agricultural engineering, with 61 faculty and 872 students. 5-year graduate degree in biology with 274 faculty and 10,504 students.

d) Universidad Estatal de Guayaquil

Offers 5-year degrees in veterinary medicine and forest engineering, with 172 faculty and 2,140 students. Five-year graduate degrees in biology and geology are offered, involving 149 faculty and 1,227 students.

e) Universidad Nacional de Loja

5-year degrees are offered in agronomy, forestry, agriculture and veterinary medicine by 55 faculty to 430 students.

f) Escuela Politecnica de Chimborazo

6-year degree in agronomy, 26 faculty and 393 students.

g) Escuela Politecnica de Litoral

3-year fisheries technician degree, 12 faculty;
4-year oceanography degree, 19 faculty and 109 students.

h) Universidad Tecnica de Ambato
4-year degree in natural sciences, 82 faculty and 1,909 students.

i) Universidad Tecnica de Babahoyo
5-year degree in agronomy, 82 faculty and 1,596 students.

j) Universidad Tecnica de Esmeraldas
5-year degrees in forestry and animal science, 46 faculty and 782 students; 4-year degrees in biology and chemistry, 74 faculty and 2,659 students.

k) Universidad Tecnica de Machala
5-year degrees in agronomy, veterinary medicine, and animal sciences, by 50 faculty to 360 students.

l) Universidad Tecnica de Manabi
5-year agronomy degree with 54 faculty and 1,162 students, and a 5-year agricultural engineering degree by 37 faculty to 443 students.

m) Universidad Tecnica Particular de Loja
5-year degree in agricultural engineering, 18 faculty and 140 students.

2. Several centers and institutes warrant special mention:
a) Centro de Biologia, Universidad de Ecuador offers practical experience in systematic botany, genetics and biology for students from any department; 11 faculty.

b) Departamento de Biologia, Pontificia Universidad Catolica de Ecuador
Offers a 4-year degree in biology, with 8 semesters of course work, specializing in training for science educators; manages a large herbarium; 17 faculty.

c) Escuela de Biologia, Universidad Central de Ecuador
Several aspects of conservation and natural resources are incorporated into curriculum, and research and seminars relate to natural resource topics; 5 faculty.

d) Escuela de Ingenieria Forestal, Universidad de Loja
Offers a complete 5-year program in forestry; 24 faculty.

e) Escuela Politecnica Nacional
Manages the Museo de Ciencias Biologicas.

f) Instituto de Ciencias Naturales, Universidad Central del Ecuador
Working closely with faculties of chemistry, pharmacy, agronomy, biology, among others, this institute promotes research in biology and related fields. It also operates a herbarium and a museum and publishes an annual bulletin.

3. Technical-level Education
Centro Forestal Conocoto

A 2-year course is offered for forestry technicians and supports research in silviculture and wood technology; a one-year course if offered for forest guards. Most of the courses are taught by personnel from the Direccion General de Desarrollo Forestal (forest service). Average annual enrollment of 20 students.

B. Environmental and Natural Resource Agencies

1. Centro de Levantamientos Integrales de Recursos Naturales por Sensores Remotes (CLIRSEN)

The basic functions of CLIRSEN include: realize a natural resource inventory of Ecuador; plan, organize, carry out and control activities related to remote sensing; develop cartographic maps of Ecuador; and provide technical assistance to other institutions needing expertice in remote sensing.

2. Consejo Nacional de Desarrollo (CONADE)

This agency organizes, evaluates and controls the implementation of the national development plans. It has 4 major divisions: Infrastructure, Industries (including fisheries), Agricultural activities, and Rural development.

3. Direccion General de Desarrollo Forestal

The 5 principal functions are: the conservation of forest resources and fauna; supervision and/or execution of forest production; development of special forestry activities, including forestation and reforestation; research; and training of personnel in forestry. The Direccion General is organized into 6 departments: Administracion de Areas Naturales y Vida Silvestre, Supervision y Estudios, Forestacion, Aprovechamiento y Produccion, Inventario y Patrimonio Forestal, and Investigacion Silvicultural. The Direccion General is responsible for law enforcement on forest protection, forest utilization, reforestation, agrarian reform, protection of wildlife and fish and soil conservation areas. There is currently a proposed project which would unite and coordinate these various laws into one body.

The Departamento de Administracion de Areas Naturales y Vida Silvestre deals specifically with the administration of wildland areas. At the national office in Quito there are 6 professionals while in the field (11 areas under management) there are 10 professionals, 24 technicians, and 115 guards. Projected additional personnel needs include: 15 more professionals, 36 more technicians and 115 more guards. This department has realized several workshops and courses for various levels of park employees. Most recently an international workshop was held in the Galapagos Islands with 40 participants. The major themes of this

event included: 1) analysis of the state of conservation and wildlands management in Latin America; 2) management of wildlands; and 3) development of cooperative efforts in conservation between Latin American nations.

The department plans on carrying out one training course per year.

4. Fundacion Natura

This is the Ecuadorian office of the World Wildlife Fund and it functions principally to administer W.W.F. funds for several national parks. Natura is also coordinating a massive environmental education campaign and a diagnosis of the state of the environment of Ecuador.

5. Instituto Nacional de Colonizacion de la Region Amazonica Ecuatoriana

This institute coordinates, plans and executes colonization and integral development in the Ecuadorian region of the Amazon. Within this institute there is a Departamento de Ecologia which coordinates all of the natural resource related agencies' activities in the Amazon. They have also sponsored several seminars on topics such as: agroforestry, economics, social-cultural considerations, agriculture and ecology. There are 15 professionals in the entire institute, 4 of which work in Ecologia.

6. Instituto Nacional Ecuatoriano de Recursos Hidraulicos (INERHI)

INERHI is in charge of the protection, management and administration of hydrologic resources of the country. Over 3,000 persons are employed in this Institute of which 239 are engineers or other professionals working in their central office in Quito.

7. Museo Ecuatoriano de Ciencias Naturales

This museum has focused its efforts on the inventory, classification, conservation and exhibition of the natural species of Ecuador. There are 4 professionals working for the museum.

8. Programa Nacional de Regionalizacion Agraria

The major concern of this program is to promote biologically and socio-economically sound agricultural development. There are 100 professionals employed by this agency, most of whom are involved in research related to ecology, soils, hydrology, remote sensing, socio-economic agricultural analysis, geomorphology and integrative studies.

APPENDIX ID

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

ANDEAN SUBREGION

PERU

A. Educational Institutions (currently functioning)

In Peru there are some 35 universities, 25 of which are state operated and the rest are private. The schools offering degrees related to natural resources are listed below, by university:

1. Universidad Nacional Agraria

a) Facultad de Ingeneria Forestal. Offers a bachelors degree. There are 30 faculty members and 297 students.

b) Ingenieria Pesquero. This department offers a bachelors degree. There are 23 faculty members.

c) Ingenieria Agricola. Offers bachelors degrees. There are 477 students in this program.

d) Biologia. One hundred and twenty-three students are enrolled in the biology program.

e) Facultad de Agronomia.

f) A bachelors degree is offered in Zootechny. Five hundred and 40 students are in the program.

g) A masters program in agricultural economics is available.

h) Masters degrees are offered in soils and water resource engineering.

2. Universidad Nacional Agraria de la Selva

a) The Facultad de Recursos Naturales Renovables offers a bachelors degree in Renewable Resources.

b) The Facultad de Agronomia includes a program in agronomy.

c) A bachelors in fisheries sciences is also offered. Two hundred students and nine faculty members are involved in the program.

3. Universidad Nacional del Altiplano
   The Facultad de Ciencias Biologicas composed of 23 faculty members offers a bachelors degree in Biology.

4. Universidad Nacional Amazonia Peruana -
   Ingenieria Forestal offers a bachelors degree in forestry. There are 19 faculty and 361 students involved in the program.

   b) The Facultad de Agronomia offers a bachelors degree. One hundred and twenty six students participate in the program.

   c) The Facultad de Agronomia includes a bachelors program in Agricultural Engineering.

5. Universidad Nacional Centro de Peru -
   a) The Facultad Forestal offers a bachelors in Ingenieria Forestal. Approximately 275 students are enrolled in the program. There are 16 faculty members.

   b) The Facultad de Agronomia involves 382 students in its bachelors program in agronomy.

   c) The Facultad de Zootecnica offers a bachelors degree in Zootechny engineering. Approximately 400 students are active in the program.

   d) Arquitectura includes a bachelors program in architecture.

6. Universidad Nacional Daniel Alsides Carrion -
   The Zootechny Department has over 360 students enrolled in their bachelors program.

7. Universidad Nacional Faustina Sanchez Carrion -
   The Fisheries program offers a bachelors degree in Fisheries Engineering.

8. Universidad Nacional Frederico Villarreal -
   a) The Facultad de Arquitectura made up of 78 faculty and 750 students includes a bachelors program in architecture.

   b) The Facultad de Geografia offers a bachelors degree in geography.

   c) Degrees are offered by the facultad de Pesqueria in Fisheries and Oceanography.

9. Universidad Nacional Hermilio Valdizan -
   The Facultad de Agronomia offers a bachelors in agronomy. There are 18 faculty members and 473 students involved in the program.

10. Universidad Nacional de Ingenieria -
a) The Facultad de Arquitectura offers a bachelors in this program.

b) A bachelors degree is offered in Oceanography. Approximately 30 faculty members participate in this program.

c) The Facultad de Planificacion offers a bachelors degree in planning. There are 57 faculty members on the staff.

d) A masters program with a specialization in architectural design is also offered.

11. Universidad Nacional Pedro Ruiz Gallo -
a) Bachelors degrees are offered in Agriculture and Agricultural Engineering.

b) In Biological Sciences a bachelors in microbiology, parasitology, fisheries, botany or zoology is offered. Approximately 250 students participate in these fields of study.

c) The Facultad de Agronomia serves some 727 students pursuing bachelors degrees in agronomy.

d) There are 280 students in the zootechny program. Bachelors degrees are offered in zootechny engineering.

e) In veterinary medicine a bachelors degree is offered.

12. Universidad Nacional San Agustine -
a) The Facultad de Ciencias Biologicas, composed of 18 faculty members, is attended by 312 students pursuing bachelors degrees in Biology.

b) In architecture, bachelors degrees are offered in a program which includes 38 faculty members and 727 students.

13. Universidad Nacional San Antonio Agad -
a) Over 325 students and 28 staff make up the biological sciences program. A bachelors degree in biology is offered.

b) In agricultural sciences almost 700 students are pursuing a bachelors degree in agronomy engineering. There are 28 faculty members on the agronomy staff.

c) The Facultad de Arquitectura includes 33 faculty members and offers a bachelors in architecture. Approximately 490 students are in the department.

14. Universidad Nacional San Cristobal de Huamanga -
a) Twenty-five members make up the Biological Sciences staff. A bachelors degree with specialization in microbiology or hydrobiology is offered.

b) In agronomy a staff of 28 faculty and almost 800 students comprise the Agronomy Engineering Program. A bachelors degree is offered.

15. Universidad Nacional San Luis Gonzaga -
Twenty faculty and 630 students are actively involved in the agronomy program of this university.

16. Universidad Nacional de San Marcos -
a) The Facultad de Ciencias Biologicos serves 443 students and offers a bachelors degree in Biology.

b) A bachelors degree is obtainable in geography.

c) The veterinary medicine program offered by this university is the chosen field of specialization of some 270 students.

17. Universidad Nacional de Tacna -
Course work yielding a bachelors degree in fisheries engineering is offered.

18. Universidad Nacional Tecnica del Callao -
A bachelors in fisheries is offered by this university. Forty faculty members and 925 students are involved in the fisheries program.

19. Universidad Nacional Tecnica de Pirura -
a) A bachelors degree in fisheries is offered. Over 550 students are enrolled in the program.

b) The Facultad de Agronomia offers a bachelors in agronomy.

c) Two hundred students are enrolled in zootechny program. A bachelors degree is offered.

20. Universidad Nacional Tecnica del Altiplano -
a) A bachelors degree in agronomy is offered. There are 834 students and 38 faculty members in the program.

b) Veterinary medicine bachelors degrees are pursued by almost 525 students at this university.

21. Universidad Nacional Tecnica de Cajamarca -
a) Courses leading to a bachelors degree in agronomy are offered. Approximately 815 students participate in this field of study.

b) The school of veterinary medicine is attended by over 800 students seeking bachelors degrees in veterinary sciences.

22. Universidad Nacional de Trujillo -
a) The Facultad de Ciencias Biologicas, composed of 36 faculty members and 525 bachelor candidates, offers a degree program in biology with a specialization in botany.

b) A bachelors in fisheries biology is also offered.

23. Universidad Particular Ricardo Palma -
The Facultad de Arquitectura offers a bachelors degree in architecture. Over 1,500 students are enrolled in these courses. There are 100 faculty members on staff.

24. Universidad Peruana Cayetano Heredia -
a) A bachelors in biology is offered. There are 11 staff members and 53 students in this program.

b) A masters program in Biology is also functioning.

c) A doctoral program in sciences is currently functioning.

25. Universidad Peruana Ricardo Palma
a) In the biology department, which is staffed by 32 faculty members, almost 775 students are working on their bachelors degrees.

26. Technical Level Education - Programa Forestal de la Escuela Superior de Educacion Professional (ESEP), Pucallpa
a) Course work includes 6 semesters of classes in forest management, Silviculture, forest products and wildlife. There are currently 35 students in the program. This will soon be increased to 120 per year.

B. Environmental and Natural Resource Agencies (currently functioning)
1. Ministerio de Agricultura y Alimentacion
Within the Ministry of Agriculture the following departments are directly involved in natural resource management:
a) Direccion General Forestal y de Fauna
This agency is responsible for protection and utilization of forest resources, including wildlife. In total there are 765 employees in the Direccion General Forestal y de Fauna. Of these, 101 are professionals, 36 technicians, and 506 laborers. They work in the Direccion de Conservacion, Direccion de Silvicultura, Direccion de Extracciones Forestal, Direccion de Transformacion Primaria y Comercializacion, and Direccion de Operacion de Distritos Forestales.
i) La Direccion de Conservacion
This branch of the ministry is involved with protection and management of wildlife and wildland resources. There are 40 employees in the central office of which some 29 are professionals. This Direccion

manages the national system of parks and equivalent reserves (14 areas protecting 4,184,107 hectares) and assists the Direccion de Extracciones Forestales in management of 7 national forests. There are 17 professionals, 12 technicians, and 42 laborers working within the parks. Future personnel needs call for an increase of 82 professionals and technicians and 368 guards to staff adequately a projected park system of 22 areas.

ii) Projecto Especial de Utilizacion Racional de la Vicuna

This project established in 1978 by the Direccion General Forestal y de Fauna seeks to repopulate the high andean area with vicuna to provide a needed source of income for the local people of this area. The project has realized training courses in vicuna management and is administered by 34 professionals, 60 technicians, and 57 guards.

iii) Direccion General de Aguas y Suelos

This agency carries out the important role of management of soil and water resources. There are 4 divisions within this office: Direccion de Aprovechamiento de Aguas, Direccion de Manejo de Cuencas, Direccion de Operacion de Distritos de Riego and Direccion de Tarifas y Costos. Efforts are currently being made to develop a national plan for watershed management in Peru. There are 56 professionals and 63 technicians in this Direccion.

iv) Instituto Nacional de Investigacion Agraria (INIA)

This agency carries out studies related to agriculture, cultivation of wild flora and fauna, agroindustry and soil and water conservation. INIA currently operates two field stations and has several more planned (one in each natural region). There are 25 professionals and 7 technicians now working for this agency. By the year 2000 an additional 53 professionals and 123 technicians should be added.

v) Oficina Nacional de Evaluacion de Recursos Naturales

ONERN is involved in integrated studies dealing with natural resources and economic development, collaboration with the Institute Nacional de Planificacion in formulating national conservation strategies, and investigating man/environment interactions in Peru. They have also developed a training program in remote sensing and are carrying out an environmental diagnosis in several parts of the country. ONERN has also realized several seminars dealing with environmental issues. There are 170 persons working within this unit.

vi) Policia Forestal de la Guardia Civil del Peru
This branch of the Guardia Civil monitors and controls extraction of forest resources and enforces legislation dealing with natural resource protection.

C. Development projects related to renewable natural resource management

1. Centro de Investigaciones de Zonas Aridas (CIZA) - Universidad Nacional Agraria
Involved in investigation and training related to arid zone management.

2. Centro de Capacitacion e Investigacion para la Reforma Agraria - Ministerio de Agricultura
Involved in investigation and training related to Agrarian Reform in Peru.

3. Consejo Nacional de Investigacion (CNI) Presidencia de la Republica
Formulates the national strategy for scientific development.

4. Direccion de Hidrografia y Navegacion de la Marina - Ministerio de Marina
Research related to marine resources.

5. Direccion General de Desarrollo Urbano (DGDU) Ministerio de Vivienda y Construccion
Involved in the prevention of environmental degradation due to development.

6. Direccion General de Extracciones - Ministerio de Pesqueria
Investigates sound utilization of aquatic resources.

7. Direccion General de Investigacion. Cientifica y Technologica - Ministerio de Pesqueria
Plans and coordinates fisheries investigations at a national level.

