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Gentlemen:

Enclosed please find copies of the study made by ROCAP Consultants Paul Dulin and Luis Garcia under USAID Contract No. 596-0000-C-00-2029-00 and 596-0000-C-00-2030-00 respectively, with the purpose of analyzing watershed management in Central America and Panama.

Sincerely,

Frank Zadroga

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SUGGESTIONS FOR A REGIONAL WATERSHED MANAGEMENT PROJECT

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PREFACE

WHAT IS WATERSHED MANAGEMENT?

Watershed management is a catch-all phrase which encompasses a number of different definitions depending on the interest and priorities of the land user or land manager. For the purposes of this study, watershed management is considered:

> A well planned and executed utilization of natural (physical) resources within areal limits naturally defined by hydrographic divides (a watershed), which takes into account the capacity of certain land units to support different uses based on their ecological make up and geomorphology ("ecodevelopment") while incorporating concepts of multiple-use, sustained yield, and conservation.

It is a balanced approach to the optimal use of land, incorporating all aspects of human and physical resources into the planning effort. Such a concept promotes an integral development of resources, so as to avoid conflict between the land uses themselves, and without incurring irretrievable losses or irreversible changes in the natural resources base.

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LIST OF ACRONYMS USED IN THIS REPORT

ROCAP	Regional Office for Central American Programs (USAID)
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
DRNR	Departamento de Recursos Naturales Renovables (CATIE)
PASC	Programa de Areas Silvestres y Cuencas (DRNR-CATIE)
IICA	Instituto Interamericano de Cooperación para la Agricultura
CIDIA	Centro Interamericano de Documentación e Información Agrícola
RDO	Regional Development Officer (USAID)
OFIPLAN	Oficina de Planificación y Política Económica (Costa (Rica)
MAG/DGF	Ministerio de Agricultura y Ganadería/Dirección General Forestal (Costa Rica)
ICE	Instituto Costarricense de Energía
ICAA	Instituto Costarricense de Acueductos y Alcantarillados
IGN	Instituto Geográfico Nacional
MIPLAN	Ministerio de Planificación (Nicaragua)
IRENA	Instituto de Recursos Naturales y Del Ambiente (Nicaragua)
INE	Instituto Nicaragüense de Energía
MIDINRA	Ministerio de Desarrollo Agropecuario y Reforma Agraria (Nicaragua)
MIPPE	Ministerio de Planificación y Política Económica (Panamá)
RENARE	Dirección General de Recursos Naturales Renovables (Panamá)
IRHE	Instituto de Recursos Hidráulicos y Energía (Panamá)
IDIAP	Instituto de Investigación Agropecuaria de Panamá
STRI	Smithsonian Tropical Research Institute
INETER	Instituto Nicaraguense de Estudios Territoriales
ITCR	Instituto Tecnológico de Costa Rica
UCA	Universidad Centroamericana (Nicaragua)
PID	Project Identification Document
PP	Project Paper
CRIES	Comprehensive Resource Inventory Evaluation System
SAS	Statistical Analysis System
LASPAU	Latin American Scholarship Program for American Universities

INTRODUCTION AND SUMMARY

The following report is the result of a 30-day consultancy that involved 15 days of field research and interviews in the countries of Costa Rica, Nicaragua, and Panama and 15 days of orientation, research and report preparation in the offices of ROCAP in Guatemala.

The Consultant was contracted by USAID/ROCAP to provide the background information and detailed suggestions for the preparation of a Project Identification Document for a proposed "Regional Watershed Management Project" for Central America and Panama. A second consultant, Dr. Luis García, concurrently prepared a similar report based on investigation and interviews in Guatemala, El Salvador and Honduras. His report should be considered a complement to the present report, and vice-versa. Together, the reports are a response to what are considered the watershed management needs in Central America and Panama, and provide insight into their fulfillment with the implementation of a regionally-based project.

Visits to the countries of Costa Rica, Nicaragua and Panama revealed common deficiencies in the capabilities of the national governments to properly manage their watershed resources:

- Discrepancies and weaknesses in the legal base which delegates the authority and responsibilities of watershed management to institutions within the countries.
- A chronic lack of the human resources necessary to plan and manage watershed resources for their optimal utilization.
- Weaknesses or the total absence of an appropriate educational infrastructure to provide training in watershed resources management.

- Incapability of national institutions to collect, analyze, manage, and disseminate the information necessary for watershed management planning.

In response to these deficiencies, the following is a proposed 5-year project of regional design, consisting of a series of components which address the various weaknesses in the capabilities of the institutions to manage watershed resources in Central America and Panama. The project would strengthen the watershed management infrastructure at the regional and national levels with the following objectives:

1. An adequate infrastructure of human resources and operational capability within the natural resource institutions at the national level.
2. National watershed management plans that include the prioritization of principal watersheds and diagnostic plans that will facilitate future funding for specific watershed management projects.
3. A more appropriate mechanism (s) for the collection, analysis, management, and dissemination of natural resources information pertinent to planning on national and regional levels.
4. The substantial improvement in the legal and policy base necessary to bring about the more rational utilization of watershed resources through the more effective cooperation and comprehensive management between government institutions.

The project will be coordinated by CATIE in Turrialba, Costa Rica through the Wildlands and Watershed Management Program (PASC) within the Department of Renewable Natural Resources. PASC will build its staff, and in the first year

of the project will collect information and make the formal contacts necessary to establish priorities for the plans for action, sign formal agreements of collaboration with counterpart institutions at the national level, and contract the necessary personnel. Once established at the national level, PASC will orient and assist counterpart institutions in the implementation of the components listed below.

The Comité Regional de Recursos Hidráulicos (CRRH) and the Secretaría de Integración Económica Centroamericana (SIECA) will collaborate in both the preparatory and execution stages of the project (see García report).

The proposed project would have the following components:

1. Technical Assistance in Watershed Management
   - Provision of technical assistance in watershed management planning;
   - Development of preliminary natural resources inventories;
   - Preparation of diagnostic plans for priority watersheds;
   - Preparation of national watershed management strategy.
2. Curriculum Development
   - Assess training needs for national educational and natural resources regulatory institutions;
   - Provision of necessary human resources for training purposes;
   - Scholarships and research assistanceships
   - Seminars and short courses
   - Pilot watersheds for training, demonstration and investigation.
3. Instructional Resources Development
   - Establishment of a regional instructional resources laboratory;
   - Assessment of instructional resource needs in countries;

- Development of education modules, technical training packages, texts, manuals, etc.
- Dissemination of needed publications and bibliographic materials.

4. Natural Resources Information Management
   - Assess information management needs and data gaps in countries;
   - Establish and promote CRIES and other appropriate information management systems in appropriate national institutions within a regional information network;
   - Consolidate existing natural resources information and put into system.
5. Natural Resources Policy Support
   - Assess Legal and administration policy and diagnosis;
   - Promote needed policy changes in each country.
6. Conciousness Raising in Institutions
   - Strategy
   - Information Modules
   - Newsletters
   - Field Trips, Congresses, and Seminars

THE IMPORTANCE OF WATERSHED MANAGEMENT IN CENTRAL AMERICA

The importance of watershed management is exemplified in the various uses of water resources in the countries of Central America and Panama that are dependent on watersheds for the production of these same waters. These uses are included in three major categories: (1) potable water, (2) hydroelectricity generation, and (3) water for agriculture.

Surface waters are the major supply source for domestic and industrial water users in Central America, and ground water is a secondary source. Small dams and collection "boxes" are constructed to permit the transfer of water from the stream source to urban and sub-urban centers via aqueducts. Rural areas may have small surface water collection systems or, depending on the level of dispersement of a settlement, may use shallow wells.

Surface waters are the source for powering hydroelectric power plants. Waters are collected in storage dams or by diversion structures and their gravitational energy "head" is utilized to drive turbines and generate electricity. The amount of hydroelectric capacity potentially available in a country depends on the existence of appropriate geomorphologic aspects (mountainous terrain) and an ample supply of precipitation over the watershed feeding the water source.

Surface waters are important to agriculture when utilized for irrigation. These waters and irrigation schemes are especially important in areas of deficient or seasonal rainfall, where irrigation can facilitate agriculture in an otherwise hostile climatic region.

A brief explanation of these water uses in each country follows. Additional information is presented in the institutional profiles for each country.

COSTA RICA

Potable Water

In 1980 approximately 98% of the urban population and 62% of the rural population were serviced with some form of improved water supply system for a total of 82% of the population being served. The rest obtained water directly from "rustic" or natural sources such as streams, springs or rainbarrels. Most of this water is derived from surface streams (especially for the metropolitan area of San José and other urban areas) while ground water accounts for a much smaller portion of isolated rural well systems.

Hydroelectric Energy

Costa Rica generates more than 99% of its electrical energy demand by hydroelectric sources, with an installed hydroelectric capacity of 506 MW. Most of this energy comes from power plants of from 30 to 157 MW of capacity, but there are also some 35 "mini" and "micro" powerplants of from 180 to 10,000 KW of capacity (appendix CR-8). Of this energy: 45% went to residential uses, 33% to industrial, and 19% went to commercial uses. The Instituto Costarricense de Electricidad (ICE) has identified another 75 separate hydroelectric projects with a potential of more than 9,000 MW of capacity. These projects if constructed would involve projects on rivers throughout most of Costa Rica.

Agriculture

There are approximately 25,525 hectares of agricultural land under intensive irrigation in Costa Rica, plus another 40,000 hectares which are irrigated (when needed) by the banana companies. Another 250,000

hectares are suitable for irrigation: of these 8,300 are scheduled for inclusion in the Tempisque Irrigation Project by 1985.

NICARAGUA

Potable Water

No figures were readily available as to Nicaragua's water supply situation, however it is known that most of the potable water needs in the country are met by surface water sources. In the metropolitan area of Managua, supplies are met by nearby volcanic lagoons bearing ground waters. Other urban and suburban supplies are met through surface water sources in the mountainous areas north and east of Managua and by ground water sources and some surface water sources along the Pacific coast and central Valleys. The quality of water in Lake Nicaragua is good and is used for some water supplies, but the waters of Lake Managua are high in salts and chemical contaminants and are used only infrequently.

Hydroelectric Energy

At present hydroelectric sources account for 100 MW of the total of the approximately 275 MW of installed capacity (counting purchases). These hydro sources generate approximately 32% of all electrical energy consumed in Nicaragua (see appendix N-8). The Instituto Nicaraguense de Energía will develop three new hydroelectric projects by 1983, adding another 355 MW of installed capacity that will generate approximately 63% of all electrical energy to be consumed in the country. All of these existing projects and future ones will be carried out on two rivers: the Río Tuma and the Río Grande de Matagalpa.