8. Instituto de Biologia Andina - Universidad Nacional Mayor de San Marcos
Studies human ecology of the Andes region.

9. Instituto de Salud Ocupacional - Institutos Nacionales de Salud - Ministerio de Salud
Promotion of environmentally sound development.

10. Instituto del Mar del Peru - Ministerio de Pesqueria
Investigate management and utilization of fresh and salt water resources.

11. Instituto Frances de Estudios Andinos - Embajada de Francia en Peru
    Carry out ecological studies in the Andean region.

12. Instituto Nacional de Planificacion - Presidencia de la Republica
    Design national development plans.

13. Oficina Nacional de Evaluacion de Recursos Naturales - Oficina del Primer Ministro
    Define optimal use of Peru's natural resources.

14. Programa Academico de Ciencias (PAC) Universidad Nacional Agraria
    Involved in scientific investigation and education.

15. Sociedad Geografica de Lima
    Promote investigations related to the geography of Peru.

APPENDIX ID

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

ANDEAN SUBREGION

VENEZUELA

A. Educational Institutions

In Venezuela there are: 19 public and private universities attended by 81.79% of the total national student body, 4 Institutos Politecnicos with 1.45% of the students, 6 Institutos Universitarios Pedagogicas with 7.01% of total student enrollment, 18 Institutos Universitarios de Technologia with 5.92%, 10 Colegios Universitarios with 3.83%, 8 private universities and 4 military university institutes. Universities with curriculum related to natural resource protection and management are listed under their respective geographic location.

1. Colegio Universitario de Carupano, Carupano
   6-semester course for advanced technicians in fishing technology.

2. Instituto Universitario de Technologia Agroindustrial Regional de Los Andes, San Cristobal
   A six-semester advanced technician degree in agronomy.

3. Instituto Universitario de Tecnologia de Cumana, Cumana
   Advanced technician degree in agronomy.

4. Instituto Universitario de Tecnologia del Mar, Nueva Esparta
   6-semester program for technicians in oceanography and aquaculture, and advanced technicians in navigation and fishing.

5. Instituto Universitario Pedagogico Experimental R. Escobar Lara, Maracay
   Offers a 10-semester teaching degree in biology.

6. Instituto Universitario Pedagogicos Experimental de Barquisimeto, Barquisimeto
   8-semester teaching degree in education.

7. Instituto Universitario Pedagogico de Caracas, Caracas
   Offers teaching degrees in biology and in earth sciences.

8. Instituto Universitario Pedagogicos Experimentales de Maturin, Maturin
   8-semester teaching degrees in biology and education.

9. Universidad Central de Venezuela, Caracas
   Offers a 10-semester masters program in biology, a 10-semester engineering degree in hydrometeorology, and a degree in architecture.

10. Universidad Central de Venezuela, Maracay
    Offers 10-semester degrees in agricultural engineering and veterinary medicine. The Instituto de Zoologia Tropical of this University offers post-graduate work in ecology.

11. Universidad Central Occidental Lizandro Alvardo, Barquisimeto
    10-semester programs in agricultural engineering and veterinary medicine.

12. Universidad de Los Andes, Merida and Trujillo
    Offers 10-semester degrees in biology, agricultural engineering (Trujillo only), and forestry, with 67 faculty members in the Forest Sciences Department. A six semester course if offered for agrobiological technicians (Trujillo). The University, in cooperation with OAS, directs the Centro Interamericano de Desarrollo Integral de Aguas y Tierras which offers technical assistance, carries out investigation and training activities and disseminates information. Eco-development concepts have been incorporated into their programs.

13. Universidad Experimental de Los Llanos Ezequiel Zamora, Barinas - Conservation en ineering
    10-semester animal sc nce degree.

14. Universidad de Rafael Urdaneta, Maracaibo
    A 10-semester course in animal science.

15. Universidad de Zuilia, Maricaibo and Cabimas
    Offers 10-semester degrees in general studies, related to biology, veterinary medicine or agronomy.

16. Universidad del Oriente, Bolivar
    University-level degrees in geology and marine biology.

17. Universidad del Oriente - Sucre, Nueva, Esparta, Managas, Anzoategui
    University degree programs in biology, geology, agricultural engineering, animal science and marine biology. A 10-semester course in applied marine sciences (Nueva Esparta only) includes aquaculture and marine foods technology.

18. Universidad Experimental de Los Llanos Ezequiel Zamora, Barinas and San Fernando de Apure
    - Agricultural Engineering (Barinas)
    - Conservation Engineering (San Fernando de Apure)

19. Universidad Experimental de Los Llanos Ezequiel Zamora, Guanare
    10-semester programs in conservation engineering and animal science.

20. Universidad Experimental de los Llanos Ezequiel Zamora, San Carlos
    Offers a 10-semester degree in agricultural engineering, and features the Centro de Estudios Integrales del Ambiente.

21. Universidad Nacional Experimental Tachira, San Cristobal
    10-semester degrees in agricultural engineering and animal science.

22. Universidad Simon Bolivar, Caracas
    Offers a masters in biology.

B. Environmental and Natural Resource Agencies (currently functioning)

1. El Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR)
    Created in 1976 MARNR has as its principal objectives the following:
    - Formulate the political structure necessary for the defense and rational utilization of natural resources
    - Plan and organize the defense and rational utilization of resources
    - Plan and administer programs related to the regulation, use and control of hydrologic resources
    - Administer and manage forest resources
    - Administer and manage faunal resources (including fish) in both terrestrial and marine habitats
    - Establish and administer national parks forest reserves, natural monuments, protected zones, wild region reserves, watersheds, national hydrological reserves, wildlife refuges, recreation parks and other reserves
    - Protect important watershed regions
    - Guard other public areas such as beaches and their adjacent zones
    - Protect scenic landscapes
    - Monitor and control solid and liquid contamination
    - Inventory natural renewable resources
    - Promote environmental education

- Train personnel in management and protection of natural resources
- Develop criteria to measure environmental impacts of development
- Cooperate in developing land use plans for Venezuela
- Coordinate public administrative actions which relate to natural resource utilization

MARNR also administers the Ley Forestal de Suelos y Aguas, Reglamentos de la Ley Forestal de Suelos y Aguas, Ley de Proteccion a la Fauna Silvestre, and Ley Organica de Ambiente.

Training of both MARNR personnel and the general public remains a high priority in this ministry. Educational activities of MARNR include:

a) Direccion General de Informacion y Investigacion del Ambiente
   - Generates and distributes information related to cartography, remote sensing, tenure, geology, geodesy, surveys, soils, hydrology, meteorology, geohydrology, seismology, and related geomorphological data.

b) Direccion de Educacion Ambiental
   - Produces and disseminates environmental education materials including radio, television and newspapers
   - Coordinates (with the Ministry of Education) environmental education curriculum in the school system
   - Organization of charlas and workshops related to environmental issues
   - Realizes training programs for MARNR personnel

c) Fuerzas Armadas de Cooperacion
   - Provides training in some aspects of natural resource management to personnel of the armed forces

d) Instituto Nacional de Parques
   The Institute, an autonomous organization in charge of administration, development, protection and management of National Parks and Equivalent Reserves (under the auspices of MARNR laws), realizes training programs for park guards and directs environmental interpretation programs within the parks. The Institute is currently planning a training center for studies related to park management.

e) Direccion de Manejo de Cuencas
   - Carries out 6 or 7 courses per year for professionals in watershed management and 5 or 6 for technicians

f) Oficina de Desarrollo Professional y Relaciones Internacionales (ODEPRI)
- Promotion and organization of training opportunities for technicians and professionals in MARNR

g) Direccion de Ordenacion del Territorio
- Publishes materials related to the environmental impact of development

h) Direccion de Planificacion de Los Recursos Hidraulicos
- Publishes and distributes information related to water resources and the effects of development on their quality

C. Development projects related to renewable natural resource management

1. Audubon Society
   - Emphasizes the study and protection of bird species

2. Fundacion para la Defensa de la Naturaleza (FUDENA)
   - Promotes protection of habitats, conservation programs for endangered species and environmental education programs

3. Fundacion para la Educacion Ambiental (EDUCAM)
   - Produces environmental education materials
   - Carries out extension activities

4. Programa del Hombre en la Biosfera
   - Composed of two representatives of the Instituto Venezolano de Investigaciones Cientificas (IVIC), one representative from the Direccion de Parques Nacionales and one from the Universidad Central de Venezuela. The MAB program is currently involved in several ecological and socio-ecological investigations.

5. Sociedad Venezolana de Ciencias Naturales, Caracas
   - Investigation, technical assistance and education (including training programs for park guides and environmental education for rural teachers) are the principal objectives of this society

APPENDIX IE

REGIONAL TRAINING PROGRAM
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

SOUTHERN CONE SUBREGION

ARGENTINA, CHILE, PARAGUAY AND URUGUAY

I. Argentina
   A. Educational Institutions (currently functioning)
      1. Centro de Ecologia y Recursos Naturales, de la Universidad Nacional de Cordoba
         a) Offers an advanced university degree in Ecology for biologists and agronomists.
         b) Applied research in ecology is carried out by students and faculty.
         c) The Center is the coordinator for the Argentina MAB program.
      2. Centro de Instruccion "Bernabe Mendez" (Parque Nacional Nahuelhuapi) del Servicio Nacional de Guardaparques
         a) This center is charged with adequately training personnel for managing, developing and protecting national parks. Courses last for 15 months and focus on general skills needed by park guards.
         b) Staff includes: 1 Director, 2 Professionals, 4 Technicians and 10 temporary Professionals. Approximately 30 students graduate every 15-month session.
      3. Universidad Nacional de Misiones Escuela de Ingeniera Forestal
         a) This department is oriented towards industrial forestry.
         b) Natural resource protection themes are included in course curriculum.
      4. Universidad Nacional del Nordeste, (Corrientes) Facultad de Recursos Naturales
         a) It had offered wildland management until 1977 when the material was omitted in a program reorganization.
         b) Natural resource protection themes are included in course curriculum.
      5. Universidad Nacional de la Plata
         a) Escuela de Bosques
            i) Forestry programs include protection, flood control and watershed management.
         b) Programa de Ciencias Naturales Basicas
            i) A course in Protection and Conservation of Nature is available. This focuses upon general conservation with some management covering most all natural resources and their interrelationship to man.

ii) Wildland management is the topic of one field of study in this program.

iii) Pollution control is also an available topic for students to pursue.

6. Universidad Nacional de Salta
   a) Basic materials in wildlife management are included in the curriculum.
   b) A degree in natural resources is offered.
7. Universidad Nacional de Santiago del Estero, Departamento Academico de Recursos Naturales.
   a) Forestry program is resource management oriented. The Industrial Forest Engineering program is directed towards industrial utilization, although watershed management is included. About 9 students graduate annually.
   b) There are courses that pertain to ecodevelopment, agroforestry, wildlife, fisheries and wildland management.
   c) The Department receives substantial assistance from West Germany (mostly in wood technology) and cooperates with the Universidad de Curitiba (Brazil) for graduate studies in forestry.

B. Environmental and Natural Resource Agencies (currently functioning)
1. Instituto Forestal Nacional is under the Subsecretaria de Recursos Naturales Renovables y Ecologia - Secretaria de Estado de Agricultura y Ganaderia del Ministerio de Economia.

   Goals of the Institute are basically to promote plantations of exotic species.
2. Direccion Nacional de Fauna - Subsecretaria de Recursos Naturales Renovables y Ecologia as described above.
   a) Major objectives of this agency are aimed at the management and protection of wildlife resources.
   b) Personnel include: 1 Director, 8 professionals and several technicians.
3. Servicio Nacional de Parques Nacionales - Subsecretaria de Recursos Naturales Renovables y Ecologia
   a) The Park Service functions as the administering body of national parks and equivalent reserves. It organizes and facilitates investigations and planning activities related to the management of these sites. Finally, it is charged with the protection of protected natural areas.
   b) Several nongovernmental conservation groups also participate indirectly in the management of these areas.
   c) Staffing includes: 1 Director, 17 professionals and 20 technicians.
4. Nongovernmental Organizations operating at the national level. These groups realize a variety of conservation and environmentally-related activities including participation in the management of the National Park System.

Environmental education activities are an important component of their mandates. All of the groups listed operate on small budgets which limits their effectiveness:

a) Asociacion Amigos de Parques Nacionales
b) Asociacion Argentina de la Ciencia del Suelo
c) Asociacion para la Proteccion del Ambiente
d) Asociacion Argentina de Ecologia
e) Asociacion Natura
f) Asociacion Argentina de Ciencias Naturales
g) Comite Argentino de Conservacion de la Naturaleza
h) Fundacion Vida Silvestre
i) Sociedad Argentina de Ecologia

5. El Departamento de Areas Naturales de Cordoba

Several provinces maintain independent natural resource management units, the most advanced being in the Province of Cordoba. They have established natural resource legislation and currently manage several provincial wildland and wildlife protection units.

C. Development Projects Related to Renewable Natural Resource Management (currently functioning)

1. Rio de la Plata watershed management project with OAS. This large conservation project includes erosion control, irrigation, water supply for urban and industrial uses, power production and conservation education.
2. National Forest Plantation Plan

The goal of the reforestation plan is to plant 2,326,000 hectares in exotic species by the year 1994, in selected areas in need.

3. Erosion control project in Patagonia by Instituto Nacional de Technologia Agropecuaria (INTA).

This project has identified key areas in need of reforestation and is currently implementing an extensive conservation campaign.

4. Centro para la Ecologia y Recursos Naturales of the Universidad Nacional de Cordoba

This Center is the major representative of the MAB program in Argentina. Through this program and in collaboration with the Comision Nacional Cientifica y Tecnologica (CONICYT) of Chile, the Center is carrying out applied ecological research in the Andes. These research projects include environmental impacts of mining, and the impact of domestic cattle and hunting on wildlife. These research projects when coupled with baseline biological data are designed to improve natural resource management and land use throughout the biome.

II. Chile

A. Educational Institutions (currently functioning)

1. Universidad de Chile - Facultad de Ciencias Forestales

Wood Technology and Forest Resource Management

programs are well-developed within the Forestry School.

a) The Forest Resource Management curriculum includes the following courses:
   - Use, Classification and Conservation of Soils
   - Forest Management I
   - Forest Management II
   - Forest Management in Arid Zones
   - National Park Planning
   - Forest Hydrology
   - Wildlife Management and Conservation

b) Research projects within this program include the following:
   - Recreation and Environmental Education
   - Environmental Impact of Recreation
   - Classification and Reclassification of Wildlands
   - Boundary work on La Campana National Park
   - Economic Evaluation of National Parks

c) Faculty resources within the school include: 14 professionals with graduate degrees, 29 full time staff without degrees and 62 part time professionals.

d) The numbers of graduates who have taken courses relating to wildlands are:

	Number of Graduates from the courses						
	1972	1973	1974	1975	1976	1977	1978
Wildlife management and conservation	5	19	51	47	66	43	71
National Park Planning	--	21	29	25	17	40	35
Hydrology	--	34	31	33	24	53	47

2. Universidad Austral de Chile (Valdivia) - Facultad de Ingenieria Forestal

   This university offers a bachelors-level degree in forestry.

   a) A partial listing of courses related to management is included below:
      - Forestry Legislation
      - Conservation of Natural Resources
      - Forest Management
      - Wildland Management
      - Flood Control
      - Forest Policy

   b) Research efforts focus upon the following projects:
      - National Park establishment on Chiloe island
      - Establishing new boundaries for Puyehue National Park

- Proposed regulations for natural forest utilization
- Management alternatives for Huerquehue National Park
- User response to interpretive installations
- Interpretive trail development in National Parks
- Road planning in National Parks
- Management planning in Villarrica and Tolhuaca National Parks and China Muerta Forest Reserve
- Protection, tourism and recreation in the andean foothills in the Province of Valdivia

c) The School of Forestry maintains several specialized laboratories for research into wood technology. These include facilities for:
- Wood Anatomy
- Wood Physics
- Wood Mechanics
- Wood Drying
- Lumber
- Impregnation
- Pulp and Paper
- Forest Pathology a. d Entomology
- Silviculture
- Forest Soils
- Forest Trails
- Photogrammetry
- Arboretum
- Experimental Nursery
- Seed Garden
- Experimental Forestry Center (including a small sawmill, and six forest reserves totaling 3,828 hectares)

d) Staff includes 13 full time professionals with post-graduate degrees, 20 full time professionals without undergraduate degrees, and 10 full time technicians.

e) Numbers of graduates that have taken courses relating to wildlands are:

	1975	1976	1977	1978	1979
Wildland management	36	37	14	10	31
Flood Control	--	--	--	--	16
Natural Resource Conservation	--	--	29	22	12
Forest Policy	10	12	31	18	29

3. Universidad de Concepcion

The Centro de Ciencias Forestales will graduate university-level foresters beginning in 1981. It is a new program that will concentrate on silviculture

and exotic species plantations but will also include some aspects of forest recreation and watershed management.

4. Forestry schools - Technician level
   There are several other forestry schools which offer technician degrees in forestry. These are:
   - Universidad Tecnica* (Puerto Montt)
   - Universidad de Concepcion (Chillan)
   - Universidad Catolica (Maule)
   - Universidad Tecnica* (Talca)
   - Universidad Tecnica* (Chillan)
   - Ministerio de Educacion* (Contulmo)
   - Ministerio de Educacion* (El Vergel)

   All of the above schools for technicians are oriented to silviculture and harvesting of exotic species. Generally they are not teaching management-type courses.
5. El Centro Nacional de Capacitacion Forestal, de Escuadron Corporacion Nacional Forestal (CONAF) - Concepcion
   a) The center trains workers in forestry field operations, mostly concerning the plantation forestry of private companies. Over 100 short courses per year are facilitated by the center.
   b) Seven professional foresters staff the facility. Up to 60 students per session graduate.

B. Environmental and Natural Resources Agencies (currently functioning)
1. Corporacion Nacional Forestal (CONAF)
   CONAF is composed of elements of the Servicio Agricola y Ganadero, the Instituto de Desarrollo Agropecuario, and the Corporacion de Fomento de la Produccion de Reforma Agraria.
   a) Its central goal is to conserve, foster, manage and utilize the forest resources of the country. Specific program objectives of CONAF are:
      - Identify and manage the forest resource of the government
      - Assist in management of private forest lands
      - Develop incentives for the forestry sector
      - Forest resource protection
      - Forest worker training
      - Industrial forestry
      - Forestry research
      - Conservation: native species management (flora and fauna) and national parks and equivalent reserves
      - Extension and technical assistance
      - Interinstitutional relations
   b) The institute is operated by a staff of 42 professionals foresters with degrees and 81 without. Over 30 other professionals are involved in their programs as well as some 60 technicians.

---

*Under study which may lead to the discontinuation of the program.

C. Development Projects Related to Renewable Natural Resource Management

1. United Nations Development Program
   UNDP has an ongoing forest research and development project. Begun in 1977, it has several program areas and has published 31 official documents through January, 1980.
2. Large industrial forestry projects are generally based on extensive plantations. Chile has been reforesting the south at close to 100,000 hectares per year during the last 5 years. Using private landowner incentives they have had great success in their forestry projects.
   a) Projecto Astillas Chiloe - Study of a large wood chip plant (1,250,000 tons per year) to supply Jananese markets, from the forests of Chiloe. Value $U.S. 64,250,000.
   b) Projecto Forestal Pauguipulli - Study of a large pulp plant, sawmill and plywood mill. Value $U.S. 290,000,000.
   c) Projecto Sarao - Prefeasibility study to utilize 500,000 hectares of native forest, with an estimated volume of 35,000,000 cubic meters of commercial lumber.
   d) Projecto Cuenca de Rio Valdivia - Reforestation project using Monterey pine to replant 80,000 hectares for commercial purposes. Value $U.S. 18,000,000.

III. Paraguay

A. Educational Institutions (currently functioning)

1. La Universidad Nacional de Asuncion, Facultad de Ingenieria Agronomica has a forestry program currently assisted by the Universidad de Chile, Facultad Forestal. This forestry program is staffed by 11 professionals and 6 administrators. Approximately 7 students graduate per year.
2. Centro Forestal Alto Parana del Servicio Forestal Nacional.
   a) Assisted by Swiss Technical Cooperation, this center offers training for technicians and forest guards.
   b) There are currently 6 professionals and 4 technicians staffing the program. About 11 technicians and 5 forest guards graduate annually.

B. Environmental and Natural Resource Agencies (currently functioning)

1. Servicio Forestal Nacional, Ministerio de Agricultura y Ganaderia
   a) This agency is charged with management of forest resources and industries as well as wildlands and wildlife.
   b) National parks are managed by the Departamento de Manejo de Bosques y Parques Nacionales which is a division of this service. There are 11 protected areas. Staffing is carried out by 11 professionals and 9 technicians.

C. Development Projects Related to Renewable Natural Resources
   1. FAO has proposed a forestry research program with the Agronomy faculty and the Universidad de Chile.
   2. Several small forest plantation projects are being realized however none of these are on a large scale.

IV. Uruguay
   A. Educational Institutions (currently functioning)
      1. La Universidad de la Republica, Facultad de Agronomia
         a) Staff includes 8 full time, 1 half time and 6 part time instructors.
         b) Graduates number 10-12 per year. Currently this school is receiving assistance from Universidad de Chile.
         c) Bachelors level programs are facilitated in Forest Technology, Dendrology, Silviculture and Landscaping.
      2. La Universidad del Trabajo
         A technician level course is offered in reforestation methods.

   B. Environmental and Natural Resource Agencies (currently functioning)
      1. La Direccion Forestal, Parques y Fauna, Ministerio de Agricultura y Pesca
         a) This agency manages both wildland and wildlife resources as well as forest protection and utilization.
         b) Staffing is carried out by 2 professionals and 12 technicians.
      2. El Instituto para la Preservacion del Medio Ambiente (INPMA)
         a) This governmental coordinating group for environmental management also realizes some research and training.
         b) The Institute is staffed by 2 professionals.

   C. Development Projects Related to Renewable Natural Resources
      1. Research project on the carrying capacity and habitat of the otter, an economically important species. This activity is being carried out by the Instituto para la Preservacion de la Naturaleza.
      2. An environmental impact study on the Salto Grande dam, by INPMA, is in the implementation stage.
      3. Several forest plantations of exotic species are being planned and implemented by the Direccion Forestal, Parques y Fauna.

APPENDIX IF

REGIONAL TRAINING PROJECT SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES

BRAZILIAN SUBREGION

A. Educational Institutions (currently functioning)

The levels of education in Brazil are divided into pre-school, secondary, college and graduate levels.

I. Pre-school Education

Pre-school - 9,349 school rooms
30,686 teachers
679,823 students per year

The pre-school figures are from 1975. Environmental education instructors must train teachers in advance to be able to manage a school-age population of this magnitude.

II. Primary Education

Primary schools are free and obligatory for students 7 to 14 years old. Brazil has 188,260 school rooms, 896,652 teachers and 19,549,249 students enrolled at this level. There currently are no courses in environmental education at this level, though there exist proposals to be implemented. The first is a publication Nocoes de Conservacao de Natureza para Professores for teachers to use in teaching natural resource conservation at this level. It describes basic principles of conservation and some suggested teaching techniques. The second is an extension course for primary school teachers in the area of the environment. This course is offered by: Secreataria Especial do Meio Ambiente (SEMA), Fundacao Educacional do Distrito Federal and the Fundacao Universidade de Brasilia 1976 - 4 volumes - theoretical and practical elements. The afore-mentioned proposed course appears not to have had an impact on implementing environmental education. Several environmentally oriented childrens books have been published by different government agencies.

III. Secondary Education

There are 10,885 courses, 1,681,728 graduates per year, and 156,174 teachers at this level in Brazil. There is one program currently offered for technicians in the field of natural resources: Tecnologos em Agropecuaria e Florestas at the Escola Media de Agricultura de Florestal in Minas Gerais. There are proposals for an ecology course at the secondary level:

Ecologia uma Proposta para o Ensino de 2 Gran. This proposal is sponsored by Companhia Estadual de Technologia de Saneamento Ambiental, and Ministerio de Educacao e Cultura (MEC), and the Departamento de Ensino Medio (DEM). A seminar in Sao Paulo in 1977 tried to design a system for implementing the course. Today it is still a proposal, but one very much needed. The basic idea is to integrate environmental objectives into the science and social studies courses at both the theoretical and practical level. The general objectives are listed below:

A) Provide basic environmental awareness and create an interest in maintaining an environmental equilibrium.
B) Develop an interest for further studies in the environmental field.
C) Stimulate the formation of technicians in environmental fields.

IV. Universities and Institutes for Higher Learning

Brazil has 57 universities and 803 institutes for higher learning with a student population of 593,009 in 1970. There are 4,520 college level courses and 1,555 graduate level courses facilitated by 92,546 professors. Of these, 6,132 professors have masters degrees and 1,287 have PhD's.

Three universities offer courses directly related to natural resource management training. These are: the Universidade Federal do Parana, Universidade Federal de Vicosa em Minas Gerais, and the Escola Superior de Agricultura "Luiz de Queiroz" en Piracicaba Sao Paulo. They offer courses such as Wildlife Management, Forest Management, Wildland Management, and Watershed Management.

The Universidade Federal do Ceara and Universidade Federal Rural de Pernambuco graduate fishery engineers. Also associated with the Universidade Federal do Ceara is the Centro de Treinamento em Desenvolvimento Economico Regional (CETREDE) which offers a course in Renewable Natural Resource Administration.

The Centro de Recursos Hidricos e Ecologia Aplicada in the Escola de Engenharia de Sao Carlos which is associated with the Universidade de Sao Paulo, graduates experts in hydrology and applied ecology at the graduate level.

Institutes of higher education in Brazil are best organized by grouping them into regions of the country that are easily distinguishable; the North; the Northeast; the West-Central; the Southeast; and the South. Programs are undergraduate level unless otherwise noted.

A. North Region

1) Universidade do Amazonas
   Includes programs in sciences, biology and agronomy.
2) Faculdade de Ciencias Agrarias do Para
   Courses in forest engineering and agronomy are featured.
3) Universidade Federal do Acre
   Offers courses in biological sciences.
4) Universidade Federal do Para
   Programs in agronomy and environmental health technology are offered.
5) Instituto Nacional de Pesquisas Da Amazonia
   Research leading to masters, and doctorates is carried out in the following subject areas: Botany, Ecology, Freshwater Biology, Fisheries and Entomology.

B. Northeast Region

1) Escola Superior de Agricultura de Mossoro (Rio Grande do Norte)
   Agronomy Program courses include: Plant ecophysiology, Natural resource conservation and Agricultural ecology.
2) Faculdade de Agronomia do Medio Sao Francisco - Bahia
   An Agronomy Program is operating.
3) Faculdade de Filosofia do Recife
   A Biology Program is offered.
4) Universidade Federal de Alagoas
   a) Science Program courses include: Biological geography 1, Biological geography 2, Elements of Hydrology, Climatology and Meteorology, Biological education, Botany I, II, III, IV, Zoology I, II and Ecology.
   b) Environmental Health Program courses offered are: Environmental health biology, Environmental health, Practical water and sewer treatment, Tropical ecology, Sanitary engineering, Project methodology in environmental health, Health administration and Health law.
5) Universidade Federal da Bahia
   a) Programs in Agronomy and Biology are available.
   b) Graduate programs in Plant Physiology are also facilitated.
6) Universidade Federal do Ceara
   a) Centro de Ciencias Agrarias facilitates several classes related to oceanography. These are: Introduction to Fisheries, Limnology, Aquatic Biology I, II, III, Navigation, Fisheries biology I, II, Aquatic microbiology, Introductory Oceanography, Fisheries economics I, II, Biology of Plancton, Ocean fisheries, Aquaculture I, II, Fisheries technology I, II, Fish product technology I, II, Agricultural meteorology and climatology, Fishery administration, Fishery statistics, Hot and cold technology, Marine motors and machines, Machines for fish processing and Supervised work experience.

b) The Centro de Ciencias e Technologia includes these related courses in its curriculum: Geography Program with emphasis on ecology, and the Ecology Program which includes a course on planning and administration of natural resources.

7) Universidade Federal do Maranhao
A Science Program is offered.

8) Universidade Federal de Paraiba
Programs in Science and Agronomy with graduate degrees in Rural Sociology, Soil Conservation and Management and Animal Production are available.

9) Universidade Federal de Pernambuco
There is a Biological Science Program with concentrations at masters level of: Biochemistry, Biophysics, and Physiology.

10) Universidadt Federal do Piaui
a) Centro de Ciencias Agrarias Departamento de Fitotecnia
The Agricultural Technique Program disciplines maintain several ecology courses: General Ecology, Interdependence between humans and the environment, Adaptation of human beings to the environment, Human relations, Ecosystems, Conservation and preservation of the environment, Man and his pollution, and Pollution and its impact on Brazil.
b) The Centro de Ciencias Naturais Departamento de Biologia Discipline realizes these Ecology courses: General Ecology, Plant Ecology, Animal Ecology and Applied Ecology.

11) Universidade Federal do Rio Grande do Norte
The Biological Sciences program courses consist of, Ecology (including applied ecology), Plant ecology and Animal ecology.

12) Universidade Federal Rural de Pernambuco
a) A Fisheries Engineering program is available.
b) Graduate programs in Soil and Water Science, Irrigation and Drainage, Plant Health (phytopathology and entomology) and Botany (morphology, physiology, systematics, evolution, ecology, phytogeography and genetics) are also facilitated.

13) Universidade Federal de Sergipe
Chemical Engineering Program courses in Environmental Science and Civil Engineering Program courses in Environmental Health I, II are study options.

West-Central

1) Fundacao Universidade Federal do Mato Grosso
a) Sanitary Engineering program courses in Environmental Protection and Quality, Water Pollution Control, Atmospheric pollution control, Food Hygiene, Sewage and Water Treatment, and Health problems in Mato Grosso can be taken by students.

b) Environmental Health Technology Program courses include: Basic Sanitation Biology, Environmental Health I, II and Sanitation education.
c) The Biological Capacitation Program facilitated by the Departmento de Ciencias Biologicas, includes courses in: General ecology, Ecology and pollution, Plant ecology, Animal ecology, Botany of the Cerrado, Taxonomy of Angiosperms, Plant Taxonomy, Applied zoology, Zoology, Invertebrate zoology, Vertebrate zoology, Zoology and Parasitology, Entomology, Economic Botony, Organografia e Taxonomia de Talofitos, and Organografia e Taxonomia de Cormogitos.
d) The Forest Engineering Program in the Departamento de Enhenharia Florestal includes courses in forest ecology.

2) Universidade de Brasilia - Distrito Federal
a) Biological Sciences Program courses at the graduate level include: Population Ecology, Co-evolution of insects and plants, Behavioral Ecology, Vertebrate populations, Bioclimatology, Ecophysiology of Animals and Plants, Ornithology, Vegetation and Soils, Populations, Phytosociology, Biomass dynamics, Vegetation description, Human populations, Behavioral ecology and environmental education, Plant taxonomic ecology, Plant ecophysiology and Limnology.
b) The Departamento de Biologia Vegetal includes these concerns in their Biology curriculum: General ecology, Environmental Sciences, Plant ecology, Forest ecology, Ecological methods I, Conservation of Natural Resources, Limnology, and Renewable Natural Resource Management (Masters in Ecology).
c) The Departamento de Biologia Animal facilitates several courses in animal ecology.

3) Universidade Catolica de Goias
Curriculum in the Sciences and Biological Sciences is available to interested students.

4) Universidade Estadual de Mato Grosso
Several courses in Biological Sciences and the Sciences are available.

5) Universidade Federal de Goias
Programs in Agronomy, Biological Sciences and Environmental Health are offered.

D. Southeast

1) Escola Media de Agricultura de Florestal (Minas Gerais) - associated wtih the Universidade Federal de Vicosa
a) Includes a school for technicians in Agriculture and Forestry. Programs are 3 years of study. The only technician-level Natural Resource school in Brazil.
b) Centro de Ensino de Extensao
This center is also associated with the Universidade

Federal de Vicosa. The center offers rural extension and refresher courses from the University.

2) Escola Paulista de Medicina (Sao Paulo)
   a) Biological Science programs are in operation for undergrads.
   b) Graduate level programs include Microbiology and Immunology.
3) Escola Superior de Agricultura "Luiz de Querioz", associated with the Universidade de Sao Paulo
   Programs in Forest Engineering and Agronomy Engineering include these courses: Wildlife Management, Wildland Management, Water Quality, Studies in Forest Ecosystesm, Watershed Management, Forest Ecology, Quantitative Methods in Forest Resource Management, Natural Resource Conservation and Ecology, Ecology of Populations, Plant Ecology, and Forest Ecology.
4) Escola Superior de Agricultura de Lavras (Lavras - Minas Gerais)
   a) Programs in Agronomy, Agronomic Engineering, Zootechnique and Biology are offered.
   b) The Agricultural Engineering program, with courses in: Plant, Water, Soil relationships, Pollution Control in rural areas and Air-photo interpretation, is a major field of study.
   c) Agronomic Engineering program includes classes in Silviculture and General Plant Pathology.
   d) Courses presented by the Soil Conservation program at the graduate level are: Minerology and petrology, Intemperismo de Rochas, Land-use planning and soil conservation, Soil fertility testing methods, Soil, Plant, Water relationships, Fertilizer use technology, Irrigation and Drainage, and Air-photo interpretation applied to soils.
5) Escola Superior de Agronomia de Paraguacu Paulista (Sao Paulo)
   An Agronomy Program is established.
6) Faculdade de Agronomia e Zootecnia Manual Carlos Goncalves (Sao Paulo)
   Programs in Agronomy and Zootechny are available.
7) Faculdade de Educacao, Ciencias e Letras Marechal Castelo Branco (Rio de Janeiro)
   Programs in Physical Sciences and Biological Sciences are available.
8) Faculdade de Zootecnia de Uberaba (Minas Gerais)
   A Zootechny program is established for undergraduates.
9) Fundacao Getulio Vargas (Rio de Janeiro)
   Agricultural development at the graduate level focuses upon the following areas of concentration: Agricultural planning and Brazilian agriculture.
10) Universidade Estadual de Campinas (Sao Paulo)
   a) Programs in Environmental Preservation, Soil Works, and Biological Sciences at the undergraduate level are well developed.

b) At the graduate level, programs in Immunology, Plant Biology, Ecology and Agricultural Engineering are available.