Agriculture

Approximately 74,000 hectares are under intensive irrigation, especially in the central valley areas where commercial fields (cotton, sugar, corn) are irrigated during the low (or non) precipitation periods. Here both wells and some streams are tapped. Waters of the Lake Nicaragua are used in the alluvial areas surrounding the lake, and several projects are in preparation to greatly expand hectarage under irrigation using this source. Lake Managua waters are too saline for irrigation use, although many streams draining into the lake are tapped for irrigation (especially north and west of the lake). Nicaragua has increased area under irrigation by some 200% between 1967-1977, and the new government is planning to promote new commercial-scale irrigation projects in the short term.

PANAMA

Potable Water

Nearly 100% of urban and suburban centers are served by potable water systems administered by IDAAN, while 62% of the rural population is served by IDAAN systems (for villages of over 500 persons). The metropolitan area's water supply (Panamá and Colón) comes from Lake Alajuela and Gatun which also serve as 50% of the Panama Canal. Outside of the metropolitan urban and suburban systems are served by combinations of surface water diversions and aqueducts and wells. In rural areas approximately 700 aqueducts provide water primarily from surface water sources (of which 500 have been constructed with USAID support).

Hydroelectric Energy

Of Panama's 527 MW of installed capacity, about 260 MW or 50% is from hydroelectric sources and provides just over 51% of all electrical energy consumed in Panama (see Appendix P-7). Another 600 MW of capacity planned for development before 1990 of two major projects which should meet approximately 90% of electrical energy demands. Several mini-hydro power plants are being developed for areas outside of the interconnected grid. Of the energy consumed, 90.1% was for domestic use, 9.5% for commercial uses, and only 0.4% was consumed by industry.

Agriculture

Some 25,000 hectares are being irrigated for rice, sugar and bananas in some of the drier areas of the Departments of Chiriqui, Veraguas, Coclé, and Los Santos. This figure has increased nearly 40% since 1967 and the national government is intent on expanding irrigation by 73,000 hectares in the short and medium term to increase agricultural output. There is total estimated 272,000 hectares which are considered potentially apt for irrigation.

WATERSHED DEGRADATION

Watershed degradation is characterized by the loss in vegetative cover, increased soil erosion, loss of quality and quantity of water resources, increased sedimentation of streams and reservoirs, and increased flooding. This degradation is a result of inappropriate or abusive land uses brought about by the failure or weaknesses in land management practices and land use policies, and controls (and their enforcement). In each of the countries of Central America, a case can be made for the need of optimal watershed management based on various examples of watershed degradation.

COSTA RICA

- Between 1950 and 1977 dense forests decreased by 41%.
- Forest clearing continues at a rate of approximately 65,000 hectares per year with a concomitant loss of wildlife habitat and watershed degradation.
- Flooding and landslides have greatly increased in the last 30 years in watersheds of Ríos Sombrero, Parrita, Tuis and others have resulted serious losses in crops, infrastructure, housing and life.
- The lowering of water tables near the coastal beaches of Tamarindo, El Coco, Cahuita, and Puntarenas is caused by losses in recharge potential of upland watersheds resulting in salt incursions.

NICARAGUA

- Only 32% of total land surface in Nicaragua remains under dense forests. Deforestation rates (for all types of forests) are estimated at 90,000 hectares per year. A concomitant amount of wildlife habitat is also lost and watershed morphology is changed.
- The waters of Lake Managua are for the most part useless because of high salts, organics, and chemical contaminants brought about by sedimentation and fertilizer, pesticide, and untreated sewage effluents.
- The total clearing of original vegetative cover in the cotton growing areas near Leon has created an eolic erosion situation so serious that nearby Leon is plagued by "dust bowl" type dust storms causing health and infrastructure problems.
- Floods in the Chinandega region of Nicaragua in May, 1982 were exacerbated by the absence of vegetation in upper watersheds. Losses amounted to _____ for the one series of flood and left _____ homeless.

PANAMA

- Between 1952 and 1978, forest cover in the Panama Canal watershed declined from 83% of total land area to only 32% because of colonization pressures.
- Sedimentation rates into Lake Alajuela have increased by more than 200% in recent years. By the year 2020, 80% of the storage capacity of the lake will be lost to sedimentation if present rates persist (if not sooner with greater deforestation).
- Only about 50% of Panamá remains under forests. Deforestation is rated at 36,000 hectares per year. A concomitant amount of wildlife habitat is also lost and watershed quality is degraded.
- Accelerated erosion rates have been recorded in the Boquette, Chiriqui region at 1600 to 2000 metric tons/ha/year.
- Dropping well, spring, and stream levels and persisting drought conditions in the Azuero Peninsula are attributed to deforestation in upland watershed, especially in the towns of Penonomé and Aquadulce.
- Inappropriate or abusive uses of land in the Pacific lowland and Central regions have caused the losses of soil resources to the point that many areas are completely non - productive or wastelands.
- With 70% of the upper slopes of the Río Caldera watershed having been cleared, floods have resulted in considerable property damage and loss of life in Boquette.
- Water quality in the Tonosi, Oria, Guararo, La Villa, Parita, and Escota Rivers has greatly decreased due to the drop in water quantity and related dilution factor.

LEGAL BASE FOR WATERSHED MANAGEMENT

Each governmental institution in the Central American countries was established by a legal decree which generally outlined their responsibilities in managing or organizing resources in the Public Domain (refer to institutional profiles for each country). Most of these laws date to the 1940's to 1960's and were responses to problems or weaknesses of resource management. Many of these laws created an overlapping of authority and responsibilities (whether accidentally or on purpose) in the realm of watershed resources management. This has caused confusion between the institutions as to which really has the responsibilities to manage which resources. In most cases, instead of these institutions duplicating or working in complement with one another, the result has been that they have ignored the responsibilities and left the watershed resources unmanaged except for token attempts, usually carried out after some environmental disaster (crisis management).

The weaknesses in the legal bases of watershed management can be blamed on a number of things: the low political priority accorded natural resources management, ignorance of the importance of rational resources utilization by legislators, or the weakness of the resource institutions to better define their own authority and responsibilities within the legal system. There is a serious need for legal reform in this area, in the form of the design and promulgation of regulations which would better stipulate the responsibilities of each natural resource user or manager, and to foment by legal statute the cooperation and coordination necessary between these institutions and the public. At present, there is confusion as to how to go about this in the institutions, apparently because of the lack of experienced human resources.

INSTITUTION CAPABILITIES

The government institutions which are responsible for the management of watershed resources are not for the most part accomplishing the task. The non-fulfillment of watershed management needs in the countries is based in manifold problems involving weaknesses in legal bases, politics, economics, but most importantly: a scarcity of appropriate human resources.

This section of the report profiles the different government institutions involved in the utilization and/or management of watershed resources in each of the countries, in order to assess their capacity to manage the same.

INSTITUTION PROFILES - COSTA RICA

Oficina de Planificación Nacional y Política Económica (OFIPLAN)

Organization

OFIPLAN was created in 1963 by law No.3087, with the basic objectives of the superior planning body: elaborate plans to increase production and productivity, insure the best distribution of wealth and social services, maintain the national planning system to best involve all public institutions, and carry out the National Development Plan (see appendix CR-1). The planning is carried out on both national and regional levels as well as sectorially.

Any project or program deemed within the bounds of the National Development Plan is screened through the system in order to qualify and quantify benefits. International assistance programs are worked through the International Technical Cooperation Division. OFIPLAN is currently being partly financed by IDB monies ($800,000). The National Development Plan under the new government is in preparation.

Natural Resources

Natural Resources-related development plans are produced by the Agricultural and Renewable Natural Resources Section of the Sectorial Planning and Coordination Division (Appendix CR-1). Projects are developed by the staff or are presented for review from sector organizations (DGF, MAG) or international aid organizations.

Of interest to this study is that the Natural Resources Section is developing a proposal to create a forestry sciences school at the

Instituto Tecnológico de Cartago. Although not presently under study, interest was expressed for the creation in the same school of a watershed management program. Also, this organization produced the Plan Nacional Forestal (see Appendix CR-2).

Critique

The Agricultural and Renewable Natural Resources Section of OFIPLAN has a young and astute group of professionals. There is a need, however, in some assessment of their activities in the realm of natural resources management. Also, there is little legal expertise in the planning office - something that is needed to insure comprehensive implementation of natural resources programs.

Ministerio de Agricultura y Ganadería, Dirección General Forestal (DGF)

Organization

DGF was created with the promulgation of the Forest Law No.4465 in November 1969 which laid down general policy for the protection, use, development and conservation of the forest resources in Costa Rica (Appendix CR-3). The law covers the gamut in stipulating the duties of soil conservation, the creation of parks and reserve, watershed management, forest management, land use zoning, wildlife protection, resource investigation - all of which fall under the Ministry of Agriculture and its DGF. DGF has an organization which reflects its mandates under the Forest Law (Appendix CR-4), with administrative, legal, and infrastructural support services to four major divisions: 1) Economics and Industry, 2) investigations, 3) Conservation, and 4) Forests. These in turn carry out their programs through the forest districts. The functions of each divi-

sion are described in Appendix CR-4. FAO (forest Production), IDB (reforestation tax credit), and USAID (fuelwood project, natural resources project) are directly aiding DGF.

Watershed Management

DGF is by law the principal or lead watershed management organization in Costa Rica. Through its Conservation Division, the Department of Conservation of Soil and Water Resources seek to study the watersheds of the country to determine critical areas in need of protection, establish priority action and rehabilitation areas, and initiate conservation and protection programs. It is to do all this with very limited funds and personnel.

Realizing this, USAID developed the Natural Resources Conservation Project together with MAG/DGF. The major components of this $21 million, 5-year project are: 1) Policy Analysis and Research in Natural Resources (legal policy assessment, technical and silvicultural research), 2) Pilot Watershed Management Projects, 3) Reforestation and Range Management 4) Forestry production (commercial scale), 5) Resource Management Planning, and 6) Environmental Education.

Because of limited human resources the project has been scaled down to one watershed (Rio Parrita) that will be used as a model for the others (see list of project personnel, Appendix C-5)

Critique

Although DGF is the lead watershed management agency, mandates also exist for ICAA and ICE. It is irresponsible that these agencies have not collaborated in developing a watershed management infrastructure through DGF that could benefit them all. DGF, although recently adding perhaps 100% more personnel with the implementation of the Natural Resources Project, is still only marginally capable of watershed management activities. The project is designed to give "hands on" experience to the DGF staff. Training funds in the Natural Resource Project budget amount to only 8% of the total. This figure should be 5 times that at least in order to leave a "legacy" in the country after the 5 years of the project is over.