11) Universidade Estadual Paulista "Julio Mesquita Filho" (Cidade de Rio Claro-Sao Paulo)
   a) The Instituto de Biociencias which is associated with the university has developed a Biology program, a Graduate level Biology program, an Ecology program and a Graduate level Ecology program.
   b) The Instituto de Geociencias offers an Agrarian Geography program.

12) Universidade Federal do Espirito Santo
   Programs in Agricultural Engineering and Biological Sciences are developed.

13) Universidade Gama Filho (Rio de Janeiro)
   A Biological Science program is functioning.

14) Universidade Federal de Juiz de Fora (Minas Gerais)
   A Biology program is available for undergraduates.

15) Universidade Federal de Minas Gerais
   a) A Biological Science program is functioning for undergraduates.
   b) Graduate level programs in Biological Sciences, Biochemistry, Morphology, Microbiology, Physiology, Parasitology, Zootechny and Agronomy are available.

16) Universidade Federal do Rio de Janeiro
   Programs offered include an undergraduate degree in biology and graduate courses in: Biological Sciences, Botany, Zoology, Microbiology, Genetics, Biophysics, Nuclear bioscience and Ecology.

17) Universidade Federal Rural do Rio de Janeiro
   a) Programs in Agronomy and Zootechny are offered at an undergraduate level.
   b) Graduate level programs focus principally on Agronomy (Soil sciences).

18) Universidade Federal de Sao Carlos (Sao Paulo)
   a) Biological Sciences programs have been established.
   b) Graduate level programs include: Ecology and Natural Resources, Limnology, Ichthyology, Genetic Ecology.

19) Universidade de Sao Paulo
   a) Programs in Biological Sciences, Forest Engineering and Agricultural Engineering at the undergraduate level are offered.
   b) Graduate Level Programs include: Biochemistry, Biological Oceanography, Physiology, Parasitology, Histology, Botany, Zoology, Biology, Human genetics, Insect genetics, Human and Insect Cytogenetics, Microbiology and Immunology, Soils and plant nutrition, Entomology, Rural Sociology, Agricultural Economics, Animal nutrition and pastures, Forest Engineering - Silviculture, Technology, Environment, Plant Genetics and Improvement, Phytopathology, Phytotechny, Nuclear Energy in Agriculture, Agricultural Microbiology and Agricultural Meteorology.

20) Universidade Federal de Uberlandia (Minas Gerais)
The Forest Engineering program has developed a forestry curriculum.

21) Universidade Federal de Vicosa (Minas Gerais)
a) The Instituto de Ciencias Biologicas has several functioning departments which present natural resource related subjects. These include: The Departamento de Biologia animal with courses in Ichthyology, Limnology and Fish Culture, Forest Entomology and Agriculture and silviculture, the Departamento de Biologia Geral courses, General Ecology, Nature Conservation, Environmental Sciences and Microbial Ecology (Graduate level) and the Departamento de Biologia Vegetal courses, Plant Ecophysiology (Undergraduate and graduate level).
b) Instituto de Ciencias Agrarias
The Departamento de Engenharia Florestal offers curriculum in: Forest Products Technology, Dendrology (Undergraduate and graduate level), Forest Fire Control, Wood Preservation, Natural Resource Policy and Law, Landscaping, Watershed Management, Wildlife Management, Forest Typeology (Graduate level), Remote Sensing (Graduate level) Forestry Planning (Graduate level), Wood Quality (Graduate level), Forestry Research Methodology (Graduate level), Regional Planning of Recreational Areas, Forest Ecology (Undergraduate and graduate levels), Photogrammetry and Photointerpretation, Renewable Natural Resources Photointerpretation, Dendrometry, Forest Inventory, Forest Seed Nurseries, Practical Silviculture, Regional Silviculture, Improved Exotic and Native species culture, Forest Improvement and General Silviculture. The Departamento de Fitotecnia undergraduate level courses include: Weeds and their control, Plant Improvement, Horticulture and Agricultural Ecology. Graduate level courses are: Soil Conservation and Management, Improvement of Large Agricultural Plantings, Vegetable Improvement and Soil-Plant Relationships. The Departamento de Zootecnia sponsors these graduate courses: Animal Improvement I and II and Animal Bioclimatology.

E. South

1) Universidade Estadual de Londrina (Parana)
a) Programs in Agronomy and Biological Sciences are available for undergrads.
b) Food Sciences at the graduate level are offered.

2) Universidade Estadual de Maringa (Parana)
Programs in Agronomy and Zootechny are offered.

3) Universidade Federal do Parana
   a) An undergraduate Biological Sciences program is functioning.
   b) Biological Sciences at the graduate level include course work in: Entomology, master and doctorate level (areas of concentration are Insect Taxonomy, Insect Morphology and Physiology, Ecology and Fauna, and Forest and Agricultural Entomology) and Zoology, master level (areas of concentration are: Protozoology, Helmintology; Carcinology, Malacology, and Marine Biology).
   c) Forest Engineering (graduate level) areas of concentration are: Silviculture, Forest Management and Forest Products Technology.
4) Universidade de Passo Fundo e Pontificia Universidade Catolica do Rio Grande do Sul
   An Agronomy Program at the undergraduate level is functioning.
5) Universidade Federal de Pelotas (Rio Grande do Sul)
   a) Undergrads can choose the option of specializing in programs in Biological Sciences, Agronomy and Rural Engineering.
   b) Graduates are offered courses concentrations in Biological Sciences, Animal Production, Animal Pathology, Plant Improvement, Seed Technology, Temperate Climate Fruit Culture and Vegetable Production.
6) Universidade Federal do Rio Grande do Sul
   a) There are several programs in Biological Sciences and Hydraulic Research at the undergraduate level.
   b) Biological Sciences courses at the graduate level include: Physiology, Biochemistry, Systematic Botany, Ecology and Genetics.
   c) Agronomy (graduate level) courses concentrate on the following topics: Phytotechny, Soils and Zootechny.
   d) A specialization in Rural Economics for graduates is available.
   e) Rural Sociology at the graduate level is also a course possibility.
7) Universidade Federal de Santa Catarina (UFSC)
   The Escola de Agronomia currently provides training in silviculture.
8) Universidade Federal de Santa Maria (Rio Grande do Sul
   a) Programs in Agronomy and Biological Sciences for undergrads is available.
   b) Agricultural Education and Rural Extension at the graduate level is well established.
   c) Masters level agronomy with concentrations in Biodynamics and Soil Productivity is a curriculum option.
   d) Rural Engineering master and doctoral levels, programs include these areas of emphasis: Photointerpretation, Agricultural Hydraulics and Agricultural Mechanization.

e) Zootechny for masters students is also offered.

V. Short Courses and Educational Projects

A) Administration of Renewable Natural Resources (project).
Agency: Centro de Treinamento em Desenvolvimento Economico Regional (CETREDE)
Program goals are to develop and complement the skills and understanding necessary to manage natural resources. This exercise is primarily for upper-level professionals in agronomy, geology, geography, engineering and natural sciences. Several basic objectives of the course include: familiarize participants with modern systems of evaluation and management of projects that use plant or animal raw materials; teach participants the necessary tools for evaluation, conservation and preservation of natural resources; create consciousness of the importance that wise natural resource administration has for social welfare and improve behavioral traits for team participation in projects.

B) Applied Ecology and Environmental Protection course
Agency: (CETESB)

C) Bird Banding short course
Agency: Instituto Brasileiro de Desenvolvimento Florestal (IBDF) through its Centro de Estudos de Migracoes de Aves (CEMAVE)
The Program is offered twice yearly. A staff of 5 facilitate the course. An average of 16 persons participate in each course.

D) CETESB offers continuing education courses to update and upgrade technically trained personnel.
Agency: Superintendencia de Treinamento e Informatica in ECTESB

1) Courses programmed for the first trimester of 1980 include: Water, Water Pollution Control, Ecology, Materials Quality Control and others (Business licensing systems for pollution control).
2) Courses programmed for the second trimester of 1980 include: Legislation concerning Environmental Pollution (Level: Superior), Routine Analysis of Sewage Treatment Stations (Level: Middle), Paper Industry Wastewater Treatment (Level: Superior), Physical, Chemical and Biological Analysis: their importance and significance (Level: Superior), Multiple Tube Bacteriological Exam (Level: Middle), Corrosion and its Control (Level: Superior), Galvanoplastic Industry Wastewater Treatment (Level: Superior), Urban Drainage (Level: Superior), Small Dam Projects (Level: Superior), Sample Collection (Level: Middle) Basic Course in Acoustics (Level: Superior), Food Industry Wastewater Treatment (Level: Superior), Floculation Trials, Introduction to Industrial Wastewater Treatment (Level: Superior), Bacteriological Exams with Filtration Membrane (Level: Middle), and Pool Operator (Level: Middle).

E) Centro de Recursos Hidricos e Ecologia Aplicade, do Departamento de Hidraulica e Saneamento, da Escola de Engenharia de Sao Carlos, U.S.P.

Research goals focus upon research and on training and professional specialization in the field of water resources and applied ecology. Courses include: Meteorology, Hydrology, Hydraulics and Fluid Mechanics, Hydrobiology, Sanitary Chemistry and Technology of Water Supply and Wastewater in General.

F) FEEMA - Fundacao Estaudual de Engenharia do Meio Ambiente
Program: FEEMA offers courses throughout the year including the following:
Ecology for teachers (Level: Middle), Animal Ecology (Level: Superior), Pool Operator (Level: Technician) Epidemiology and Prophylaxis of Water Carried Diseas (Level: Superior), Limpeza de Caixa Dagua (Level: Middle), Applied Biology in Sewage Treatment (Level: Superior), Sewage Treatment Plant Operator (Level: Middle) Emergency Chlorination (Level: Middle), Sewage Treatment (Characteristics of preliminary and primary sewage treatment) (Level: Superior), Water Treatment Station Operator (Level: Middle), Disinfection of Water Supply and Wastewater (Level: Superior), Industrial Waste Treatment (Level: Middle), Ecology in Daily Life (Level: Middle), Human Ecology (Level: Superior), Hidraulica de Canais em Regime Permanente (Level: Superior), Operator de Desratizacao e Desinfetizacao (Level: Middle), Photointerpretation (Level: Superior), Agricultural Ecology, Soil Ecology (Level: Superior), Rodent Control (Level: Middle), Fluoridation (Level: Superior), Urban Sanitation (Levels: Middle/Superior), Methodology for Raising Animal Populations (Level: Superior), Physical and Chemical Water Analysis (Level: Superior), and Air Pollution (Level: Superior).

G) Projecto Integrado de Educacao Ambiental na Cidade Satelite da Ceilandia - Distrito Federal
Agency: Fundacao Educacional/Secretaria de Educacao e Cultura do Distrito Federal
The major goals are to promote dynamic and permanent educational tools and processes to develop the interest and participation of students, professors, and through extension of the community, in the improvement of Ceilandias city environment. Objectives are to provide the opportunity to the educational community of Ceilandia (three school complexes) to learn new attitudes and form necessary new habits favorable to the physical and social environment of Ceilandia and to promote activities that favor the social-cultural development of people that are involved in the educational community of Ceilandia.

H) Public Sanitation - Correspondence course.
Agency: Companhia Estadual de Technologia de Saneamento Basico e de Defesa do Meio Ambiente (CETESB)
This program focuses upon public sanitation activities

solid waste disposal, compaction of dirt and other wastes, internal transport and storage, regular collection, private per job collection, special collections, transport and street sweeping.

I) Rural Work and Alternative Educational Methodologies.
Agencies: Centro de Pos-Graduacao em Desenvolviments Agricola (CPDA/EIAP/FGV) and the Instituto de Estudos Avancados em Educacao (IESAE/FGV) are developing the research project with SENAR and Ministerio do Trabalho. The major objectives of these courses include analysis of the evolution of Brazilian agriculture, with special attention to the labor market, and analysis of programs in professional training for the rural environment and the community work programs.

J) Sanitary Sewer Systems course
Agency: (CETESB)

K) Water Pollution Control course
Agency: (CETESB)

L) Water Pollution (Course and Seminar)
Agency: Cooperacao Tecnica Brazil - Alemana (RFA)
This course is for technical professionals in need of a basic course in the field. Practical and theoretical elements are included. A Seminar offered simultaneously is designed for interchange of ideas and group discussion.

VI. Seminars, Meetings, Symposiums, Debates, Congresses, etc.

A) I Ciclo de Palestras Sobre Ecologia.
Agency: Instituto de Ciencias Biologicas, Decanato de Extensao - Universidade de Brasilia.
The debate included speeches on the following themes: Ecological Problems in Brazil, Pesticides, Plankton, Endangered Aquatic Species in the Federal District, Applied Ecology in Agriculture, Soil/Plant Relationships in the Cerrado, Natural Resource Protection, Urban Ecology, Environmental Protection Legislation, Brazil's Agricultural Development and its Effect on the Ecology, Behavioral Ecology of Animals, Human Ecology and Sociobiology, and Labor Market for Ecologists in Brazil.

B) Conferencia Nacional do Meio Ambiente.
Agency: Associacao Brasileira de Prevencao a Poluicao do Ar in collaboration with Prefeitura Municipal de Cubatao. Dates: 10/29 to 11/1/75.
The conference included speeches and panel discussions on the following topics: Technology and the Environment, Man and the Environment, Economy and Ecology, Environmental Protection Legislation, Environmental Human Resources, and Health and the Evnironment.

C) 2a Conferencia Nacional do Meio Ambiente.
Agencies: Associacao Brasileira de Prevencao a Poluicao do Ar, Prefeitura Municipal de Sao Jose dos Campos. In collaboration with Instituto

Nacional de Pesquisas Espaciais, Instituto Tecnologico de Aeronautica, Centro Tecnico Aeroespacial. Date: March, 1977.

The conference included speeches on the following themes: Environmental Pollution Control, Marine and Estuarine Pollution, Brazil's Forest Situation, Pollution and Health, Pesticides and the Environment, Land Planning and Environmental Protection, Solid Waste and Environmental Protection, Noise Pollution, Ethanol as Alternative Energy, Solar Energy, Nuclear Energy, Hydrogen as a Fuel, and Environmental Aspects of Energy Production.

D) XXX Congresso de Botanica e
XXXI Congresso de Botanica

Included on the program was the following theme: National Parks and Reserves: History, Creation of the Brazilian Conservation Unit System and Classification Categories for Units in the System.

E) I Encontro Nordestino de Ecologia
Agency: Instituto de Ciencias Biologicas, Decanato de Extensao - Universidade de Brasilia. Date: 1979.

The Meeting included speeches on the following themes: Methods for Ecological Research, Education and Nature Conservation, Alternate Technology for the Northeast, Principal Ecosystems of the Northeast and Desertification, Flora Project of the Northeast, Biological Control of Insects, Water Use, Non-polluting Energy Sources for the Northeast, Dunes, Social Aspects of Ecosystem Management in Arid and Semi-Arid Zones, Coastal Ecosystems and their Human Settlements, Coastal Lagoons, Environmental Preservation in the Northeast, Methodology to Create a Biological Reserve, and Caatinga as a Climatic Climax.

F) Encontro Regional sobre Conservacao da Fauna e Recursos Faunisticos.
Date: 3/21 to 3/22/77
Site: Recife - Pernambuco.

G) I Encontro Regional de Preservacao e Conservacao aos Recursos Naturais Renovaveis.
Date: 1977.

H) Filmes de Curta Metragem - Coloridos.
Agency: Convenio SEMA/[illegible]

The color movie sh[illegible] veloped under this agreement include the following [illegible]: A Poluicao dos Rios e Lagos, A Poluicao Marinha, A Poluicao Atmosferica, A Poluicao Sonora, Pesticidas, Sua Utilidade e seus Riscos, Residuos Solidos das Cidades, Especies Raras de Fauna Brasileira, Estacoes Ecologicas, Parques Nacionais e Outras Reservas, A Vida Aquatica and Aves do Pantanal.

I) O Rio Cuiaba estara Ameacado de Morte? Seminario Realizado na Universidade Federal de Mato Grosso.
Agency: Departamento de Engenharia Sanitiria of the Universidade Federal de Mato Grosso (UFMT).
Date: 6/4 to 6/8/79.

J) Semana da Biologia Vegetal.
Agency: Departamento de Biologia Vegetal of the Instituto de Ciencias Biologicas in the Fundacao Universidade de Brasilia. Date: 4/14 to 4/18/80.

K) Seminario Sobre Educacao Ambiental.
The objective of this seminar was to furnish background information for guidelines on Brazil's environmental education program.

L) Seminarios I, II, III, e IV sobre Estudos Biologicas.
Agency: Departamento de Biologia (UFMT). Dates: Annually since 1976.

M) Seminario sobre "Efeitos de Grandes Represas no Meio Ambiente e no Desenvolvimento Regional". Date: 1978.

N) Seminario sobre Paisagismo Rodoviario. Date: 1977.

O) I and II Seminarios sobre a Semana da Arvore.
Agency: Departamento de Engenharia Florestal de UFMT.
Dates: September of 1978 and 1979.

P) I Simposio Nacional de Ecologia. Date: 9/26 to 9/29/78.
Site: Curitiba
The simposium focused upon conservation units.

Q) Simposio sobre Parques Nacionales e Reservas Equivalentes na XXVII Reuniao Anual da Sociedade Brasileira para o Progresso da Ciencia. Date: 1975.

B. Environmental and Natural Resource Agencies

VII. Communication Media

A) Codigo Florestal
Law 4771 of September 15, 1965, Article 42, Paragraph 1: Radio and Television are obligated to include in their programming, texts and programs pertaining to forests approved by the competent agency, a minimum of five minutes weekly on different days.

B) Protecao a Fauna
Law 5197 of January 3, 1967, Article 35, Paragraph 2: Television and Radio programming must include texts and programs approved by the competent federal agency, for a minimum of five minutes, weekly, spread throughout the week.

VIII. Environmental Policy Documents

A) Agency: Fundacao Brasileira para a conservacao de Natureza.
Enforces the teaching of Ecology and Natural Resource Conservation at the superior level.

B) Camara dos Deputados.
Discusses the obligation to teach a course in Human Ecology at the primary and secondary level.

C) Departamento de Ensino Fundamental do Ministerio de Educacao e Cultura.
Includes recommendations on the selection of educational books for primary schools, based on their consideration of wise natural resource management values.

D) Fundacao Brasileira para Conservacao de Natureza.
Suggests that Ecology and Natural Resource Conservation be obligatory in school curriculums as the Codigo and Fauna Protection Law dictate (have never been implemented).

E) Ministerio de Educacao e Cultura and the Ministerio do Interior.
Subject matter covers protocol agreed upon for Ecological research and teaching at all levels, to reflect National Environmental Policy.

F) Secretaria Especial do Meio Ambiente (SEMA).
This document includes general rules for utilization of Ecological Stations of SEMA.

IX. Proposals Submitted

A) Agency: Comissao Mista MEC/MINTER
Two proposals to this Ministry relate to various activities to commemorate the Week of the Environment and a proposal to the DAU/MEC Ministerio de Educacao e Cultura to implement a national environmental human resource program.

B) Agency: Companhia de Tecnologia e Saneamento Ambiental (Superintendencia d Treinamento).
The objective of this proposal is to assist in teaching 17 seminar themes on basic concepts of Ecology. These include: Population Growth, Concept of Biosphere, Energy Flow in the Biosphere, Concept of Environment, Producer Organisms - Basic needs for survival, Producer Organisms - Primary Productivity, Renewable Resources - decomposition, Concepts of Recycling, Basic Needs for Survival, Food Chains, Concept of Ecosystem, Biogeochemical cycle, Availability of Mineral Resources, Principles of Natural Terrestrial Environments, Principles of Natural Fresh Water Environments, Principles of Natural Marine Environments, Pollution and Principles of Nature Conservation.

C) Agency: MEC/SEMA
The following themes have been suggested for seminar themes: Marine, River and Lake Pollution, Noise and Atmospheric Pollution, Pesticides: their utility and risks, Solid waste, Rare Brazilian Fauna Species, Natural Reserves, Botanical Garden in Rio de Janeiro, Aquatic Life and Life of the Pantanal.

D) Agency: PUC/EMMA
The subject: O Ensino de Ciencias Atraves da Tecnica de Projetos (a textbook) would have as its objectives: to orient professors in the use of project techniques involving scientific work in the classroom as well as the field, and to provide students their own research projects to learn techniques.

E) Agency: Secretaria de Educacao e Cultura - Estado do Rio Grande do Sol.
This project would strive to encourage schools to utilize sites as a natural classroom through reforestation and preservation of the natural environment.

APPENDIX IG

REGIONAL TRAINING PROJECT SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES WITH INTERNATIONAL ORGANIZATIONS. REGIONAL ORGANIZATIONS AND PRIVATE ORGANIZATIONS

I. International Organizations

A. United Nations Development Program (UNDP)

1. UNDP has a major policy commitment to education and training as an integral part of its development projects. UNDP is attempting to decentralize, thus training policy will be implemented through a number of centers. The average training component of each project ranges from 6-10%. Training can be fellowships and counterparts, the first being narrowly defined to cover specific project needs, the second is the most widely used. The Food and Agriculture Organization is the executing agency for most renewable resource development projects. Personnel are selected for communication skills as well as technical ability.
2. UNDP has enacted a new policy that dictates that a major portion of its budget should go to the poorest countries. The 1982-86 budget plan for the western hemisphere, however, includes only Haiti.
3. UNDP projects for 1974-1983 in Forestry number 46, in fisheries 39, land and water 53. This totals 138 with a combined budget of $69,395,996 of which 5.4% was for training.

B. World Bank

1. Bank policy is to fund the construction and renovation of schools and to finance pilot projects in education. Very little has been done, however, in education concerning environmental issues.

   Since 1974 the Bank has been lending money for environmental projects. In 1980 the Bank signed a Declaration of Environmental Principles with other development banks. The range of projects includes forestry, desertification, soil and water conservation, range management, environmental pollution, and wildlife protection. Training is still a very small component in these projects.
2. Economic Development Institute

   This is the World Bank's training center for economic development. Environmental short courses, workshops, and

seminars have been introduced into the curriculum. Most of the courses deal with the subjects of agriculture and development.

3. Forestry Program

The Forestry Sector Policy Paper prepared by the World Bank in 1978 stated that the major contribution of forestry to development would be from rural and environmental forestry and institution-building projects involving training, education, and forestry research with emphasis on agroforestry.

Funding under this new policy is expected to reach $100 million by 1983. Little money has gone to Latin America, however, because this has traditionally been the area serviced by the Inter-American Development Bank. An exception is the Bank's contribution to the Consultive Group on International Agriculture. CIAT receives $600,000 and CIMMYT receives $800,000. These regional centers provide a significant training service for the transfer of agricultural technology.

II. Regional Organizations

A. Pan American Health Organization (PAHO)

The Pan American Health Organization has an active environmental health program which includes potable water, pollution control, and waste management.

1. Pan American Center for Human Ecology and Health (ECO) in Mexico City:

A principal duty of ECO is to assess the impacts of large development projects on human health. No formal training program exists but ECO cooperates with other institutions and governments to design and conduct courses, lectures, seminars, and short courses related to human ecology and environmental health. ECO maintains an information service with current publications, journals, and unpublished documents and reports.

2. Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) in Lima.

CEPIS provides technical cooperation in pollution control, industrial hygiene and occupational health, and water treatment. Recent emphasis has been on education, research, and information exchange.

Through CEPIS, PAHO was involved in a large Peruvian project in 1978 improving water and sanitation systems. Part of the project was to develop materials, concepts, and strategies for training to be used throughout Latin America.

3. Latin American Program for Educational Development for Health (PLADES)

Created by PAHO in 1976 with a grant from the Kellog Foundation was begun with the Nuclei of Research and Development in Education and Health (NIDES). Short courses and seminars on environmental science subjects were developed to bring together people from teaching and service institutions.

4. Latin American Center for Educational Technology in Health (CLATES) in Rio de Janeiro.

   Courses organized by CLATES are designed to improve teaching and instructor training. The educational resource sector prepares programs, videotapes, and filmstrips.

   CLATES/Mexico City prepares and distributes teaching and reference materials dealing with basic and continuing education.

5. Fellowships

   PAHO awarded 1,249 fellowships in 1979 covering, in descending order: public health administration, communicable diseases, health services, medical education, sanitation, clinical medicine.

6. Institutional Development

   PAHO has identified 12 institutions in the region which will become part of a cooperative system for health education and training. Twenty two environmental health profiles have been prepared to help nations in the region assess preparedness for the 1980's. Donor agencies can use this information to establish priorities and levels of external support.

   PAHO has also aided in: the integration of water supply and sanitation considerations into national environmental health programs; infrastructure development to provide water, sanitation, and health services; consulting for specific institutional development problems; strengthening health administration training programs; promoting the continuing education of health administrators by supporting regional seminars; and encouraging the integration of training programs with health care facilities.

B. Organization of American States (OAS)

1. Training in natural resource management is a valued aspect of the OAS regional development program. Approximately $300,000 is spent annually on training, $220,000 of this goes to two OAS training centers, CIDIAT and CINDER.

   In 1979 the Regional Development Program trained 300 professionals in the course of development assistance projects. These projects include river basin development, highways, ports, agriculture, fisheries, forestry and irrigation.

   There is no OAS policy requiring training in any development project. Many times money allocated for training is diverted into technical assistance by the countries involved.

2. Centro Interamericano para Desarrollo Integrado de Aquas y Tierras (CIDIAT). Merida, Venezuela

   a) The primary emphasis of this institute originally was on development of water resources for agriculture. Current curriculum also includes Fauna

Management, Remote Sensing and Photo Interpretation, Reforestation, Ecological Systems, and Development Planning of Renewable Natural Resources.

Thirty six courses at the professional level are given annually with 30 trainees in each. Over 100 applications are received per course. OAS sponsors 6 short-course scholarships and 25 longer 18-month scholarships.

b) The Board of Directors of CIDIAT is composed of representatives from the OAS, the Venezuelan Ministry of Environment, Venezuelan Ministry of Planning and the Universidad de Los Andes. Today the Venezuelans operate the center and use it to train all their own professionals for the Ministry of Environment, and the OAS involvement is limited to an Inter-American Training Program funded jointly by Venezuela and the OAS.

Current plans at OAS are to turn the CIDIAT program into one which will provide trainers and graduates who can visit national agencies and evaluate their in-house training capability.

3. Centro Interamericano para Desarrollo Regional (CINDER) Maracaibo Venezuela

a) CINDER was established in 1976 as a training center for regional development. This was the result of a proposal to the OAS by CORPOZULIA, a semi-private regional development corporation, which planned to send its people there for training. CINDER was established with three supporting institutions; CORPOZULIA, Zulia University, and the Venezuelan National Planning Board, which spends approximately a quarter of a million dollars a year on it. The center has not developed as well as was expected because of conflicting philosophies of the supporting institutions.

b) Courses are 6 months duration, for 25-28 students per year of which 5-8 are Venezuelan. Curriculum level is oriented for project managers. Course content includes: Fundamentals of Planning, Regional Analysis Techniques, and Implementation of Regional Development. OAS is integrating one week of environmental considerations and principles for sustainable development into the course at the present time and would like to increase the scale of environmental considerations.

c) CINDER also sends instructors to other countries with the duration and subject matter dependent on the host institution. Generally these courses lack an environmental component but it would be easily facilitated if given the financial resources.

4. Fellowships

a) OAS Office of Traineeships and Fellowships issued 61 fellowships in 1979. 41 of which were in natural

resource management with the remainder in agricultural irrigation techniques.

b) OAS Programa Regular de Adiestramiento provides full scholarships to study or conduct research in a degree program in another OAS country. Of 484 scholarships granted in 1979, 74 of these were in natural resources, agriculture, general biology and ecology. The level is post-graduate.

c) OAS Programa Especial para Capacitacion provides travel scholarships for students where tuition is being paid by other sources.

5. Pasentilla (Travel-Study) is a small program under the OAS Regional Development Program. It supports individuals to travel with an objective closely related to a specific technical assistance project.

6. OAS Regional Educational Development Program (PREDE)

a) The objectives of PREDE are to: improve the curriculum and teaching methods and materials; develop school and university libraries; transfer educational technology; technical education; and prepare and disseminate educational and informational material.

7. Inter-American Institute of Agricultural Sciences (IICA) is a specialized organization of the OAS for agriculture. Responsibilities include research on the transfer of agricultural technology, production, and administration of agrarian policy, in addition to other topics of rural development.

C. Inter-American Development Bank

1. Bank policy is to respond to country requests rather than to attempt to shape programs as the World Bank does. The Bank is a signer of the Declaration of Environmental Principles, but has not promoted training, nor does it have an in-house environmental division.

2. The Agricultural Economics Section has developed a major proposal for forestry development on Latin America, but the proposal has generated a considerable amount of controversy. It attempts to expand the traditional concept of commercial forestry to include rural development and environmental forestry.

III. Private Organizations

A. Rockefeller Foundation

1. The Foundation supports the Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia, through its contributions to the Consultative Group on International Agriculture, amounting to $300,000 annually. CIAT is dedicated to developing improved technologies and production methods for beef, beans, cassava, and rice.

Training is a basic part of all CIAT programs, usually involving post-graduate researchers. Short courses for ministry and institutional personnel are also offered.

2. The Foundation supports the Centro Internacional de Mejoramento de Maize y Trigo (CIMMYT) in El Baton, Mexico. A contribution of $400,000 is channeled through the Consultative Group on International Agriculture annually.

   CIMMYT's mandate is maize and wheat improvement in collaboration with cooperating national programs. Training includes in-service programs in Mexico, masters programs at U.S. universities, and supervised doctoral research in Mexico. Post-doctoral fellows and visiting professors augment the CIMMYT staff.

3. The Foundation's Education for Development program has been focusing on strengthening agricultural teaching and training efforts, but the program could be expanded to include the management of natural resources to sustain agriculture.

4. Specific grants by the Foundation support agricultural research projects, some of which have training components.

5. Post-graduate fellowships are awarded by the Foundation, but since 1979, none have gone for studies in the natural or environmental sciences.

6. The Foundation sponsors conferences at various centers around the world. CIAT celebrated a conference on sustainable agriculture and land use in the Amazon region. CATIE will host a conference this year to survey the needs for agricultural research and development. In 1979 a conference examined manpower needs for agricultural development, including an evaluation of training capabilities.

B. Sierra Club International Program

The Sierra Club International Program has been active in tropical rainforests and marine environments. Current emphasis is on information exchange. A directory of current sources of environmental training available in the U.S. was recently prepared for USAID.

The Earthcare Network was established in 1979 to provide an international clearing house of information sources with specialized data collections of ecological and resource management materials. A major goal of Earthcare is the training and educational aspect. Films, fact sheets, slide programs, and pamphlets are envisioned.

C. New York Botanical Garden (NYBG)

The New York Botanical Garden trains botanists and aids in institution building in Latin America through counter-part programs, fellowships, publications, and through the loan of staff to national institutions, primarily universities and herbaria.

D. Rockefeller Brothers Fund (RBF)

The Rockefeller Brothers Fund has pioneered in the support of wildland management in the region. The first project was under the auspices of FAO in Chile, emphasizing wildland planning, management, research and experimentation. Training was an integral part of this project.

The Wildland and Watershed Management Unit at CATIE is supported by RBF and provides training and research opportunities in wildland planning and management.

RBF supported the Caribbean Conservation Association and began the Eastern Caribbean Natural Areas Management Program, serving the Lesser Antilles. Planning, workshops, seminars, educational materials and experimental projects are included in its programs.

The Strategic Management of Wildland Resources for Ecodevelopment project involves a partnership of SNR/UM, CCA, CATIE, and WWF, with core financial support from RBF. Ecodevelopment will be the central theme of RBF environmental management assistance for the next several years.

E. World Wildlife Fund (WWF)

The WWF funds short-term training visits on an *ad hoc* basis where specific skills can be transferred relevant to WWF projects. Latin American participants receive up to 4 fellowships annually to attend the International Seminar on National Parks. WWF aids participants in the Central American Seminar on Wildland Management at CATIE. Counterpart training of local professionals is also funded in conjunction with WWF projects in a country.

F. Missouri Botanical Garden (MBG)

1. The MBG has a staff member working on the flora of Nicaragua and setting up an herbarium, with the research supported by the Banco Central de Nicaragua.

   MBG has committed a staff member to work on a flora of Bolivia project and aids Bolivians in setting up herbariums, including some botanical training.

2. MBG organizes and supports occasional symposia on tropical botany.

3. MBG does not have fellowships for study, though its staff members sit on the admissions committee at both Washington University and St. Louis University. They have trained three Latins who have studied at these universities under supervision of MBG staff

G. Natural Resources Defense Council (NRDC)

The NRDC international project is active in tropical forestry issues. They are developing policy papers for IUCN on this subject. NRDC under contract from International Institute for Environment and Development, wrote A Study of the Environmental Policies, Procedures, and Performance of USAID. They have no training role currently but would like to work with AID to assist development of NGO's in LDC's.

H. The Nacure Conservancy

The Nature Conservancy International Program has assisted some private NGO's in a few countries in acquiring the Nature Conservancy Natural Heritage Inventory Program. They are currently selecting a Latin American field officer for the first time. Besides their inventory program, the Conservancy could offer training in fund-raising for land purchases and other land acquisition techniques.

APPENDIX I-H

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES
WITH CENTRO INTERNACIONAL DE FORMACION
EN CIENCIAS AMBIENTALES
(CIFCA)

A. Introduction:

CIFCA was created in 1976 as a joint effort between the United Nations Environment Program (UNEP) and the country of Spain. Interdisciplinary training of professionals directly or indirectly involved in environmental issues is the principal objective of the Center. Courses generally deal with some aspect of development and its relation to the natural environment. Although based in Spain, activities are generally related to Latin American countries with plans being formulated to either: 1) open a regional office or offices in Latin America, or 2) move the entire base of operations to Latin America.