Instituto Costarricense de Electricidad (ICE)

Organization

ICE was created in 1949 by Law No.449 in order to develop rationally national energy sources (especially hydraulic resources) to fortify the national economy and promote the well-being of the people of Costa Rica (Appendix CR-6). Specifically ICE is to plan and develop hydraulic resources in order to provide electricity throughout Costa Rica to satisfy industrial and domestic demand. ICE has a comprehensive organization consisting of planning, engineering, and execution branches (Appendix CR-7).

ICE has identified up to 75 possible hydroelectric projects in addition to existing ones and those in execution for a total potential of an additional 9000 mw of capacity (see Appendix CR-8). At present ICE operates about 95% of all electricity generating plants (there are two

other cooperatives). Costa Rica has an installed electrical generation capacity of 662 mw of which 506 mw is hydro. The thermal plants are for peaking whyle hydro supplies 99% of energy demand (as of 1982). A list of existing projects and power plants is given in Appendix CR-8. Future envisaged projects, if constructed, would add an additional 880 mw by 1990 (Appendix CR-9).

Watershed Management

In the same law that created ICE in 1949 are subsections mandating ICE to "conserve and protect hydraluic resources, protecting the watersheds and working in collaboration with other public institutions to carry out this task;" however ICE has not kept to the letter of the law. The Institute did provide forest guards in the Rio Macho Reserve (until a decree in February 1981 gave full watershed authority to DGF) and still does pay salaries of guards supervised by DGF. Also, ICE provides for inventories of watershed and diagnostic management plans (Arenal, Palomo), but does not carry these plans out or see that they are carried out by other authorized institutions.

Critique

It is unfortunate that ICE has not been more aggressive in the management of its priority (project) watersheds. To make the excuse that the responsibility is that of DGF is irresponsible considering that ICE has the most to lose should watersheds become seriously deforested and deteriorated. ICE should actively seek a strict collaboration with DGF and provide the funds necessary for management of the most critically degraded watersheds in existing projects and actively manage those of future projects.

Instituto Costarricense de Acueductos y Alcantarillados (ICAA)

ICAA was created by Law No. 2726 in 1981, in order to carry out the necessary planning, politics, laws, financing, and development needed to provide potable water and sewage treatment for the nation. The organization is involved with the development of surface and underground water projects and is one of the most important watershed "users" (see Appendix CR-10).

According to Article 2,C of Law 5915 (1976), ICAA must "promote the conservation of watersheds and their ecology" (Appendix CR-11), but in practice there are no real watershed activities besides some forest guards in water supply reserve areas. ICAA has done some watershed inventories as a part of their future planning (Appendixes CR-12 and CR-13), and made recommendations for the protection of those watersheds. However, the responsibility of watershed management in itself is accorded the Dirección Forestal.

Critique

ICAA should take more responsibility for their priority watersheds by entering into collaborative projects with DGF.

INSTITUTION PROFILES - NICARAGUA

Ministerio de Planificación (MIPLAN)

MIPLAN is the superior planning organization for the Government of Reconstruction, which was created shortly after the change in government on July 19, 1979. All programs and projects of government as well as private sector institutions must be approved and authorized by MIPLAN.

Of Particular interest in the area of natural resources is the Department of Territorial Studies which provides baseline studies and reports on natural and socio-economic resources by Departamento (remembering that INETER pertains to MIPLAN). This department is within the regional planning division of MIPLAN. Organization of this department is too recent to have established concrete objectives, however it is apparent that the department will have collaborative and review authority in cases of inventories and management plans involving natural resources. The department consists of:

1 Regional Planner (department head)

4 Architects

1 Ecologist

1 Agronomist

Critique

MIPLAN, in its authority to approve certain projects involving the utilization of natural resources, is seriously understaffed. Management expressed needs for qualified people in soils, hydrology, forestry, and environmental quality. Resources planning is another serious weakness in the organization.

Instituto Nicaragüense de Recursos Naturales y del Ambiente (IRENA)

Organization

IRENA was created by decree on August 24, 1979 (Appendix N-1) for the planning, administration, control, investigation, management and rational utilization of the natural resources of Nicaragua, which are considered exclusive property of the State. According to its organizational chart (Appendix N-2), IRENA has a planning division consisting of four departments which include a newly organized Watershed Management Planning Department. The planning division is designed to give support to three major programs consisting of: the National Forest Service, National Parks and Wildlife Service, and the Service for Environmental Improvement. Within each of these programs are a number of specific projects (see chart). IRENA is by law the only institution with Watershed Management responsibility in Nicaragua.

Watershed Management Activities

Of particular interest is the newly created Department of Watershed Management brought about with the recent internal reorganization of IRENA. The Department consists of five "specialists" (Appendix N-3) in hydraulic engineering, soils, land use, and regional planning. The principal activities and responsibilities of the Department are at present to prepare a watershed management plan for the country's priority watershed: that of southern Managua (Appendix N-4). The plan scheduled for completion in December 1982, will provide the basis for the design of programs and projects necessary for the rational use of resources, reduce soil erosion, increase aquifer recharge, and regulate precipitation runoff in the watershed. The Department of Watershed Management would, in theory, eventually produce management plans for most of Nicaragua as dictated by priorities which have been identified in a study undertaken by the semi-autonomous organization, Financiera de Preinversión (FINAPRE), which devel-

opes projects for future funding.

Watershed Management Priorities

Because the Nicaraguan Government of Reconstruction has decided to use the watershed as a sub-regional planning unit within its territorial planning scheme (see profile on MIDINRA), a study was made by FINAPRI in order to delimit and prioritize the nation's watersheds (Appendix N-5). FINAPRI first delimited 33 watersheds and then used 19 criteria to develop priorities, based on three main fundamentals: agricultural potential, socio-politics, and other potential (natural) resources. As stated earlier the Southern Managua Watershed was ranked No.1 based on its importance to Managua. FINAPRI has managed to secure funding of $500,000 from the Inter-American Development Bank which will provide a basis to begin management plans for those watersheds of the Región Occidental and Río Viejo (see Appendix N-5). These will be carried out by an interinstitutional work group consisting of IRENA, MIPLAN, MIDINRA, FINAPRI, and with technical assistance contracted from OAS. The studies will take 16 months to complete.

Critique

On paper and in its organization, IRENA is perhaps the best watershed management-oriented governmental organization in Central America. The importance and concepts of natural resources and watershed management are well understood and are reflected in the legislation creating IRENA and IRENA's planning efforts. Unfortunately, IRENA is perhaps in the worst shape in the realm of human resources. There was a grand exodus of technical professionals after the war and there is not an appropriate educational and training infrastructure to provide needed professionals. IRENA has about 50 technical people continuing their education outside of the country, primarily in forestry (USA, Canada, Cuba, USSR, Honduras, and Venezuela). This will not be fully appropriate however for watershed manage-

ment. IRENA Management states that the primary problem in managing the natural resources of the country is the lack of appropriate trained personnel.

Instituto Nicaraguense de Energía (INE)

Organization

INE was created on March 29, 1980 by Decree No.352 (Appendix N-6) to plan and execute programs and projects involving the exploitation of hydraulic, petrothermal, geothermal, and non-conventional resources in order to provide, distribute, and supply electrical energy throughout Nicaragua. According to its organizational chart (appendix N-7), INE is obviously geared only to the construction and maintenance of the national electrical generating system. There is no emphasis on watershed management; a program that would likely fit into the organization both in the planning department and at the project levels. INE currently maintains 100% of the hydrometric stations and 60% of the meteorological stations in Nicaragua.

Hydroelectric Projects

INE is the most important "user" of hydraulic resources in Nicaragua, currently generating 32% of Nicaragua's electrical energy needs through hydroelectric projects. The importance of hydroelectricity in the overall mix of energy sources is demonstrated in appendix N-8. Hydroelectric sources will produce 50% of needed electrical energy by 1990 and 70% by 1999, with geothermal helping phase out thermal (petroleum) plants by the early 1990's.

INE is currently extending the capacity of its Centroamerica hydro

plant with construction of the Asturias project, which will facilitate additional energy generation. Other hydro projects are identified in the following table (also see map, Appendix N-9):

Nicaragua - Hydroelectric Generation Capacity

Project of Facility	Date of Operation	Source	Capacity (MW)
Centro América	1964	Río Tuma	50
Carlos Fonseca	1972	Río Tuma/Río Viejo	50
Asturias	1986	Río Tuma/Río Viejo	(added energy)
Larreynaga	1986	Río Tuma/Río Viejo	32
Mojolka	1989	Río Tuma	159
Copalar	1993	Río Grande	164

Critique

INE considers itself an engineering institution and does not want to involve itself with operation watershed management, pointing the finger at IRENA as the responsible agency. Although management realizes the importance of the maintenance of the upland watersheds, it does not feel bound by law nor ability to manage them. INE should be involved with management programs in its project watersheds if only by monetary responsibility. Project planning should include budget items for watershed activities even if carried out by other government agencies.

Ministerio de Desarrollo Agropecuario y Reforma Agraria (MIDINRA)

Organization

MIDINRA functions as the regional planning institution for agricultural production programs and projects, setting production goals, and orienting

human and monetary resources to that end. In the Division of Planning (appendix N-10) is the Sub-division of Territorial Agricultural Planning which prepares perspective land-use plans for use in developing production strategies and production targets. These are based on a multiple use approach, however there is an increasing pressure to boost production on land units, especially export crops. This planning division has the following list of personnel:

2 Soil Technicians
1 Natural Resources Specialist
1 Agronomist
1 Systems Engineer
4 Architects
2 Economists
1 Socio-Economist
1 Regional Planner
Cartographic/Photointerpretation Team

There are also support personnel (an agronomist and an architect) in each of the 7 regional offices throughout the country.

Watershed Activities

MIDINRA is striving to use the watershed as their planning sub-unit within its regional orientation. It will use the watershed delimitation developed by FINAPRI (see IRENA profile), and will also collaborate in the development of management plans for the priority watersheds around Managua.

MIDINRA sees erosion and flooding brought about by inappropriate land use and zoning as the most serious problem facing them. How to bring about changes in land use or to relocate certain groups of campesinos is to them a very difficult although needed action. Information management was mentioned as a major stumbling block. There is little or no computerized information management.

Critique

Because of recent reorganizations at MIDINRA, it is difficult to assess the role MIDINRA plays in the utilization of natural resources. They have only a skeleton crew for planning for the 7 regions within the country. MIDINRA, although in one of the best positions to bring about legal reform concerning natural resources utilization, is inexperienced and weak in this area. Considering the enormous amount of information that the planners must consult (in theory), they are in urgent need of information management assistance. According to management they would like to produce a good information base from which to plan; but are not responsible for on-ground inventories, instead they use existing information.

INSTITUTIONAL PROFILES - PANAMA

Ministerio de Planificación y Política Económica (MIPPE)

Organization

MIPPE acts as superior planning council for Panamá. All proposals for projects concerning development or utilization of natural or human resources must pass through MIPPE for review and approval. The organization has veto authority based on a proposals adherence to the national development plan and related strategies.

Projects of technical assistance must come through the Division of International Technical Cooperation recently reorganized under Economic and Social Planning (see organizational chart, appendix P-1). Projects are screened for their value to the development of Panamá; if counterpart funds are required they are located (or not) within the national budget; and final approval works its way up the bureaucracy to the ministry level.

MIPPE sights serious monetary restrictions due to the regional economic crisis, stating that projects requiring counterpart funds would have to be of the type given highest priority by the government. Because of the recent change in national government and ministers in most organizations, policy and priorities have not yet been set and MIPPE is in itself in a reorganization and reevaluation of priorities.

Critique

It is too soon after the change in government (July, 1982) to second guess the direction and priorities of the national institutions. Whether there will be a strengthening of watershed and natural resources management policy or a weakening is unknown.

Ministerio de Desarrollo Agropecuario, Dirección Nacional de Recursos Naturales Renovables (RENARE)

Organization

RENARE was created by law 12 on January 25, 1973, along with and as a dependency of the Ministry of Agriculture. This law pulled together what was formerly the Panama's Forest Service and the National Waters Commission into one functioning body, with authority based in the original forestry resources and water laws (see appendixes P-2 and P-3)

The principal objectives of RENARE are: the control of land use to ensure its rational use and the recuperation of 1.2 million hectares of degraded soils through projects of soil conservation, reforestation, agroforestry, and forestry protection. Also RENARE seeks to increase forestry production to improve Panama's economic base.

RENARE has four major departments which reflects its orientation towards renewable natural resources management: The Forest Service, Department of Soil and water Resources, Department of Wildlife and National Parks, and the Department of Agrometeorology (see organizational chart, appendix P-4). These departments support 9 separately funded programs (appendix P-4) which are supported operationally by personnel in the 10 regional offices.

External (international) assistance amounts to over $20 million for current projects totalling expenditures over the next 5 years of a total $33 million (appendix P-5). Expenditures in 1981 were nearly $6 million with 54% financed by USAID and FAO. All projects are better explained in RENARE's annual report for 1981 (appendix P-4).

Watershed Management Activities

All of RENARE activities are directly or indirectly related to water-

shed management. Of special consideration is the Department of Soil and Water Resources and the Watershed Management Project (RENARE/AID).

The Department of Soil and Water Resources has a relatively small group of professionals consisting of a watershed specialist, a hydrometeorologist, a soils specialist, and a soil and water conservation specialist. Objectives are oriented to control and reduction of soil erosion, soil inventories, optional use of water resources. Activities include: permitting water uses, licensing of sea-salt producers, maintenance of water quality, soil conservation studies, collaboration in watershed management plans, and (somewhat surprisingly) biogas research and development. The only real watershed management planning done by the Department was for the La Yeguada Watershed Protection Project and participation in the Watershed Management Plans for the Bayano Lake and the Rio Tabacerá watershed (hydroelectric projects) with IRHE.

The Panamá Watershed Management Project (AID/RENARE) is by far the largest undertaking in the country involving watershed management. This $16.8 million project is in its third year. The principal objectives are to: improve and expand the administrative infrastructure and personnel at RENARE; design administrative and management plans in the priority watersheds of the Panamá Canal, Rio La Villa, and Rio Caldera; and to execute action programs relative to the appropriate use of land and natural resources conservation. Sub-projects within this context include those of: 1) National Parks and Forest reserves, 2) Improvement and management of pastures, 3) Soil conservation, and 4) Reforestation (see RENARE's annual report, appendix P-4; Panama Watershed Management Project Quarterly Report, appendix P-6). Specific activities are described in the previously cited reports and include: agroforestry pilot projects, nursery development, silviculture, reforestation,

soil erosion experimentation plots, conservation education, soil erosion control structures, and baseline studies/information collection on physical resources. The overwhelming emphasis is on the canal watershed due to its importance to the country (and the world). This project makes up 41% of all personnel in RENARE and 46% of its total annual budget.

Critique

The Department of Soil and Water Resources' staff is small and incapable of managing the responsibilities given in it. The staff lacks a planning background or an orientation to watershed management. Although having permitting and infraction citation authority, legal and political weaknesses give RENARE no teeth with which to act. Politicians give no priority to soil and water resources management legislation even though RENARE has drafted and submitted new and more appropriate regulations for promulgation. That coupled with the small budgetary allowances for this department give it a "lame duck" authority.

The Panama Watershed Management Project had a very slow start due to political and monetary problems, but especially because of the lack of qualified national personnel (technical,administrative) on which to base the project. Nevertheless, field work has expanded greatly, especially in 1981 and in the last 7 months. Although the project may achieve many projected objectives, it is difficult to believe that the project will leave a strong natural resources management infrastructure because of the lack of training activities accorded the original project plan. Only 1.4% of the total project budget is in formal training. It should be noted that 53 students are studying forestry at the bachelor level outside of Panama while few are studying watershed management (scholarships not funded by RENARE/AID project).

Instituto de Recursos Hidráulicos y Electrificación (IRHE)

Organization

IRHE was organized to plan, develop, and maintain projects necessary to provide electricity for industrial, domestic, canal, and military uses in Panamá. IRHE also has authority and responsibility to utilize the hydraulic resources to develop the country's great hydroelectric potential in order to make Panamá self sufficient in energy and reduce dependency on foreign energy sources (i.e, petroleum). IRHE has a comprehensive organization to plan, engineer, execute, and maintain the country's hydraulic energy resources (see organizational chart in annual report, appendix P-7), and currently has a priority to develop these resources as fast as financially possible in order to reverse trade balance deficits.

IRHE has an installed capacity of approximately 527 MW of which about 438 MW is firm capacity. About 255 MW of the first figure is hydroelectric (appendix P-7) while the rest is thermal (diesel, gas). About 50% of all electrical energy consumed in Panamá is produced by hydroelectric sources (appendix P-7 and P-8). By the early 1990's the installed capacity should be more than doubled with the development of planned hydroelectric projects Fortuna (300 MW) on Río Chiquiqui to be operating by 1984 and Changuinola I (300 MW) on the Río Changuinola by 1990 (see appendix P-7).

Watershed Management Activities

IRHE created the Department of Watershed Management for two reasons: 1) RENARE's failure to give priority management to hydroelectric project watershed, 2) Requirements for watershed protection as a condition precedent in loan agreements with lending banks. The department consists of the following personnel which is used to do simple watershed inventories for the preparation of primary level management and action plans:

1 Administrator (a veterinarian)
3 Bachelor - Level Agronomists
1 Bachelor - Level Forester
1 Economist
1 Biologist
1 Hydrologist
5 Indemnization specialists

1 Medical Doctor
1 Sanitary Engineer
2 Sociologists
2 Social Workers
1 Cartographer
2 Photogrammetrists

In addition, the Department has field offices at priority watershed worksites:

Boquette (Proyecto Estrella)

1 Bachelor - Level Agronomist
1 Bachelor - Level Forester
1 Forestry Technician
1 Nursery Man
Various laborers

Changuinola

1 Administrator
3 Bachelor - Level Agronomists
3 Social workers
4 Social Promoters

Fortuna Project (Río Chiriqui)

1 Bachelor - Level Forester with a reforestation Team
3 Bachelor - Level Agronomists
1 Forestry Technician
9 Forest Guards
1 Social Worker
1 Plague Control Team

The people in the field offices of Boquette and Fortuna have began reforestation and soil conservation/alternative cropping programs. Funding is provided by IRHE and is assumed part of the development costs of each of the projects. Special funding arrangements for such activities are being planned in the budget for Changuinola and are considered in the cost/benefit analysis of the project: the first time a project in Panamá has considered such activities in the original project planning

Critique

That IRHE has created a watershed management department is an admirable achievement, regardless of the reasons. The orientation of the department in planning at the affected community level and utilizing an integrated planning approach (natural and human resources) is the right approach to managing the watersheds. Success will depend on the amount of effort, in both money and techniques, expended by IRHE.

Management expressed a need for expertise in overall watershed management planning, hence lacking that human resources. Also watershed activities should be assessed by someone with this expertise.

Instituto de Investigación Agropecuaria de Panamá (IDIAP)

Organization

IDIAP was created August 28, 1975 by Law Decree No.51 as an investigation body for agriculture in the public sector. Its prime objectives are to augment production and productivity and raise the economic level of the agriculturist with emphasis on the "small farmer." It serves as a consulting organization in the formulation and application of agricultural policies by the government and also acts as a support organization in technical training at all levels. It is sub-divided into regional offices in the four planning regions in Panamá (see organizational chart, in appendix P-11).

It operates a budget of approximately $3.5 million of which USAID finances $900,000 (1981). The AID portion is for institution building within IDIAP with emphasis on investigative work associated with the Canal watershed and its watershed management project. Projects developed by IDIAP are best explained in its annual report for 1981 (appendix P-11), primarily in three major areas of concentration: crops production and cropping system development; livestock production, forrage production, meat and dairy system improvement; and seminars and short courses concerning the same.

Natural Resources

Recently (1982) IDIAP added another program to its organization: special studies. The orientation of most of these studies is agroforestry and fuelwood:

- Investigation, Demonstration, and Training of Agroforestry Production in Panama (farming systems, land use studies) 5-years, IDIAP.
- Investigation, Development and Transfer of Improved Practices of Tree Cultivation for Fuelwood, CATIE/IDIAP (Use and Production for Sugar Industry).
- Investigations of Cashew Cultivation - IDIAP
- Establishment of Agroforestry Demonstration and Investigation Sites-IDIAP/RENARE (with annual crops).
- Characterization of Areas to Determine their Potential as Agroforestry and Silviculture Investigation Areas in Gigantito, Panama - CATIE/ICRAF/IDAIP.

Recently IDIAP signed an agreement of cooperation with CATIE, RENARE, the Smithsonian Tropical Research Institute, and the University of Panama to collaborate in future natural resources projects.

Critique

IDIAP has only recently began research in the natural resources field and does not at the present have technical or professional staff in this area except for one bachelor-level forester. They must contract for these professionals. IDIAP apparently has a good administrative make up, but the orientation is very strongly agricultural.

Smithsonian Tropical Research Institute (STRI)

Organization

STRI has studied the evolution, ecology and behavior of tropical

organisms for more than 50 years in Panamá and other tropical regions. The staff concentrates on pure research and little effort is given to applied research (see appendix P-12). Research is oriented primarily around ecology and behavior of tropical organisms.