CIFCA has already sponsored or collaborated on some 60 courses involving over 2000 students. Funding for these activities comes from the Government of Spain (60%) and UNEP (40%). Nations cooperating or hosting seminars are expected to provide at least half of the local expenses. Approximately 30 courses have been held in Spain while the rest were in Latin America. However, because of high transportation costs for participants and the fact that Latin American environmental problems are distinctly different from those of Spain, plans are being developed to shift the locus of most future activities to Latin America.

CIFCA has as its principal objectives:

1) Promote the training of professionals involved in environmental affairs.

2) Cooperate with national institutions in the formation of an international network of courses dealing with, bioecology, sociocultural matters and socioeconomics.

3) Promote the development of cooperative programs between institutions dealing with environmental management.

4) Prepare and distribute information related to environmental sciences.

5. Assist governments and institutions that solicit aid in developing trained personnel in environmental sciences.

B. Structure and Programs

CIFCA is administered by a director and assistant director - both chosen by UNEP and the Government of Spain, and a Technical Committee made up of 12 representatives from member nations.

Programs are structured in the following manner:

1) Program of Basic Courses.

CIFCA organizes and carries out several interdisciplinary courses related to environmental management and development. These are generally directed at professionals or decision makers involved in some aspect of development or environmental protection. Courses for professionals usually last for 2 or 3 months and those for high level officials 2 or 3 weeks.

2) Program of Special Courses.

These 1 to 4 week seminars promote the exchange of information and experience between professionals involved in particular aspects of environmental management.

3) Information and Communication Programs.

CIFCA is continually collecting data and information which is being disseminated and transferred to those agencies and individuals in need of such knowledge. A special library and publication of several bibliographies on relevant topics have been organized. Also, notebooks containing presentations given during seminars as well as textbooks have been printed.

4) Consulting Services

The Center offers its assistance to institutions seeking to develop personnel trained in environmental affairs.

5) Program for Higher Education.

They have cooperated in identifying needs and developing programs for higher education related to environmental studies.

6) Program of Institutional Relations

CIFCA has as one of its primary goals the development of a regional network of institutions and organizations cooperating on pertinent environmental issues.

C. CIFCA Programming for 1980 and 1981.

In July of 1980 the Director of CIFCA solicited course suggestions from member countries as well as consent to organize joint seminars and courses. The information received (included below) was utilized in formulating the Center's 1981 course program.

Suggested courses by country include:

1) Venezuela - ODEPRI and CIDIAT
   a) Environmental Planning
   b) Environmental Law
   c) Environmental Education
   d) Environmental Impact Study
   e) Appropriate Technology
   f) Energy and the Environment

2) Chile
   a) Environmental Health and National and Regional Planning

3) Central America - ICAP
   a) Watershed Management
   b) Use of Humid Tropical Soils
   c) Regional Planning
   d) Water Pollution
   e) Social Communication and the Environment
   f) Using Biomass for Energy Production
   g) Planning of National Parks and Equivalent Reserves
   h) Environmental Interpretation in National Parks
   i) Public Administration and Environmental Affairs

4) Brazil - IPEA
   a) The Environmental Aspects of Development Planning
   b) The Environmental Dimension of Development Plans

5) Argentina
   a) Expansion of the Agricultural Frontier and Its Environmental Impact
   b) Environmental Impact of Large Construction Projects

6) Mexico - CECODES
   a) Ecology and Development
   b) Hydrocarbons and the Environment
   c) The Politics of Tropical Latinamerican Colonization

7) Dominican Republic
   a) Planning and Management of National Parks

8) Peru - ODEPRI
   a) Environmental Impacts on Humid Tropical Ecosystems
   b) Environmental Impacts on High Mountain Ecosystems.

9) Panama
   a) Administration, Management and Conservation of Watersheds
   b) Design of Scientifically-Oriented Policies
   c) Hydrology
   d) Aquaculture - Cultivation of Lobsters in a Controlled Environment

e) Water Conservation
f) Monitoring Sub-surface Waters
g) Environmental Legislation
h) Occupational Health
i) Environmental Technology

Based upon these and other suggestions for CIFCA courses, the following subjects have been tentatively chosen by the Center for development as seminars or workshops during 1981:

a) Environment and Development - February 2, (3 months)
b) Evaluation of Environmental Impact - March 9, (15 days)
c) Tourism and the Environment - March 30, (15 days)
d) Land-use Management - April 20, (7 days).
e) Forest Resources - May 11, (10 days)
f) Economics and the Environment - May 11, (15 days)
g) Environment and Development - June 8, (3 months)
h) Environmental Training - June 15, (15 days)
i) Scientific Documentation and Social Communication Related to the Environment - June 15 (7 days)
j) Ecological Planning of Human Settlements - July 13, (15 days)
k) Environmental Impact - July 20, (15 days)
l) Agrarian Civilization and the Environment - August 3 (7 days)
m) The Environment and Development - September 7 (3 months)
n) Environmental Impact - September 21, (15 days)
o) Energy (hydrocarbons) - September 21, (15 days
p) Socio-Economic Criteria in Relation to Environmental Problems - November 9 (7 days)
q) The Environmental Dimension of Development - November 9 (3 weeks)
r) Natural Spaces and Biosphere Reserves - December 7, (7 days)

APPENDIX I-I

REGIONAL TRAINING PROJECT
SUMMARY

EXISTING AND PLANNED TRAINING OPPORTUNITIES
WITH UNITED STATES GOVERNMENT AGENCIES

I. U.S. Department of Interior

A. U.S. Fish and Wildlife Service (USFWS)

1. The USFWS has a small international office under the Deputy Director. Staff is made up of three professionals plus a director. One professional is the Latin American coordinator. This office responds to Congressional or International Treaty mandates.

Although there is no annual training program for foreign personnel some training activities are realized:

a) USFWS specialists involved in temporary duty in other countries include counterpart training in their projects. The criteria for facilitating a request for a specialist to work in Latin America and the Caribbean are:

i) It must have a good training potential with qualified counterparts;

ii) It is best if the requesting country has signed the Western Hemisphere Convention.

b) Personnel from other countries receive specialized training at USFWS facilities. Currently this training is on an individual basis, though the Latin American coordinator would like to expand this program to include mobile courses for a small number of professionals. Most of the projects this office coordinates are funded by other branches of USFWS, AID or the requesting government.

2. The USFWS has one of the best qualified assemblages of tropical biologists in the world. Most of them are working out of the Smithsonian Institute. These USFWS employees can be tapped for use in training in their respective fields. One of these biologists has proposed an Amazonian Scientific Research Station that would include a strong training element for up to 30 students at a time. The station is proposed for Yasuni National Park in the Ecuadorian Amazon. Its objectives are three-fold:

a) To improve knowledge and technology for the rational use and development of the renewable natural resources, especially the wildlife of Amazonian Ecuador.

b) Conduct scientific and technical training programs on renewable natural resources of this region for professionals and technicians from Ecuador and other Amazonian countries, and carry out public education programs.
c) Support programs and projects of pure and applied scientific research in the use of renewable natural resources. These will be supported and conducted by qualified personnel from other countries who have an interest in improving their knowledge of tropical biology and cooperating in the rational development of Amazonia.

This project is currently only on paper and there is no firm funding from the U.S. Ecuadorians support it, and have agreed to help finance it but the bulk of a proposed budget of three million dollars is still lacking.

3. The "International Wildlife Resources Conservation Act of 1980" is a bill introduced in the U.S. Senate March 5 of 1980, the same day the World Conservation Strategy of IUCN was officially presented to the world governments. This bill, if passed, would provide for:
a) An International Wildlife Conservation Corps, in which U.S. experts working within the federal, state or private wildlife conservation entities could be identified and made available to other nations to assist them in developing programs, systems, institutions or other means of improving their capability to manage their wildlife and habitat resources;
b) The establishment of a system to provide selected foreign nationals formal, problem-oriented or "on-the-job" type training opportunities in the field of wildlife resource conservation and administration in the U.S. or elsewhere;
c) The establishment of a small group (not more than 10) of "Regional Wildlife Resource Attachees" to be stationed in our embassies abroad to help ensure that actions taken by the U.S. government which may affect the conservation or utilization of wildlife and habitat are based upon the best information available;
d) The establishment of an "Advisory Council on International Wildlife Conservation Policy" comprised of representatives of appropriate federal agencies, the National Science Foundation, the States, and the public which would coordinate activities that may effect the attainment of the purposes of this Bill and report to the Congress on: geographic and subject areas to be given priority under the Bill; progress and problems in implementation of the Bill and other relevant matters.
e) The Bill also authorizes the use of U.S. owned, excess foreign currencies for wildlife conservation purposes, and the appropriation of $7,000,000 per year to implement the Act.

f) The Secretary of the Interior, acting through the Fish and Wildlife Service, in consultation and cooperation with the Secretary of State, would be responsible for implementation of the Act.

B. U.S. National Park Service (USNPS)

1. The USNPS operates the International Park Affairs Division, in the Office of Cooperative Activities. Within the Division are the following technical programs which relate to training.

a) The International Seminar on National Parks and Equivalent Reserves is designed for senior level professionals responsible for protected areas (generally national parks or refuges). It is a mobile seminar which visits specific U.S. and Canadian parks and refuges. Expertise on specific kinds of management problems in these areas is the focus of the workshop. It is jointly offered by the School of Natural Resources of the University of Michigan, the USNPS and Parks Canada. There are 36 participants per year, all expenses are covered by the participants or their sponsors. The costs for the 30 day seminar per student are about $2000, exclusive of travel to and from the seminar. There have been 448 participants from 88 countries over the last 14 years.

b) The Western Hemisphere Activities Program coordinates requests for training from Western Hemisphere countries.

i) The training of foreign personnel in USNPS units or facilities is initiated in this office and further facilitated through the bi/multilateral program management and coordination office.

ii) In fiscal year 1980 USNPS personnel participated in twenty-three projects in western hemisphere countries with a total personnel commitment of 300 person weeks. These projects range from strategic planning and high level policy consultancies, to interpretive planning, to legal aspects of wildlands management. Training of counterparts is a significant output of these bilateral technical assistance projects. Training is an expressly identified objective in eight of the projects. Authority for these international activities comes from either the Endangered Species Act, the Western Hemisphere Convention and Executive Order 11911 or the Foreign Assistance Act (AID). Funding is generally shared between the foreign national government, USNPS, and other donors such as AID, WWF, IUCN, CATIE, OTS, etc.

c) The Bi/Multilateral Program Management and Coordination unit is responsible for P L. 480 projects, bilateral agreements and exchanges, the USNPS participation in the

World Heritage Convention, Foreign National Programming and Peace Corps liaison. Of the above mentioned, three are important for living natural resource training in the Western Hemisphere.

i) The World Heritage Trust Fund has money allocated for training if the country has signed the treaty, and preferably has a designated World Heritage Site though the latter is not mandatory. The international workshop on management of national parks and reserves held in November of 1979 in Ecuador was partially funded with World Heritage money.

ii) The Foreign National Programing office coordinates foreign professionals who have requested in-service training in the USNPS, and responds to information requests. To facilitate international visitors each major park has an international representative who coordinates the in-park visit. But basically the visitors are on their own once oriented, and during in-service training they work with the staff.

iii) There is a USNPS person stationed at the Peace Corps. This position will help backstop the peace corps volunteers in the field and also assist in their training needs since many PCV's are skill trained rather than professionals.

d) The Park Service is the publisher of PARKS magazine with the assistance of various international organizations. It is the only international technical information dissemination magazine in the world on national parks. It is published in French and Spanish as well as English. The editor is a USNPS staff person. It is sent out free of charge to all developing country park professionals who request it. This provides a medium for exchange of information on management techniques throughout the world.

e) The African Assistance Office coordinates training assistance to the Anglophone Regional College of African Wildlife Management in Mweka, Tanzania, in addition to responding to requests for assistance from Africa. The USNPS is assisting the College in strengthening their training capacity with 16 person months of USNPS training.

C. U.S. Geological Survey (USGS) responds to foreign training needs related to this project concerning water resources and remote sensing. All training of foreigners and scientific exchange is coordinated by the USGS International Activities Committee and all training must be paid by the national government or a sponsoring agency such as AID.

1. USGS training overseas is either by individual on-the-job training or group training in the field or classroom. The Survey integrates on-the-job training into essentially

all its bilateral technical assistance projects. In the last 30 years at least 2,500 foreign nationals have been trained in this way by the U.S.G.S. There have been over 1,100 technical assistance projects in the thirty years preceding 1974, involving all the divisions of USGS. In 1977, 40 USGS specialists went to LAC countries on technical missions and 16 Latins came to the U.S. for training (mostly in Remote Sensing) associated with these technical projects. The survey also supplies instructors for universities or agencies overseas to build their institutional instructional capacity. These instructors have taught both classroom courses and field courses. Several of these courses have been in hydrology.

2 Training in the U.S. can take three forms.
a) Individual in-service training for specialists to become familiar with administrative techniques USGS uses to run their large scientific organization.
b) Group training and special seminars, including a 12 week Water Resources training course, and the International Remote Sensing Workshop. The latter trained 58 scientists in 1977. These courses are designed for mid and upper level scientists.
c) USGS hosts and/or sponsors numerous conferences or short seminars throughout the world for exchange of scientific information.

II. U.S. Department of Agriculture (USDA)

A. Office of International Cooperation and Development (OICD)

This office is USDA's agency which is "responsible for technical assistance, international training, development programs, coordination of international organization affairs, scientific exchange agreements and the development role of food assistance". Most of the funding for OICD comes from AID. Other international organizations such as FAO, OAS, the development banks and national governments also contract OICD for assistance.

1. The Technical Assistance Division of OICD facilitates U.S. technical assistance in food and fiber production in LDC's. In 1978 over 700 experts worked in 51 countries. Technical assistance projects relevant to environmental training include Land and Water Management, Nutrition, Marketing, Credit, Cooperatives, Planning and Policy Analysis, Forestry and Remote Sensing. These projects are always in the host country. The USDA perceives them as institution building projects.
2. The International Training Division (ITD) of OICD is responsible for training foreign nationals for USDA. ITD offers assistance to government personnel involved in "planning, designing and implementing training components of development projects". It also is responsible for managing and conducting training programs in the US and abroad. ITD also offers project management

training and assistance in organizational efficiency. Approximately 2,500 foreign nationals participate in ITD programs per year. ITD programs can include academic degrees from the bachelor's through the doctorate level.

Specialized short courses lasting from a month to 18 weeks, at the middle manager level are offered. They can be in the U.S. or in another country, with many available in Spanish.

In 1980, 37 courses were facilitated, four of which related directly to environmental management and training, including an agricultural trainer development course. ITD recently conducted a needs survey of USAID missions, which reflected a strong demand for the environmental management-type courses.

3. The Development Programs Division of OICD studies most of AID agricultural development projects. This program, along with ITD, warrants more research to determine if the AID forestry and environmental mandate is being integrated into agricultural development training programs.

B. U.S. Forest Service (USFS).

1. USFS manages the Caribbean National Forest in Puerto Rico, as well as the Institute for Tropical Forestry in Rio Piedras, Puerto Rico. For many years the Institute for Tropical Forestry facilitated both research and training in tropical forestry. Over the past 20 years there have been 16 international three-month short courses in tropical forestry sponsored by either AID or FAO at the Institute. A few professionals are accepted to work alongside the researchers when study needs and research projects coincide. OICD would like to formulate a continuing tropical forestry training program based at the Institute of Tropical Forestry. This program would have a full time professional staff directing and coordinating the program and would be assisted by a secretary. Not all the courses would need to be sited at Rio Piedras nor would the instructors have to be U.S. citizens. Courses could be in Spanish or English. The focus would be on tropical America and the proposed courses could include the following subjects:
    a. The assessment of Tropical Forest Ecosystems
    b. Tropical Timber Plantation Management Techniques
    c. Forest Management Research Techniques
    d. The Administration of Public Forests in the Tropics
    e. Tropical Land Use Planning for Forestry
    f. Management of Tropical Watersheds
    g. Tropical Forest Recreation and Wildlife Management

    The proposed course length would range from four to six weeks.

2. Office of International Forestry of USFS includes one training coordinator for foreign national professionals who come to the U.S. for short or long-term USFS training. In 1979, 350 professionals came to the USFS for training, funded by FAO, AID, their national governments or development projects.

   This international office also has a coordinator for requests for technical assistance from outside the U.S.

C. The Soil Conservation Service (SCS) has a foreign programs coordinator servicing both technical assistance requests from abroad and in-service training in the U.S. for foreigners. The SCS has recently undergone a substantial reorganization and the new director is very interested in placing SCS personnel in LDC's.