STRI boasts an excellent technical library (appendix P-13), which is open to the public. A recently signed agreement will allow the sharing of facilities between STRI and the University of Panamá. The government of Panamá will build a National Library and archive center near STRI, at the same time that STRI is building a new technical library.

Watershed Management

The only research project directly applicable to watershed management is that work being carried out by Dr. Donald Windsor on the Island of Barro Colorado. This is a monitoring project to measure changes in the forest environment including those of meteorology, hydrology (moisture through the system), and the flowering and fruiting of many forest species.

Critique

STRI is known for pure scientific research. Several students do their post-graduate research at the faculty. Institute professors, although they ocassionally do, do not enjoy teaching and training, preferring instead to continue their research. STRI does however collaborate on such things as management plans, planning investigations, etc.

INFORMATION COLLECTION AND MANAGEMENT

There is an obvious lack of an appropriate information base upon which to make decisions regarding watershed resource utilization. What information does exist (and there is much of it) it dispersed throughout the various institutions having the responsibilities to generate it. In many cases, numerous institutions collect the same types of information, but do not consolidate their data. (This is especially true for hydrologic, meteorologic, and soils information.) In some cases information is considered "privy" to the institution collecting it, and should "only be applied to their projects and planning activities."

Although the sectorial or supreme planning organizations must consult all existing information in order to base development decisions, they must carry out literature and data searches every year. This section briefly profiles the principal information agencies in each of the countries, although it does not mention all of the institutions which collect and maintain watershed resource data. Also profiled is IICA, and its regional information gathering efforts.

Instituto Nicaragüense de Estudios Territoriales (INETER)

Organization

INETER was created by Decree No.830 (Appendix N-11) on October 5, 1981 and is responsible for the study, classification and inventory of all physical (natural) resources in Nicaragua and to collaborate in the planning for their utilization. The law groups three formally separated organizations under one organizational structure: the Instituto Geográfico Nacional, Servicio Meteorológico Nacional, and the Instituto de Investigaciones Sísmicas. INETER will function as a program under the Ministry for Planning (MIPLAN).

As is illustrated in the organizational chart (Appendix N-12), INETER is responsible for collection of data concerning soils, surface waters, ground waters, seismology, geology, meteorology, hydrology, geodesy, map making, and documentation of the same. Personnel at present include:

1 Surface Water hydrologist
1 Ground water hydrologist
1 Geophysics Investigator
1 Civil Engineer
3 Geologists
1 Volcanics Scientist
19 Photogrammetrists
10 Geodetic Technicians
6 Agrometeorologist Technicians
150+ support field personnel in mapping and data collection.
5 Meteorologists
3 Aeronautic Meteorologists
11 Meteorologist Technical Assistants
3 Computer Specialists
4 Documentationists
5 Key Punchers
3 Cartographers
10 Draftsmen
9 Climatic Technicians

INETER is supported at present by several technical assistance programs including: an Italian mission for remote sensing and a Cuban mission for remote sensing (training and equipment) and photogrammetry.

Critique

INETER is only now in the initial stages of organization. Management states that at present capacity of personnel, budget, and experience that INETER will be hard placed to take on new projects such as the watershed management planning project developed by FINAPRI. That most of the responsibilities for the inventory of natural resources rest with INETER, there is a good chance that in the future information will be better collected and consolidated in one place.

There is however the reality that INETER is painfully understaffed and under-equiped, especially in the management of all the information, whether existing or to be collected.

Instituto Geográfico Nacional (IGN) - Costa Rica

The Institute is responsible for the maintenance, updating, and development of geographic materials that are needed by all public institutions in their planning and development needs. The Institute consists of mapping and reproduction facilities, photogrammetry laboratories, a map and air photo library, and a number of special project offices that include a remote sensing/land use mapping project financed by IDB ($600,000); that will result in a comprehensive land use map taken from satellite imagery and air photos which will be updated as needed. IGN collaborates with other institutions (SEPSA, DGF) in the reproduction of thematic maps such as soils and forest cover.

Secretaría de Planificación Sectorial (SEPSA) - Costa Rica

Because of reorganization, the Natural Resources Section of SEPSA has been transferred to the Dirección General Forestal for a more comprehensive resource planning approach. For this reason, this Section is included under the profile of DGF.

Instituto Geográfico Nacional "Tommy Guardia" (IGN) - Panama

Organization

IGN was created in 1946 as a cartographic unit under the Ministry of Public Works. It has since acquired much more responsibilities in the inventory and mapping of physical resources in Panamá. Within its jurisdiction is the development of information (through mapping) needed for the investigation, planning, and execution of diverse projects in the socio - economic development of Panamá. Specific objectives of the Institute include: production of topographic, nautic, aeronautic, and thematic maps in whatever scales necessary for the various planning and programming agencies and the public; update and publish periodically the National Atlas of Panamá; and maintain and update information needed in the fields of geography, photogrammetry, geodesy, hydrography cartography, and topography.

According to the organizational chart (appendix P-9), IGN is divided into various disciplinary units reflecting specialization in map making. IGN also has a public sales office and maintains a small library containing geographic and technical information. IGN gets technical assessment from the Inter-American Geodetic Survey and the Pan-American Institute for Geography and History (OAS).

Critique

IGN "Tommy Guardia" has a professional and responsible staff. They are well trained and capable. What is missing is a good information management system within the context of data maintenance. This causes somewhat of confusion in the "existence" and location of pertinent natural resources information.

Instituto Interamericano de Cooperación para la Agricultura (IICA)

IICA is the technical assistance branch of OAS for agriculture in Latin America and the Caribbean. An orientation to some of the programs carried out by IICA and an organizational chart is presented (in appendix R-1).

IICA recently began investigations into the possibilities of creating a new natural resources program for technical assistance in Latin America and the Caribbean, but because of financial obstacles, this has been placed on the "back burner."

Of particular interest to this study is the information and documentation program in IICA, Centro Interamericano de Documentación e Información Agrícola (CIDIA) and its recent activities in the collection and documentation of natural resources information in Central America. CIDIA was created to better facilitate the management of the ever-increasing amounts of agricultural information in the region. Through its program, various projects and sub-programs including computerized bibliographic systems, thematic bibliographics, information management systems, etc. have been developed. A CIDIA/ROCAP project known as Programa de Infomación Agropecuaria del Istmo Centroamericano (PIADIC) was begun in 1976 to create a better organized and systematic information collection and documentation scheme for agriculture in Central America and Panamá.

The PIADIC scheme involved the inventory and classification of physical and socio-economics resources through a sample-frame profile creating new inventory units based on easily identifiable physical and cultural features. The configuration and area of the sample frame could be different depending on the features. Once established and inventoried this

frame could be reinventoried periodically and resource utilization and production per unit area could be quantified.

One of the inventory and documentation methods employed is the computerized geographic information system (CRIES) developed by Michigan State University. This system provides a systematic framework for the storage and analysis of mapped information. The system is being developed by IICA (CIDIA) with financial assistance from ROCAP and technical assistance from Michigan State University. Approximately 8 thematic maps including land use, life zone ecology, population density, dry season, annual precipitation temperature and evapotranspiration, and political boundaries have been logged into the system for each Central American country and Panamá. Several applications of both regional and national levels have been performed using the system, and efforts are being made to move the system into each of the countries. The system has already been installed at CATIE. In Costa Rica, the Dirección General Forestal is expanding the use of the system, inputing more information for larger scale analyses for projects within its jurisdiction including the DGF/AID Natural Resources Project.

Critique

The staff at CIDIA is both efficient and professional and the administration is flexible enough in its support of the development of new programs. PIADIC was perhaps too ambitious in its goal to reorganize existing resource information into area sample frames. It would have been more advantageous to begin with the consolidation of existing information of all kinds under one roof, perfect the collection, storage and documentation of this information, and then perhaps later improve on the system. Nevertheless, PIADIC made great inroads into Central America in information management, setting up experienced groups in various ministries of government (see Appendix R-2). This experience should not be lost, but should be followed up with technical assessment.

EDUCATION AND TRAINING INFRASTRUCTURE

All of the Central American countries have some form of education oriented to natural resources management. This orientation is rooted in soil and water resources management involving agriculture and does not usually take into account the interrelation of all natural resources, nor their rational management for multiple-use and conservation. For the most part, this education is offered in the schools of agronomy of the national universities and may involve a sub-program of forestry leading to the technician level. Although there is interest on the part of most universities in the region to expand curricula to include more natural resource management programs, necessary funds and manpower is lacking. There is also an accute absence of natural resource-related texts (especially in Spanish). This section briefly profiles the principal education institutions with some sort of natural resource curricula. Also limited by the absence of a natural resource-related education infrastructure, is the lack of appropriate investigation in the same field. Some simple investigations are carried out in relation to thesis work at the universities and regional centers, but is of little consequence considering the enormous natural resource management problems in the region. Perhaps the most important research is carried out at CATIE - the regional research and training center.

Instituto Tecnológico de Costa Rica (ITCR)

ITCR has a natural resources-related program already developed within the Institute's Division of Civil and Forestry Engineering (see Appendix CR-14). Under the Department of Forestry Engineering, students may obtain a 4-year (Bachiller) technical degree with concentration in one of four areas: forestry engineering (basic), silviculture, dasonomy, or forest management. Watershed Management basics are taught in the latter program. The program for the most part is considered basic leading only to the technical and not "Ingeniero" level (licenciatura).

According to OFIPLAN, there is growing interest to develop a 5-year forestry sciences school at the Institute. A proposal is already being studied by OFIPLAN. At present there is no provision for a watershed management sub-program.

Critique

ITCR is young and growing with new facilities and a young and capable staff in the natural resources field. The staff is limited, however, and any forestry sciences school would require staff expansion, as would any sub-program in watershed management.

Universidad de Panamá, Facultad de Agronomía

Organization

The Facultad de Agronomía has a program of natural resources focus - primarily to forest production. The School is split between Panama City and David, Chiriqui, with most of the program located recently in the latter. The natural resources focus is located in their Desarrollo Agropecuario School (see curriculum, Appendix P-10, P.33), under Protección Vegetal. This program

however, does not lead to any real proficiency in forestry since the degree is still in agronomy.

The faculty has expressed interest in a watershed focus within this same program - i.e., a sub-concentration in water and soil management. They are, however, weak in human resources without any expertise in this field. The dean says he would prefer Latin American expertise because of the acceptance factor of the students.

Critique

That the interest is there for establishing watershed management curricula is of course the first step in broadening the natural resources planning orientation in the educational system in Panama. It was notable the absence of any faculty members in the natural resources field.