1. As of May 1st., 1980, SCS had 12 resident experts on technical assistance projects in LDC's, including one in Latin America. These experts generally go for two-year terms and about 90% of their activity is devoted to the technical aspects of the project. SCS views these experts as institution builders, and incorporates on-the-job training into the foreign projects. SCS has the authority to place personnel in universities or training institutes but has done very little because of a lack of requests for this manner of assistance.
2. The SCS also facilitates practical in-service training in the U.S. They do not offer classes or short courses to foreign nationals though the potential is clearly there for classroom training in addition to fieldwork. In 1979 there were 184 foreign personnel that received some sort of training with SCS for a total of 1272 training days. Of these, 52 were AID sponsored, 19 FAO sponsored and 113 were funded from their national governments, universities, foundations or by themselves.
3. The SCS soil classification has been criticized by some tropical land managers and ecologists who tentatively claim it does not adequately account for the increased leaching in tropical soils once the vegetation has been removed. The result has been land use potential maps overly optimistic for agricultural and grazing lands with a corresponding discrimination against forest and other natural resource utilization recommendations. This has sometimes tended to locate agricultural colonization projects on fragile soils that cannot sustain agricultural production once the forest is cleared.

III. The Department of State

The State Department supports environmental training through the Agency for International Development (AID).

A. The Development Support Bureau of AID funds the Man and the Biosphere Program (MAB) through the Office of Science and Technology

1. MAB projects include: preparation of 17 country environmental profiles; development of course materials such as a book on watershed management for a course that was presented by OICD of USDA; elaboration of a Directory of Environmental and Natural Resource Study Programs in the U.S.; sponsorship of several conferences such as the World Conference on Sea Turtle Conservation, and the U.S. Strategy Conference on Tropical Deforestation; and the distribution of the NRDC Tropical Forest Newsletter.

MAB projects currently underway for 1980 are: Report on the Status of Endangered Species in Thailand; Environmental Guidelines for Projects Involving Clearance of Tropical Forest Areas in the Amazon Basin; Environmental Guidelines for the Design of Large and Small Scale Irrigation Projects; Training Program on Techniques for Gathering and Monitoring Environmental Baseline Data; Support for Indonesian MAB Rural Ecology workshop at Mulawarman University in Kalimantan on "The Relationships Between People and Forests"; Training Sessions on Environmental Mutagens and Carcinogens; Location and Inventory of Audio-Visual Materials on the Environment; Training at the College of African Wildlife at Mweka, Tanzania; Adaptive Environmental Assessment Technology Transfer.

MAB/AID is interested in expanding the above mentioned projects through increased funding of the MAB Research Consortium. MAB/AID would like to receive research proposals for locally-based research projects in LDC's in conjunction with the local people. These in-country projects would involve more social and anthropological considerations than the above mentioned projects. MAB is also interested in assisting in the development of MAB Project 8 - biosphere reserves, in the developing countries. These reserves are very good for on-site experimentation and training in eco-development techniques appropriate to each biome.

2. The Science and Technology division of the Development Support Bureau (DS/ST) has a series of Environmental training projects in the development stage and several in the implementation phase. Two ongoing projects deal with natural resource information needs. Remote Sensing for Agriculture is evaluating remote sensing techniques to improve land use and crop forecasting. On a more fundamental level the Expanded Information Base project hopes to make available to AID a broader data base for decision making. Training, Assessment, and Management are recurrent themes in all of the projects. Forestry,

land use, and watersheds are priority resources areas. A major lesson that AID has learned in more than seven years of training efforts is that these activities must be designed on a continuing basis. Recent training programs have involved other sources of institutional funding and support. Courses are now underway or planned on watershed management, ecological and environmental monitoring, natural resources inventories and land use planning. Although project funding over the next three years surpasses $12 million, the project office will operate with a full-time staff of 15.

3. The DS/ST has a four year Forest Resources Management Project for $3.3 million. This will involve a network of experts, both staff and consultants, with socially and technically relevant professional expertise in forest resources working in AID mission backstopping for the forestry sector. They will be facilitating and implementing USAID forestry programs, which include personnel training.
4. The Peace Corps has a new program funded by AID DS/ST that will significantly increase its role in forestry-related field work. The Peace Corps will benefit from the new AID forest management network of experts. There will be considerable training of Peace Corps volunteers at the beginning of their service as well as in-service training with host-country national staff.

APPENDIX II

REGIONAL TRAINING PROJECT

ALTERNATIVE TRAINING METHODS

A series of training methods have been applied in the region, and elsewhere, which are applicable to the fields associated with natural resources and environmentally related problems. They shall be presented in brief with emphasis upon their common characteristics, advantages and disadvantages.

University Degree Programs

University programs in fields such as forestry, biology, agronomy and marine sciences, among others, deal with study areas in comprehensive and formal ways. Upon successful completion of a program, which requires four to six years of full-time dedication (including summer periods where field work may be involved), participants receive a degree. The programs provide theoretical fundamentals and principles, and occasionally experience in practical application. Advantages include the opportunity for depth in a broad diversity of topics and to obtain both philosophical and disciplinary perspectives. Disadvantages include length of time required for the program and the concentration on abstraction and theory, often at the expense of practicability. And, it is precisely the disciplinary nature of study that tends to produce a narrow, reductionist approach which can be retained throughout the career. The university degree program is of course expensive.

University Post-Graduate Programs

Following an appropriate university-level degree, individuals may choose to specialize through a post-graduate program in that country, or elsewhere in the region, or the world. Grounded upon previous study and experience, post-graduate work concentrates on a specific field or sub-field. Masters-level programs usually require from 12 to 24 months while the doctorate can require three or four years beyond the university or even the master's

degree, depending upon the field of study. The advantages of graduate work are that the individual is carried to the limits of existing knowledge, the intellectual experience is deep, and the individual gains particular expertise. Disadvantages include the normal tendency to become narrowly and theoretically oriented. Unless the programs are carefully geared to fit into the realities of the circumstances within which the individual will work subsequent to studies, problems of orientation and application of the special training can arise.

Short Courses

Special formal courses are offered normally for professionals with university degrees. These courses are designed to provide additional skills, up-to-date information and reorientation to changing technical, economic or social perspectives. Some are oriented to assist professionals to stay current within their field. Short courses may consume one to several months in the classroom or field. The advantage of short courses is their open format allows for interdisciplinary work, integrated exercises with case histories, and other innovations often difficult to achieve within the typical university formats. Courses can be designed to fit into summer vacation periods, to meet the needs of particular groups of employees of chosen institutions, can be given in a variety of locations, and can be offered at moderate cost. A disadvantage is that participants with diverse backgrounds and disparities in their abilities and experience often participate in the same session.

Seminars

Seminars provide the opportunity for individuals with sufficient background and experience to dialogue on particular subjects at either relatively simple or sophisticated depths. Format is informal; a topic is introduced and background statements or papers are presented to orient and stimulate the discussion. Then, invitees are expected to participate in an active interchange of ideas and experience. Typically, the seminar is held in a round-table fashion. Occasionally, it is combined with field visits in order to gather information and stimulate exploration of concepts. Seminars may run from several hours on defined, limited topics, to several months where they form components of university education. Advantages include the simplicity of arrangements and facilities, the less demanding preparation on the part of participants, and the opportunity to develop synergy through a meeting of minds. On the other side, seminars are of limited usefulness if the

participants are unaccustomed or unprepared to participate actively. The cost of most seminars is low.

Workshops

The workshop format involves a formal combination of theory and practice, and an informal opportunity to develop intellectual interchange among peers. Different from either the seminar or short course, the workshop implies exercises and laboratory or fieldwork where participants actually perform tasks and practice and test skills, methods and techniques. Workshops generally focus upon problems and examine interdisciplinary methods to be utilized in the search for solutions. They may run from one week to three months. The agenda is normally kept sufficiently flexible to allow participants the opportunity to pursue topics of greatest interest or those that require further exploration. Working relationship between staff and student is characterized as personal, each individual striving to develop concepts and skills at the individual's own rate. Each individual is expected to offer ideas and experience to enhance the learning of colleagues in the program. The advantages of the workshop format are the intensity at which learning occurs, the high amount of synergy among peers, and the combination of theory, principle, concept and hands-on application. The participant can return from a workshop prepared to perform a task and to appreciate the philosophical framework within which the task is to be realized. A disadvantage is the amount of preparation required to arrange for the staging of a workshop. Facilities often require exclusive lodging/meals services and easy access to field sites. Workshops are moderately expensive.

Technician Programs of Study

Training for practitioners can be provided through programs of study which require eight to twelve years of previous schooling and certain physical abilities. Typically, these courses run from nine months to two years, and provide practical skills to implement field programs, such as forest ranger, national park ranger, wildlife officers, assistants to researchers, fisheries officers, assistant extension agents, and forestry and agricultural technicians. The courses combine classroom and field activities, and a blend of theoretical notions and pragmatic hands-on methods and techniques. The advantage of technician-level training is that individuals can be prepared to implement practical resource management programs in the field, working with local residents,

at the level where ecodevelopment is most significant. This can free the professional to concentrate on more technical issues, planning, investigation, training and other activities more in keeping with professional-level preparation. The disadvantage of technical-level training has been the creation of a quasi-professional, an individual who is almost a professional. The tendency has been to provide technicians with a mini-program of the related profession, rather than create a separate and unique course of study and career in its own right. An example includes the forestry technicians who are provided a condensed forestry engineer course. The cost of technician training is similar to university and post-graduate courses, since virtually all costs related to the maintenance of the trainees are generally borne by the program.

Conference

A conference can serve indirectly as a training mechanism. Conferences are called and organized to provide an opportunity to discuss and consider particular issues among peers. Lasting from several hours to two weeks, this format can examine a problem of concern to a profession or a diverse community. Some conferences focus on local issues while others, such as the United Nations Conferences on the Environment, Desertification, Habitat, Tropical Forest, among others, deal with issues of global concern. These formal gatherings generally terminate with recommendations directed to a particular audience for the purposes of orienting procedures and solutions, as for example, the Environmental Action Plan for the Wider Caribbean (UNEP, 1980). Participation may range from tens to hundreds; sessions are typically held indoors. The advantage of conferences is the opportunity to discuss and debate a problem or issue of concern, make publicity, call concerns and recommendations to the attention of political leaders and authorities, and short duration. Disadvantages include the relative superficiality of treatment of the subject, and the fact that the means of influencing the skills, perspectives and knowledge of the participants are only indirect. Conference costs may run moderate for local gatherings, to high where specialized facilities, translations and electronic equipment are required.

Congress

In congresses, a professional or problem-oriented group meets at a more or less established frequency to develop policy and examine technical, scientific, economic or other issues, session upon session over the years. Examples include the World Forestry Congresses sponsored by the Food and Agriculture Organization of the United Nations. Congresses may or may not involve official

delegates of governments or institutions. Sessions can run from ten to thousands of participants, and agendas are often complex, involving carefully prepared papers and calling for decisions on policy and for resolutions requiring follow-up action. There is often a secretariat charged with certain responsibilities between sessions. The advantages of the congress as a training mechanism include the ability to foster intellectual, philosophical and technical growth of a profession as well as of individuals, and the formal declaration of policy (see the 8th World Forestry Congress Declaration on "Forestry for People" (FAO, 1978c). Negative aspects include the low level of personal interaction among those who attend, and a tendency to retain a fairly closed perception of the profession. The cost is generally high.

Panels and Debates

Topics of current interest, such as energy, contamination, land use policies, and deforestation, can be developed through the organization of panels and debates. Several knowledgeable individuals are invited to provide background information on the various issues and points of view involved. These types of encounters can either confine the dialogue to the panelists or debators, or they can be open sessions with audience participation. Panels and debates can be held in regular offices, in places of work, or on the media, including television, and are generally focused to raise the awareness and perception of particular individuals or audiences about the problem under discussion. Advantages include ease of arrangement and facilities, and the direct impact upon attendees. The effects are, however, superficial since only general impressions can be achieved. The cost is low except where expensive media communications are brought in.

In-Service Training

It has been noted that natural resources and environmentally related problems can most appropriately be addressed through close field contact. However, a major limiting factor for training in the region is the difficulty for employees to leave their jobs for extended periods. Furthermore, it is difficult for management departments to organize training sessions for individual incoming staff persons.

In-service training is a procedure whereby incoming employees work alongside already experienced individuals to learn the tasks to be performed. Or, experienced employees may be assigned to work with individuals in other departments to gain additional

skills. In Kenya, for example, recent graduates from the College of Wildlife (Mweka, Tanzania), are assigned to work with an experienced national park warden for several years in a form of apprenticeship. At the end of that period, the individual may have the opportunity to become a warden of a small, or relatively simple sector for several years (Miller, 1980, p. 726).

The advantages of in-service training are that work is not interrupted and few costs are added to the budget. The procedures and methods accepted by the organization can be extended to new incoming employees to ensure continuity, and the orientation is practical. The problems with in-service training, especially where it is not accompanied with some formal orientation, include the limited extent to which intellectual growth and creativity in the search for new methods and practices may evolve. Old ways may be perpetuated which are no longer efficient or relevant. The cost of in-service training is very low.

Field Visits to Case Study Sites

Individuals from all levels of work can benefit from visits to observe the methods and results of field activities. Reforestation, marginal lands reclamation, dune control, watershed stabilization, conch mariculture, natural area management and other field studies can serve to demonstrate the development of techniques and the search for solutions to problems. They serve to illustrate management-oriented research, and research-oriented management. Policy-level people can be shown the implications of alternative lines of action. Professionals can observe the results of applying various techniques. And, technicians can gather information on methodologies for practical application elsewhere.

Field visits may take place in the local setting, in other regions of the country, or internationally: they may either accompany attendance to conferences or congresses, or be the main or sole reason for travel.

Advantages include the potentially high impact upon the visitor in observing real world applications of science and technology to solve problems, and potential to influence the transfer of methods for application to other areas. Disadvantages are few: principally, there is the danger that without adequate orientation and background, visitors may attempt direct transfer of technology to other contexts where environmental, social, economic, cultural or political differences require considerable adjustment to methods and procedures. The costs are related directly to the expenses of travel to and from the site.

Informal Meetings

Not a conventional training mechanism, informal meetings of selected individuals can be effective in providing information, exploring options, and influencing decisions. The meetings take place within offices, such as, for example, regular Friday afternoon sessions where the director invites his officers to review the week and think ahead to future challenges. Influential individuals may invite a minister and several informed professionals to consider a natural resource or environmental problem which is not receiving the necessary attention of government. Such gatherings often take advantage of a visit to the institution or native country of an outstanding national or international figure. Informal meetings of this nature have influenced several key decisions throughout the region, and their importance should not be underestimated. The opportunity to develop the training program in each country will probably require a series of informal meetings with key authorities in order to develop the necessary awareness and support for the program.

The disadvantage of informal meetings is that they rely almost exclusively upon personal judgements and abilities with little formal or systematic input. Usually, there are no written documents, minutes or recommendations. Records are not kept and follow-up relies quite entirely upon the interest and memory of the participants. The advantages stem from the informality; participants tend to be more candid, employee/employer relations tend to relax and the interchange of ideas and the exertion of influence can be extensive. The cost of informal meetings may amount simply to the expenses of meals and refreshments.

TV and Radio Reports, Press Editorials and Reports

The public media can serve as an indirect form of training in natural resources and environmentally related problems. Ministers and high-level policy makers are keen to keep current on the opinions and concerns of the public. Well-placed programs of debate and editorial comment can influence decisions in important ways. Examples are topics like water supplies, smog from agricultural burning, deforestation, erosion, endangered species, illegal practices in the extraction of natural resources, among others.

Commonly, directors of natural resources have close contacts among the staffs of leading newspapers, TV and radio stations, where articles and commentary can be provided for publication. Many media have employees who are deeply motivated regarding natural resources and the environment and who only require orientation and access to information.

The opportunity to have impact on political leaders and the general public is high. The messages are normally short and superficial, but can lead to reorientation towards specific issues, development of interest and generation of action. Experience in the region shows this mechanism to be a very powerful tool. Obviously, the same procedure can be utilized by other views and interests, and often, the opposition has more sophisticated support and techniques. The initiation of public debate must be designed with care and political astuteness to avoid opposite results to those intended. The cost of working with the media consists primarily of the time and energy of the persons who choose to become involved.