Universidad Centroamericana (UCA)

Organization and Watershed Management Programming

Under the Facultad de Ciencias Agropecuarias, the School of Ecology and Natural Resources has a 5-year program leading to a Bachelor of Science (Licenciatura) degree. The Consejo Nacional de Educación Superior decided that Natural Resources is one of the top priorities in national education, so UCA has been trying to improve its focus on this discipline. In its 5 year-program: 3 years are of basic preparatory and fundamentals of natural resources; the last 2 years are then directed at one of the 3 sub-programs of 1) Flora, Fauna, and Wildlands, 2) Fisheries and agriculture, or 3) Forestry and Watershed Management (see appendix N-13).

Although the programs are projected until 1986 and are currently under way, there is an acute lack of professors to follow through with the three 2-year concentrations. There is but one specialist in the 3 fields - these instructing part-time after their normal jobs with the government resource agencies. There are currently two guest professors provided through the LASPAU exchange system with universities in the USA; these in aquaculture and forestry.

Critique

Obviously UCA is understaffed in the natural resources area. The director mentioned three areas of need: human resources, texts, and an updated library of recent articles and journals. The administrative and organizational basis exists at UCA, but needs in the areas mentioned will keep UCA from producing adequate and appropriate professionals in the natural resources field.

Centro Agronómico Tropical de Investigaciones y Enseñanza (CATIE)

Organization

CATIE was created under IICA as an investigative body and research section in agriculture and livestock production. The organization consists of four major departments (see Appendix R-3): Animal Production, Crops Production, Human Resources Development, and Renewable Natural Resources. The Department of Renewable Natural Resources is of importance to this study as is the entire physical plant of CATIE.

CATIE boasts the best library in Central America and the Caribbean for agriculture and natural resource-related publications. It is currently building a new library and has recently installed a new IBM computer with 20 times the capacity of the old system.

Department of Renewable Natural Resources

The Department's objective as stated in its annual progress report for 1981 (Appendix R-4) is: promote the harmonious development of renewable natural resources through the planning, rational use, and more favorable interactions of land use, with the goal of satisfying both long and short-term needs of the rural population. There are three major programs in the Department: silviculture for forest production, agroforestry systems, and wildlands and watershed management. There is also a Forestry Information Service in the department (INFORAT). The annual report discusses specific projects and accomplishments of the Department. Also included in the report are financial and funding statements for the projects and participating bi-lateral and multi-lateral aid organizations. ROCAP is funding three projects in the Department: 1) Fuelwood and Alternative Energy Sources, 2) Agro-

forestry Training, and 3) Watershed Management Specialist and operating funds.

Wildlands and Watershed Management Program (PASC)

PASC was added as a formal program to the Department in 1977 with core budget covering the salaries of the program principals. The program's forte has been in wildlands and parks planning through which several park and reserve management and interpretive plans have been produced (see PASC annual report, Appendix R-5), this primarily due to the work of the program director and his assistant - both professional resource planners, and that of several short-term consultants. The watershed management part of the program has suffered neglect from the outset although watershed management is considered part of multiple-use resource management. From 1977 to 1980 the program employed one part-time watershed specialist to teach courses and prepare seminars, but his time was quite limited. Up until September 15,1982, there has not been any watershed personnel at CATIE, when a Ph. D. Civil Engineer/Hydrologist/Watershed Resources Planner was added to the staff (ROCAP funded). It is now up this specialist to provide instruction, investigative leadership for various post-graduate students, and to collaborate in the needs of watershed management in the region. Accomplishments of the program in watershed management are reviewed in Appendix R-5. An expanded profile is provided in Annex 1 which further explains the regional activities of PASC.

Critique

CATIE serves an important function in being the only regional center for the study, training, and project coordination in natural resources for Central America and Panamá. It continually suffers from financial and political fluctuations due to its "adjunct membership" in IICA, and administrative changes tend to shift the organizational structure every two or three years. CATIE's

research station and proximity to diverse ecological zones in Costa Rica give it a unique location for carrying out investigations and training.

The Department of Renewal Natural Resources is currently undergoing a change in the personnel of several key positions, hopefully to fotify both investigation and training components. Although a watershed management specialist is being added to the staff, he is by no means enough considering the work that CATIE could contribute to the region in this field, including the integral linkage with and strengthening of the Wildlands Management Program in the Region.

The Department of Renewable Resources is in the position of not only being able to carry out its specific task-oriented programs and projects, but because it shares CATIE with the other departments, can enjoy an interdisciplinary interchange of ideas.

The well-tested and proven approach to strenghtening the region's and each nation's human resources and institutions already well underway in wildlands management demonstrate the strategy, tactics and methods needed to do the same in watershed management; linking the two even more effectively and with other natural resource management activities. The project proposed in this study would profit from, build upon and improve that approach.

The Department's staff for the most part is capable and professional, but considering the importance of such a regional center, the Department is limited by the human resources available. The Department turns down many requests for technical assistance due to the shortage of manpower.

PROPOSED REGIONAL WATERSHED MANAGEMENT PROJECT

Based on the discussions in the preceeding sections, it is clear that any assistance program concerning the management of watershed resources, must be geared to the resolution of related weaknesses in the legal, institutional, educational, and information infrastructure in the Central American countries. The following is a proposed project of regional design, consisting of a series of components which address the various weaknesses in the capabilities of the institutions to manage watershed resources in Central America and Panama. The project would strengthen the watershed management infrastructure at the regional and national levels.(also see García Report).

Project activities would complement the USAID natural resources projects operating on national level (Panama, Costa Rica, Honduras, and El Salvador), as effort will be made to directly involve personnel and objectives of thos projects. The activities of the regional project should furthermore have a strengthening effect on those of the host country/AID projects in their provision of a human resources and information infrastructure which is directly related to needs in the national project areas.

Project Goal

Strengthen national institutions to better plan, manage, utilize their watershed resources.

Project Objectives

1. An adequate infrastructure of human resources and operational capability within the natural resource institutions at the national level.
2. National watershed management plans that include the prioritization of principal watersheds and diagnostic plans that will facilitate future funding for specific watershed management projects.

3. A more appropriate mechanism (s) for the collection, analysis, management, and dissemination of natural resources information pertinent to planning on national and regional levels.
4. The substantial improvement in the legal and policy base necessary to bring about the more rational utilization of watershed resources through the more effective cooperation and comprehensive management between government institutions.

Project Organization and Methodology

The project will be coordinated by CATIE in Turrialba, Costa Rica through the Wildlands and Watershed Management Program (PASC) within the Department of Renewable Natural Resources (DRNR). PASC will augment its present staff to facilitate the administration of a series of components designed eventually to strengthen national government natural resource institutions, so that they can better manage and utilize their watershed resources with little or no external assistance. PASC will build its staff, and in the first year of the project will collect information and make the formal contacts necessary to establish priorities for the plans of action, sign formal agreements of collaboration with counterpart institutions at the national level, and contract the necessary personnel.

Once established at the national level, PASC will orient and assist counterpart institutions in the implementation of the components listed below. PASC will furthermore execute the components of special emphasis (instructional resources) at CATIE.

The Comité Regional de Recursos Hidráulicos (CRRH) and the Secretaría de Integración Económica Centroamericana (SIECA) will collaborate in both the preparatory and execution stages of the project (See García report).

The project period is 5 years, including one year for start-up activities at CATIE and 4 years of project activities throughout the region.

Figure 1 suggests the possible organization of the project and lists collaborating and national counterpart agencies. The organization is further explained in following sections with the description of components.

COMPONENTS

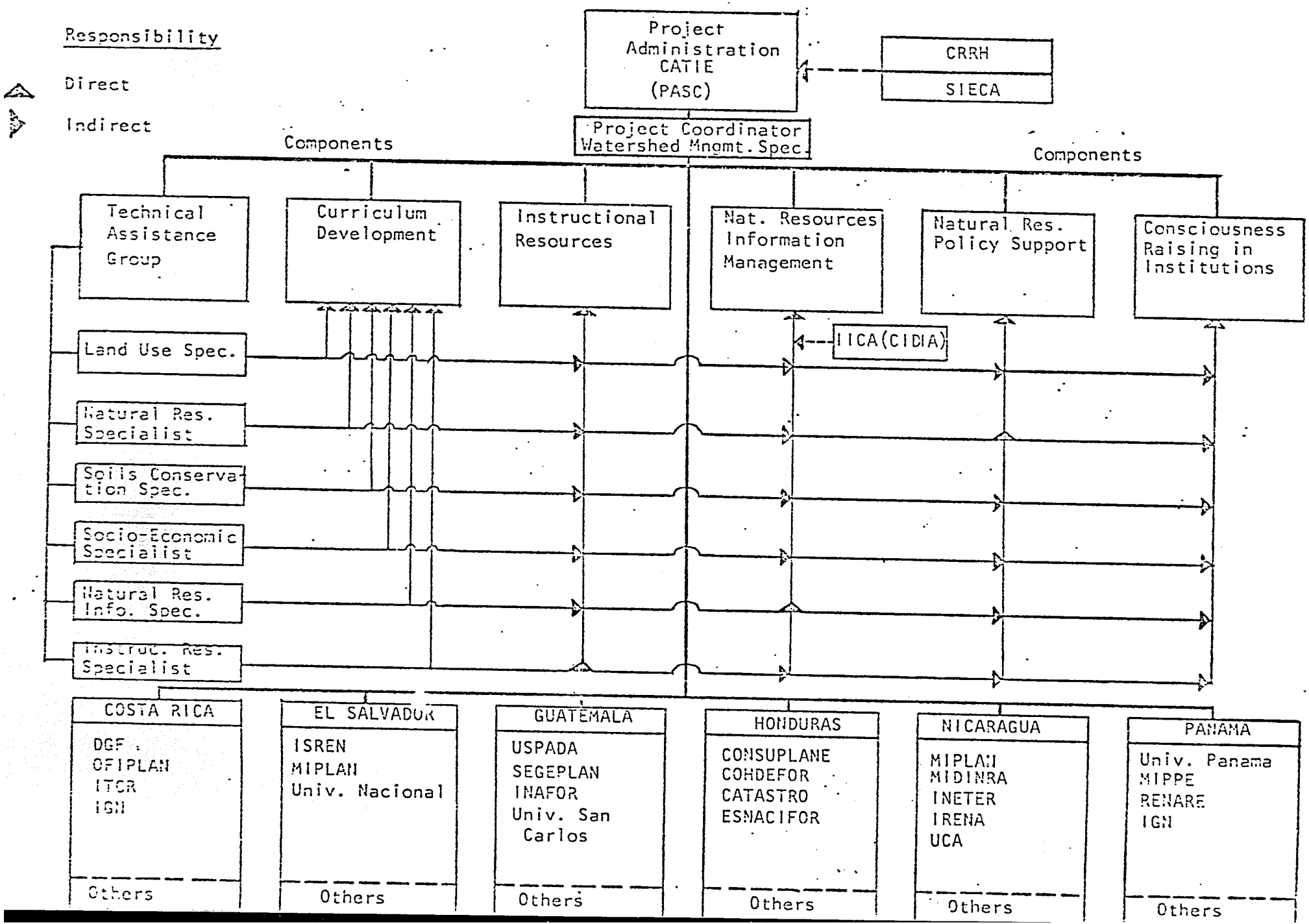
1. Technical Assistance Group for Watershed Management at CATIE

A group of professionals will be contracted to augment the staff of PASC in the Department of Renewable Natural Resources at CATIE. This group (see terms of reference) will coordinate the Regional Watershed Management Project and provide technical professional consulting services to the national natural resource organizations in the planning and management of their watershed resources, and collaborate in the execution of the other project components.