POTENTIAL INSTITUTIONS FOR COLLABORATION WITH
REGIONAL TRAINING PROJECT

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
ARGENTINA		
- Centro de Instrucción "Bernabé Mendez" - Servicio Nacional de Guarda Bosques (Bariloche)	IV	21,25,26,31,32,37
- Centro de Ecología y Recursos Naturales - Universidad Nacional de Córdoba (Córdoba)	II,III,IV	25,31,37
- Dirección Nacional de Fauna (Buenos Aires)		21,25,26,31,32,37
- Fundación Bariloche (Bariloche)	I,II,III	37
- Servicio Nacional de Parques Nacionales (Buenos Aires)		21,25,26,31,32,37
Universidad Nacional de La Plata (La Plata)	II,III	31
- Universidad Nacional Santiago del Estero	II,III	25
BELIZE		
- Fisheries Department (Belize City)		1
- Forestry Department (Belmopan)		1
- Belize Audubon Society (Belize City)	I	1
BOLIVIA		
- Centro de Desarrollo Forestal (La Paz)		5,6,21,25,30,35,36,37,47
- Departamento de Ingeniería, Suelos y Riego - Facultad de Ciencias Agrícolas y Pecuarias Departamento de Biología - Facultad de Ciencias y Tecnología Universidad Mayor de San Simón (Cochabamba)	II,III,IV	35,36

APPENDIX III-1

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
BOLIVIA (cont.)		
- Departamento Forestal y Vida Silvestre - Cordepaz (La Paz)		5,35,36,47
- Escuela Técnica Forestal - Centro de Desarrollo Forestal Cochabamba)	IV	35,36
- Facultad de Ciencias Agrícolas - Universidad Boliviana Gabriel Rene Moreno (Santa Cruz)	II,III	21
- Facultad de Ciencias Agrícolas (Carrera Forestal) - Universidad Misael Saracho (Tarija)	II,III	21,25
- Instituto de Ecología - Universidad Mayor de San Andres (La Paz)	II,III	36,47
- Instituto Nacional de Fomento Lanero (La Paz)		36
- Programa ERTS - Bolivia (La Paz)	II,III,IV	5,6,21,25,35,36,37,47
- Programa de Plantaciones Forestales (Santa Cruz)	II,III,IV	35
BRAZIL		
- Fundaçao Brasileira para Conservaçao da Natureza (Rio de Janeiro)	I,II,III,IV	4,5,6,7,8,9,20,28,29,30,32
- Instituto Brasileiro do Desenvolvimento Florestal - IBDF (Brasilia)		4,5,6,7,8,9,20,28,29,30,32
- Instituto Nacional de Pesquiza da Amazônia - INPA (Manãus)	II,III	5,6
- Escola Superior de Agricultura Luiz de Queiroz (Piracicaba SP)	II,III	9

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
BRAZIL (cont.)		
- Universidade Federal de Viçoca (Minas Gerais)	II,III	8
- Universidade Federal de Santa María (Río Grande do Sul)	II,III	32
- Universidade Nacional de Brasília (Brasília)	II,III	30
- Secretaría Especial do Medio Ambiente - SEMA (Brasilia)		4,5,6,7,8,9,20,28,29,30,32
CARIBBEAN - Spanish speaking countries		
Puerto Rico		40
- Colegio Regional de Aguadilla	IV	40
- Universidad de Puerto Rico (San Juan)	II,III	40
- USFS - Institute of Tropical Forestry	II,III	40
DOMINICAN REPUBLIC		
- Comisión del Medio Ambiente (Santo Domingo)		40
- Dirección General Forestal (Santo Domingo)		40
- Dirección Nacional de Parques (Santo Domingo)		40
- Departamento de Recursos Pesqueros Departamento de Suelos y Aguas Departamento de Vida Silvestre de la Subsecretaría de Recursos Naturales (Santo Domingo)		40
- Unidad del Medio Ambiente - Secretaría Técnica de la Presidencia (Santo Domingo)		40

APPENDIX III-4

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
CARIBBEAN - French speaking countries		
I -Departamentos Franceses de América y Guyana Francesa		
- Centre Universitaire des Antilles et de la Guyane, CUAG (Guadeloupe)	II,III	4,41
- Institut National de la Recherche Agronomique - INRA	II,III	4,41
- Office National des Forêts (Guadeloupe, Martinique, Guyane)		4,41
- ORSTOM (Martinique y Guadeloupe)		41
- Programa "Mangroves et Zones Côtière". Office National des Forêts		41
- Service des Affaires Maritimes		4,41
II - Republic of Haiti		
- Centre de Formation en Aménagement des Bassins Versants	IV	40
- Conseil National des l'Environnement et de Lutte contre l'Erosion - ONAELE (Port-au-Prince)		40
- Département de l'Agriculture des Ressources Naturelles et du Développement Rural (Port-au-Prince)		40
- Direction de l'Aménagement des Terres et de la Protection de l'Environnement - Département du Plan (Port-au-Prince)		40
- Faculté d'Agronomie et de Médecine Vétérinaire - Université d'Haiti (Port-au-Prince)	II,III	40
- Service de Conservation des Sols des Forêts et de la Protec-		40

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
CARIBBEAN - English speaking countries		
- Caribbean Fisheries Training and Development Institute - CFTDI (Trinidad y Tobago)	IV	41
- College of the Virgin Islands - CVI (St. Thomas)	II,III	41
- Forestry School of the Eastern Caribbean Institute of Agriculture and Forestry - ECIAF (Trinidad y Tobago)	IV	41
- University of Guyana (Guyana)	II,III	4
- University of the West Indies - UWI (Campus-Jamaica, Barbados y Trinidad)	II,III	41
- Caribbean Conservation Association (CCA), Barbados (Serves all Antilles)	I,II,III,IV	41
- Eastern Caribbean Natural Areas Management Program (ECNAMP), St. Croix (Serves all Antilles)	I,II,III	41
CHILE		
- Carrera de Ingeniería Forestal - Universidad Austral de Chile (Valdivia)	II,III	10,11,22,37
- Carrera de Ingeniería Forestal - Universidad de Chile (Santiago)	II,III	10,11,22,23,37
- Centro de Ciencias Forestales - Universidad de Concepción (Concepción)	II,III	22
- Centro Experimental Forestal - Universidad Austral de Chile	II,III,IV	10
- Centro Nacional de Capacitación Forestal de Escuadron (Concepción)	IV	22
- Corporación Nacional Forestal - CONAF (Santiago)		10,11,22,23,24,37

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
COLOMBIA		
- ACUA - NGO (Popayán)	I,II,IV	33,34
- Carrera de Ingeniería Forestal - Facultad de Agronomía - Universidad Nacional de Colombia (Medellín)	II,III	33
- Centro Interamericano de Fotointerpretación - CIAF (Bogotá)	III	3,5,17,27,33,34
- Centro Internacional de Agronomía Tropical - CIAT (Palmira)	I,II,III	27,33
- Colciencias (Bogotá)	II,III	3,5,17,27,33,34
- Escuela de Tecnología Forestal - Universidad Nacional de Colombia (Medellín)	IV	33
- Facultad de Ingeniería Forestal - Universidad Distrital Francisco Jose de Caldas (Bogotá)	III	34
- Facultad de Ciencias del Mar - Universidad de Bogotá Jorge Tadeo Lozano (Bogotá)	III	34
- Fundación para la Educación Superior (Cali)	I,II,III	33
- Grupo Ecológico - Universidad de Tolima (Ibagué)	I,II,IV	33,34
- Gaviotas (Bogotá)	I,II,III,IV	27
- Servicio Nacional de Aprendizaje Sena (Popayán)	IV	33,34
- Sub-Dirección de Desarrollo - Corporación Autonoma Regional del Cauca, CVC (Cali)		33
- Sub-Gerencias de: a) Protección y Control; b) Pesca y Fauna Terrestre; y c) Bosques, Aguas y Suelos - INDERENA (Bogotá)		3,5,17,27.33.34

COUNTRY/INSTITUTION	CRITERIA	
	Training Level **	Biogeographical Provinces ***
COSTA RICA**		
- Centro Agronómico Tropical de Investigación y Enzeñanza - CATIE (Turrialba)	I,II,III,IV	1,2,14,15,16,21
- Comisión Nacional de Asuntos Indígenas - CONAI (San José)		16
- Dirección General Forestal (San José)		16
- Dirección de Recursos Pesqueros y Vida Silvestre (San José)		16
- Federación Mesoamericana de Asociaciones Conservacionistas No-Gubernamentales - FEDEMAC (San José)	I,II	12,14,16,21
- Instituto Costarricense de Turismo - ICT (San José)		16
- Instituto Tecnológico de Costa Rica (Cartago)	III,IV	16
- Instituto de Tierras y Colonización - ITCO (San José)		16
- Organization of Tropical Studies - OTS (San José)	I,II,III,IV	1,2,14,15,16,21
- Servicio de Parques Nacionales (San José)	II,III,IV	16
- Universidad de Costa Rica (San José)	II,III	16
- Universidad Estatal a Distancia/Centro de Información y Documentación Ambiental (San José)	I,II,III,IV	16
- Universidad de La Paz (San José)	I,II,III	2,16
- Universidad Nacional (Heredia)	II,III	16
ECUADOR		
- Area de Pesquería - Escuela Politécnica del Litoral (Guayaquil)	III	19

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
ECUADOR		
- Centro de Biología - Universidad Central del Ecuador (Quito)	II,III	33
- Centro Forestal de Conocoto (Quito)	IV	33
- Centro de Levantamientos Integrados de Recursos Naturales por Sensores Remotos - CLIRSEN (Quito)	II,III	3,5,19,33,34,35,37
- Departamento de Biología - Pontificia Universidad Católica del Ecuador (Quito)	III	33
- Departamento de Ecología - Instituto Nacional de Colonización de la Región Amazónica (Quito)		5,35
- Escuela de Ingeniería Forestal - Universidad Nacional de Loja (Loja)	II,III	33,37
- Fundación Natura (Quito)	I,II,IV	3,5,19,33,34,35,37
- Instituto de Ciencias Naturales - Universidad Central del Ecuador (Quito)	II,III	33
- Instituto Nacional de Investigaciones Agropecuarias (Quito)	II,III	3,5,19,33,34,35,37
- Dirección de Desarrollo Forestal (Quito)		3,5,19,33,34,35,37
EL SALVADOR****		
- Dirección General de Recursos Naturales Renovables - DIGERENARE (El Salvador)		16,21
GUATEMALA****		
- Centro Universitario del Nor-Occidente (Huehuetanango)	III,IV	1,21

CRITERIA

	Training Level**	Biogeographical Province(s)***
HONDURAS**		
- Centro Universitario Regional Litoral del Atlántico, Universidad Nacional Autónoma de Honouras (La Ceiba)	II,III	16,21
- Corporación Hondureña de Desarrollo Forestal - COHDEFOR (Tegucigalpa)		16,21
- Dirección General de Recursos Naturales Renovables - RENARE (Tegucigalpa)		16,21
- Dirección de Recursos Hidráulicos (Tegucigalpa)		16,21
- Escuela Nacional de Ciencias Forestales - ESNACIFOR (Seguatepeque)	IV	16,21
- Instituto Hondureño de Antropología y Historia (Tegucigalpa)		16,21
MEXICO**		
- Bioconservación - A.C. (México,D.F.) Centro Internacional para el Mejoramiento de Maiz y Trigo - CIMMYT (El Batón)		21
- Comisión de Aguas del Valle de México (México, D.F.)		21
- Comisión Nacional de Zonas Aridas (México, D.F.)		7,8,9,10
- Comisión del Plan Nacional Hidráulico (México, D.F.)		21
- Consejo Nacional de Ciencia y Tecnología (México, D.F.)		1,7,8,9,10,13,14,15,16,21
- Departamento del Distrito Forestal (México, D.F.)		21
- Instituto de Investigación sobre Recursos Bióticos (México, D.F.)	II,III	21

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
MEXICO		
- Instituto de Ecología - Museo de Historia Natural (México, D.F.)	II,III	1,7,8,9,10,13,14,15,16,21
- Instituto Mexicano de Recursos Naturales Renovables (México, D.F.)		1,7,8,9,10,13,14,15,16,21
- Instituto Nacional de Pesca (México, D.F.)		
- Instituto Nacional de Investigaciones Forestales (México, D.F.	II,III	1,7,8,9,10,13,14,15,16,21
- Petróleos Mexicanos (México, D.F.)		1,10,21
- Universidad Autónoma Agraria "Antonio Narro" (Buena Vista, Saltillo, Coahuila)	II,III	9
- Universidad Autónoma de Chiapas (Chiapas)	II,III	1,16,21
- Universidad Autónoma de Chapingo (Chapingo)	II,III	21
- Universidad Nacional Autónoma de México (México, D.F.)	II,III	21
- Subsecretaría de Agricultura y Recursos Hidráulicos (México, D.F.)		1,7,8,9,10,13,14,15,16,21
- Subsecretaría Forestal y de Fauna (México, D.F.)		1,7,8,9,10,13,14,15,16,21
- Subsecretaría de Manejo del Ambiente (México, D.F.)		1,7,8,9,10,13,14,15,16,21
NICARAGUA		
- Instituto de la Naturaleza y el Medio Ambiente (Managua)		16
- Instituto de Pesca (Managua)		

CRITERIA

	Training Level**	Biogeographical Province(s)***
PANAMA		
- Centro Regional Universitario de David, Universidad de Panamá (David)	II,III,IV	2
- Dirección General de Recursos Marinos (Ciudad de Panamá)		
- Dirección General de Recursos Naturales Renovables - RENARE (Ciudad de Panamá)		2
- Instituto de Recursos Hidráulicos y Electrificación - IRHE (Ciudad de Panamá)		2
- Universidad de Panamá (Ciudad de Panamá)	II,III	2
- Smithsonian Tropical Research Institute - STRI (Barro Colorado)	I,II,III	2
PARAGUAY		
- Centro Forestal Alto Paraná - Servicio Forestal Nacional (Asunción)	IV	21
- Facultad de Ingeniería Agraria - Universidad Nacional de Asunción	II,III	21
- Servicio Forestal Nacional (Asunción)		8,21,32
PERU		
- Departamento de Manejo Forestal - Universidad Nacional Agraria, La Molina (Lima)	II,III	5,24,35,36,37
- Dirección General de Aguas (Lima)		5,19,24,35,36,37,47
- Dirección General Forestal y de Fauna (Lima)		5,19,24,35,36,37,47
- Instituto Nacional de Investigación Agraria (Lima)	II,III	5,19,124,35,36,37

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
PERU		
- Instituto del Mar del Perú (Callao)		
- Instituto Nacional de Planificación (Lima)		5,19,24,35,36,37,47
- Oficina Nacional de Evaluación de Recursos Naturales - ONERN (Lima)		5,19,24,35,36,37,47
- Programa Académico de Pesquería - Universidad Nacional Agraria, La Molina (Lima)	II,III	
- Proyecto Especial de Utilización Racional de la Vicuña (Lima y Pampa Galeras)		36
- Proyecto Primates - Ordeloreto (Iquitos)		5
URUGUAY		
- Centro Docente Rural de Silvicultura - Universidad del Trabajo (Montevideo)	IV	32
- Dirección Forestal, Parques y Fauna (Montevideo)		32
- Instituto para la Preservación del Medio Ambiente - INPMA (Montevideo)		32
- Facultad de Agronomía - Universidad de la República (Montevideo)	II,III	32
VENEZUELA		
- Areas de Ciencias Aplicadas del Mar - Universidad del Oriente (Nueva Esporta)	II,III	
	II,III	34

COUNTRY/INSTITUTION	CRITERIA	
	Training Level**	Biogeographical Province(s)***
VENEZUELA		
- Corporación Venezolana de Guyana (Caracas)		27,28
- Dirección General Sectorial de Parques Nacionales - Instituto Nacional de Parques (Caracas)		4,5,17,18,27,28,33,34
- EDUCAM - Fundación para la Educación Ambiental (Caracas)		18
- Escuela de Geografía - Universidad Central de Venezuela (Caracas)	II,III	18
- Facultad de Ciencias Forestales - Universidad de los Andes (Caracas)	II,III	18
- FUDENA - WWF, Venezuela (Caracas)	I,II	4,5,17.18,27,28,33,34
- Instituto de Zoología Tropical - Universidad Central de Venezuela (Caracas)	II,III	18
- Instituto Venezolano de Investigaciones Científicas - IVIC (Caracas)	I,II,III	4,5,17,18,27,28,33,34
- Ministerio del Ambiente y de los Recursos Naturales Renovables (Caracas)		4,5,17,18,27,28,33,34
- Sociedad Venezolana de Ciencias Naturales (Caracas)		18

* The indicated institutions have demonstrated their abilities in management or academics involving natural resources and related environmental problems.

** Training levels: I=Senior policy level; II=Senior professional/manager level; III=Professional level; IV=Technician level.

***Biogeographical provinces according to Udvardy (IUCN, 1975) for the Neotropical Region:

1. Campechean 2. Panamanian 3. Colombian Coastal 4. Guyanan 5. Amazonian 6. Medeiran
7. Serra do Mar 8. Brazilian Rainforest 9. Brazilian Planalto 10. Valdivian Forest
11. Chilean Nothofagus 12. Everglades 13. Sinaloan 14. Guerreran 15. Yucatecan
16. Central American 17. Venezuelan Dry Forest 18. Venezuelan Deciduous Forest
19. Ecuadorian Dry Forest 20. Caatinga 21. Gran Chaco 22. Chilean Araucaria Forest
23. Chilean Sclerophyll 24. Pacific Desert 25. Monte 26. Patagonian 27. Llanos
28. Campos Limpos 29. Babacu 30. Campos Cerrados 31. Argentinian Pampas
32. Uruguayan Pampas 33. Northern Andean 34. Colombian Montane 35. Yungas
36. Puna 37. Southern Andean 38. Bahamas-Bermudan 39. Cuban 40. Greater Antillean
41. Lesser Antillean 42. Revilla Gigedo Island 43. Cocos Island 44. Galapagos Islands
45. Fernando de Noronja Island 46. South Trinidade Island 47. Lake Titicaca.

****For Mexico and Central America, the following provinces are from the Nearctic Region:
7. Californian 8. Sonoran 9. Chihuahuan 10. Tamaulipan 21. Madrean-Cordilleran