During the first year, CATIE in coordination with the CRRH will assist the national institutions in the execution of a natural watershed inventory of information already available within the institutions related to the actual and potential use of watershed resources (e.g. hydraulic and forestry resources) that will provide a first level classification of watersheds according to importance. Based on the watershed inventory, during the second year the project specialists will also assist in the preparation of a preliminary national watershed diagnoses. This diagnosis should include more detailed information on physical and socio-economic variables within selected watersheds and will contribute to the development of pilot watersheds for train-

FIGURE 1

PROPOSED PROJECT - ORGANIZATIONAL STRUCTURE



ing, investigation and demonstration purposes (see Curriculum Development component).

Once the above information is available, the next step will be the preparation of national plans and strategies for the management of watershed and related resources based on priorities which are consistent with national development plans.

Annex 2 presents a list of the principal specialists that will be needed for project implementation. Also, presented are the terms of reference for each specialist. Resident project managers will be needed for the coordination of activities at the national level (see García Report). Their terms of reference are not included here because they will be selected in each of the countries (preferably host-country nationals) and their terms will be designed by the Project Coordinator based on the needs within each country. Auxiliary personnel (secretaries, field assistants, etc.) are also not included included in this report.

In addition to those specialists contracted directly for the project, collaboration will be sought from other CATIE staff members in the planning and implementation of various aspects of the project. These staff specialists include but are not limited to those in: agroforestry, forest production and economics, ecology, natural resource economics, hydrology, wildlands and parks management, computer sciences, and information management. Also, as needs dictate, consultants will be contracted to provide short-term project support.

2. Curriculum Development

The project staff at CATIE will visit the designated educational institutions in each of the countries (see organizational chart) will consult with university directors and professors, review existing programs in natural

resources, and will determine how best to support and strengthen the curriculum in watershed resources management. At the same time, an assessment will be made concerning the capabilities of the natural resources institutions. Areas of deficiency in watershed management will be targeted for support. Support for the national educational and regulatory institutions will probably be in the form of a combination of the following sub-components:

a) Intensive short courses in rotation of 1-2 weeks taught by CATIE project staff and/or other contracted experts.

b) Provision of full time professors for certain periods (3-9 months) from universities already established in watershed management. These professors could be directly contracted; loaned through the university; provided by Title 12 grant funds to U.S. universities; or provided through LASPAU agreements with U.S. universities. Effort would be made to try to obtain professors from Latin American universities. In any case, the professors and their teaching program would be screened by the project staff and will be fluent in Spanish.

c) Provison of instructional resources in the form of instructor's guides, education modules, texts, bibliographies, journals, magazines, training packages, minor field equipment, basic audiovisual equipment, etc. as deemed necessary.

d) Scholarships and research assistantships especially at post-graduate levels to Latin American universities and training centers (CIDIAT-Venezuela, Chapingo-Mexico, ESNACIFOR-Honduras, CATIE-Costa Rica, ERIS-Guatemala) and to universities in the United States. Candidates would come from government institutions dealing in watershed resource management or particularly bright students from national educational institutions. A screening

committee will be formed of members of the project staff and regulatory and educational institutions in each country to select the scholars according to the specific needs in each of the countries (e.g., in order to meet deficiencies).

Concurrently with the development of national watershed management plans (see Component No.1) and the curriculum development activities mentioned above, a series of pilot watersheds will be established in order to provide a physical base for training and demonstration projects, investigations, and watershed management models. Preferably, one pilot watershed will be established in each country, allowing the participation of both educational and regulatory institutions. The watersheds should be within reasonable travel distance from the institutions. These watersheds will provide a proper setting for gaining practical experience in the planning, management, and utilization of watershed resources. Also, investigations in hydrology, silviculture, soil erosion control, etc. will be promoted within the watersheds in accordance with the needs and interests of the educational and regulatory institutions in watershed management. The watersheds will be used as a practical "laboratory" for the implementation of the project components.

By virtue of the addition to the PASC of the project staff members with varied expertise, the Department of Renewable Natural Resources educational program will be greatly strengthened during the residence of the staff. Project Staff members will be required by contract to teach courses in their respective fields of expertise, as directed by the head of the department and the head of the PASC. The added "professor months" will complement the curriculum already in place at CATIE, and will contribute greatly to the development of professionals in the watershed management field at CATIE's graduate school, as well as provide staff for participation in seminars, short courses and congresses.

Counterpart institutions will include: Instituto Tecnológico de Costa Rica, Universidad de Panama, Facultad de Agronomía (Panama), Universidad Centroamericana (Nicaragua), ESNACIFOR or CURLA (Honduras), Universidad de San Carlos-ERIS (Guatemala) and Universidad Nacional (El Salvador), in addition to the natural resource regulatory agencies.

3. Instructional Resources Development

The Instructional Resources Specialist on the project staff at CATIE will use project funds to develop an instructional resources laboratory. This laboratory will consist of a photographic laboratory (basic), layout and art station, audio-visual prep station, cartographic station, etc. Necessary equipment for these stations will be purchased; local technicians, artists, and cartographers will be hired full or part-time as needed.

As stipulated in the terms of reference of the Instructional Resources Specialist, he/she will: collaborate with other project staff and DRNR specialists to develop training or education modules and publications, whose theme and content will be determined by those specialists. Specific and general themes will be developed as deemed necessary such as: silviculture, fuelwood production, hillside agriculture, soil erosion control structures, parks planning, watershed management, agroforestry, and information management. Those modules can take the form of multi-media presentations (slide and cassette, filmstrips, maps, models), audio visual (ektachrome or video), or simply thematic publications or handbooks. The Instructional Resources Specialist will be responsible for format, layout, design, editing, photography, and all aspects of production and publication. Modules and packages can be duplicated or rotated through the different countries as needed. Technology, however will be kept at a level appropriate to the educational and regulatory institutions involved. The target level of the modules will be determined by the project staff. Several literacy levels may be developed for the same theme, for instance, a watershed management module for the

technical student and one with a different focus for decision makers and management (less technical and more economics). The Instructional Resources Specialist will collaborate his/her effort with the public relations department at CATIE and when and where possible will move to expand or share facilities.

Another focus of this component is the provision of bibliographies, pertinent texts, journals, articles, and other publications to the institutions who are deficient in these complementary educational materials. The project staff will, after consultation with the designated educational institutions, determine their needs for certain types of information and texts. The staff will then work with INFORAT in order to procure the documents through the proper channels, and to later distribute them accordingly. It may be necessary to support INFORAT with more personnel (Secretary/Documentation clerk).

4. Natural Resources Information Collection, Analysis Management, And Dissemination

The Natural Resources Information Specialist will assess the "state of the art" in natural resources information management in each of the project countries and at the regional institutions. Based on this information, the specialist will designate one institution as the project counterpart for the development or improvement of information, collection, analysis, management, and dissemination in each country. The counterpart institution will supply personnel from its present information staff. The specialist will collaborate directly with the director and staff of CIDIA at IICA and INFORAT, will review present and past information management projects (PIADIC), will integrate with or expand existing infrastucture in information management at

CATIE and INFORAT (AGRINTER, AGRIS, CRIES, SAS), and will as much as possible incorporate into the project remnants or preestablished infrastructure of those programs existing in each of the countries.

The project will seek to establish a central or focal institutional location in each of the countries where natural resources information to be used as a planning base can be collected, stored, and managed. The CRIES system will be set up in each of these institutions and a constant interchange between the project's regional information center (CATIE/IICA) and these institutions will keep the system concurrent across the board. Analytical data will also be stored in the system utilizing SAS or other systems that can be interfaced with SAS. Where comparable computer systems are not available, appropriately interfacing manual systems will be developed. Efforts will be made at CATIE to perfect the information management system for natural resources already in place. If not already procured, a digitizer will be purchased to facilitate the codification and analysis of mapped information with the CRIES system. The project will have direct collaboration with the CATIE and IICA computer centers and will work in tandem with their personnel. Short-courses for information management system users will be held to demonstrate the utility and to stimulate the application of the system within CATIE.

Training modules and short-courses will be prepared by the project staff to facilitate transfer of information management techniques to the countries. The modules are intended to provide a static teaching mechanism in view of the shortage of human resources. Seminars will be held in each of the countries only after the system has been set up and demonstrated its utility to the designated information institutions. Seminars will demon-

strate the function and utility of the system to other relevant natural resource planning and management institutions.

This component will further serve to indicate the existence of important data gaps in the natural resources planning base, thereby giving priority to natural resources inventories and/or information collection activities in each of the countries.

Counterpart organizations will include, but are not limited to: Dirección General Forestal (Costa Rica); IRENA and INETER (Nicaragua); Instituto Nacional "Tommy Guardia" and RENARE (Panama); COHDEFOR and Catastro Nacional (Honduras); IGN and INSIVUMEH (Guatemala); IGN and ISREN (El Salvador).

5. Legal Policy Support for Natural Resources Management

The Natural Resources Policy specialist will compile and review all organizational and operational plans, legal decrees, organic laws, land tenure regulations, and agreements concerning the management of natural resources in each of the countries. In collaboration with a counterpart to be designated within the superior planning organization in each country, the specialist will analize the effectiveness of each of the legal instruments and their relation to the authority and responsibilities of the natural resources management or user institutions and their operational plans.

The specialist and counterpart will then prepare guidelines as needed, which would better facilitate the collaboration and designation of responsibilities within the institutions. The project would then seek to lobby, pressure, or otherwise convince the appropriate politicians and decision makers to adopt and support the policy guidelines thereby strengthening institution activities for optimal watershed resources management in each of the countries.

The legal specialist will also prepare courses, lectures, and assist in seminars concerning natural resources law in Central America. Formal courses

will be offered at CATIE, while short-courses and seminars may be offered at the national level.

In the case that "joint decrees" or "special memorandums of understanding" are needed between regional, national, bilateral, and/or multilateral organizations, the policy specialist would be instrumental in their format and presentation.

Counterpart organizations will include: OFIPLAN (Costa Rica); MIDINRA and MIPLAN (Nicaragua); MIPPE (Panamá); CONSUPLANE (Honduras); SEGEPLAN and USPADA (Guatemala); MIPLAN (El Salvador).

6. Consciousness Raising in Institutions

This component is directed at the administrative and the highest managerial level where development and policy decisions are made. The focus of the component will be to directly inform and continuosly "advise" decision makers as to the importance of optimal watershed resources management. All project specialists will collaborate in order to prepare strategy on how best to implement this component in each country. The project coordinator will be in charge of this component. Strategy will probably involve one or a combination of the following sub-components:

a) National and regional congresses for the upper stratum personnel in each of the natural resource related organizations (including sectorial planning organizations).

b) Development and presentation of "information modules" of multimedia form.

c) Infonmative "news and advise" letters

d) Public relations-related field trips to priority watershed, natural resources related project areas (fuelwood, soil conservation, hydro-electric projects).

CRRH and SIECA will give the project support in providing lobby and "persuasion" through political channels which they have already established.

PROJECT RATIONALE

Watershed Degradation and National Development

All of the countries in the proposed project area suffer from the elements of watershed degradation (see Watershed Degradation section). The deterioration of the soil and water resource base, the root of the economies of these countries, brings about diminishing returns for expenditures made for agricultural, infrastructure, and rural development projects. Large expanses of areas in each of the countries have been converted to near sterile wastelands due to inappropriate utilization of the land: Azuero and Boquette in Panamá, Choluteca Watershed in Honduras, Puriscal-Parrita Watershed in Costa Rica, Managua-Sur and Río Viejo Watersheds in Nicaragua, and various areas scattered through El Salvador - especially in the Río Lempa watershed (see García Report).

All national development policies include components of increasing agricultural production, improvement of infrastructure, raising the standard of living and services to the rural poor, and increase overall economic productivity. Since the land-water resource base is the cornerstone of the countries' subsistence and productivity, its deterioration is counter-productive to national policy.

Lack of an Appropriate Human Resources Infrastructure

As the institution profiles point out, there is an acute lack of appropriately trained professionals and technicians in those institutions responsible for watershed resource management. Most technical assistance efforts in the past have not focused on training to provide an appropriate human resources infrastructure to manage resources through proper planning and activities. Many of these projects have involved large expenditures

for contracting international "experts" who come, dwell on the problem, and go, leaving in many cases only technical reports which fill shelves.

Several projects financed by USAID in the region provide an example of this weak focus on training host country nationals:

- Costa Rica Natural Resources Conservation Project

  Total Expenditures projected: $21,000,000

  Training and Seminars: $ 1,662,000 (7.9%)

- Honduras Management of the Choluteca River Watershed

  Total Expenditures projected: $22,000,000

  Training and Seminars: $ 484,000 (2.2%)

- Panamá Watershed Management Project

  Total Expenditures projected: $16,300.000

  Training and Seminars: $ 230,000 (1.4%)

In all cases USAID project managers and their counterparts have cited that the amounts accorded training in the projects are magnitudes under what they should be, especially in long term training (scholarships, etc. for degree level training).

In every interview with the different institutions, "insufficient human resources available" was in the top two limitations to the adequate management of watersheds. At the same time, the other limitation most frequently mentioned was the lack of funds to carry out any needed training activities. Other problems, which were most often mentioned, included: confusing or conflicting legal structures, ignorance or lack of interest on the part of decision makers, and the absence or unavailability of quality information concerning natural resources that can provide a planning base.

Why a Regional Project?

When looking for a methodology on how to effectively create or improve the human resources infrastructure needed for adequately manage the countries' watershed resources, several conditions are encountered. First, the problem or obstacles inherent in the existing watershed resources management infrastructures in the various countries are essentially the same (see preceeding discussions). Second, in theory the same or similar methodology could be used to address these problems. Third, there are relatively few professionals with advanced watershed management in Latin America, and fewer still in Central America. For all of Central America, the number of professionals with advanced watershed management training is approximately 15, with only one at the Ph.D. level (in CATIE). Fourth, mechanisms do not presently exist or are weak at the national level to bring about a change in the present situation, for all the reasons cited above.

The logic of a regional project may be stated simply in the following list of advantages based on regional needs:

- Development of a uniform methodology to treat the similar problems occurring throughout the region.
- Optimal utilization of scarce professional human resources in the region to develop human resources in the same field ("clone approach").
- Utilization of available professional resources to provide support for a strong uniform curriculum development scheme, instead of a disaggregated, weak scheme in each country.
- Creation of an interrelative information collection analysis and management system at national and regional levels, providing an improved watershed resources planning base for the same.
- Provision of a project infrastructure (human and equipment-related resources) at the regional level that would be prohibitive because of costs and lack of trained personnel in each of the countries in the region.

ECONOMIC JUSTIFICATION

The project is justified on a variety of fronts. First, any project which seeks to reverse watershed degradation and its resultant deterioration of the land and water resources (economic) base of the countries is justified in concept, if not design (see discussion on Watershed Degradation). Second, although the watershed resources management concept has been promulgated by international technical assistance organizations in a myriad of projects and programs, a "legacy" in the form of a human resources infrastructure has never been really left by these organizations to continue appropriate watershed resource management. This was due in part to the failure of the organizations to emphasize the training element, and the corollary of information management (among others), in their projects. The result is a continued dependency on outside (and expensive) technical assistance. Technical assistance experts in their fields have always been imported from other countries, if not other sub-continents requiring large expenditures of money for international salaries, moving expenses, and subsistence stipends. In several USAID projects in execution at this time, the amounts budgeted for this type of technical assistance is as follows:

Project	Technical Assistance
Costa Rica Natural Resources Conservation Project	$ 1,157,000
Panama Watershed Management Project	1,220,000
Honduras, Choluteca River Watershed Management Project	2,530,000

For the most part, these funds were paid to consulting firms outside of the project region because of the lack of these human resources within the region. Based on these projects alone, if trained personnel had

existed in the project countries, the expenditures, based on national wage scales, would have been only 25-30% of the current figure. Furthermore, if this personnel already existed in the natural resources management institutions, much of the problems of appropriate resource utilization may well have been on their way to resolution (hypothetically, of course).

A corollary, that of information management (or the lack thereof), has further complicated the task of technical assistance in the development of management and development plans. Countless man-months are spent at the initiation of each project or program to consolidate natural resources information from its dispersed sources in order to provide even the very basic planning base. Much of the information is either lost or forgotten, and funds are expended to repeat a study or resource inventory that had already been done.* Although no figures are available, estimates are that 3 to 6 man-months per specialist per year are spent on gathering the scattered information needed for work plans, etc.

In final analysis, the project is economically justified in that it seeks to obviate the dependence of the host country institutions on expensive technical assistance-oriented projects. If the human resources mechanism were already in place, projects of assistance could be oriented toward

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*USAID/ROCAP spearheaded the Natural Resources Information Project for Central America and Panama 1963-1967 which provided the first comprehensive planning base for natural resources utilization and management. This project was quite massive, involving the U.S. Army Corps of Engineers, Defense Mapping Agency, tens of international resource specialists and counterparts in the respective national institutions.

Recently, USAID has sponsored "Country Environmental Profiles" for the Central American countries at a cost of about $130,000 each. These profiles required an inordinate amount of time just to consolidate existing information concerning natural resources in each country. The profiles will be used essentially as an in-house planning base.

real economic recovery and development projects directly involving the natural resource management institutions, instead of emergency relief, quick-fix oriented projects that are treating the symptoms and not the disease. With an appropriately trained human resources infrastructure in watershed management, national governments (and lending institutions) could be sure that adequate environmental safeguards would be taken into consideration in the planning and execution of projects involving watershed resources.

ANNEX 1

WILDLANDS AND WATERSHED MANAGEMENT PROGRAM - CATIE

Expanded Profile

PASC was added as a program to the department in 1977 with basic funding for personnel and operations provided by the Rockefeller Brothers Fund. Since late 1979 its basic staff of two professional renewable natural resources planning and management specialists, a secretary and some minimal operational funding has been taken over by CATIE's core budget. In addition, it has been very successful at obtaining small amounts of operational funding for its work in Central America and Panama as well as substantial funding for the individual "on-the-ground" projects in each country and the very frequent regional and national training events which it conducts, from a wide variety of sources: AID-Costa Rica; AID-Panama; FAO; Interamerican Foundation; IUCN; Kellogg Foundation; DDA (Swiss Development Assistance); RARE; UNESCO; U.S. National Park Service; U.S. Fish and Wildlife Service; World Wildlife Fund (WWF). The Program's forte has been, and is, in working very successfully with national governmental resource management institutions, particularly interinstitutional-interdisciplinary teams, and in some cases national or local private citizens groups and/or universities, in the following major areas: (1) preparation and implementation of plans and strategies for national systems of wildlands*; (2) preparation and im-

* It should be emphasized that wildlands is used by PASC in the broad international definition of the term and includes a wide range management categories such as national forests, multiple use areas, water production reserves, national parks, biosphere reserves, wildlife refuges, hunting preserves, anthropological reserves, etc.

plementation of general Management and Development Plans (medium to long term plans) for a wide variety of individual wildlands units of different categories or types as pilot experimental and demonstration areas; (3) preparation of short-term (1-2 years) more detailed operational plans for individual wildlands and systems, technical support departments and entire institutions; (4) development, testing and improvement of planning methodologies and techniques for (1), (2) and (3) above; (5) development, testing and improving a variety of practical training forms and methods and the training of large numbers of wildlands' professionals, technicians and support personnel in regional and national level training events (mobile seminars and courses, short courses, in-service training, M.S. education, etc.), particularly using the pilot projects as training sites; (6) preparation of manuals of planning and training methodologies and sample plans, for wide distribution in the region, based on the pilot projects as case studies; (7) substantially increasing communication and collaboration between the wildlands resource management agencies in the region by acting as a secretariat and clearing house for them; and (8) increasing several fold the shared use of human resources between the countries (consultants from within the region, in-service training in national institutions, etc.). All of this has had a very large impact in the region and the wildlands situation in every country has improved notably in the past decade, particularly the past 5-6 years, largely due to the catalytic effect in the countries of PASC's work. This has most importantly of all greatly improved the quantity and quality of human resources capable of planning and managing wildlands systems, areas and institutions and of strengthening those institutions. Appendices R-5 and R-6 (Annual Reports of PASC) and R-7 give more details of the accomplishments in wild-

lands in the region and by PASC, 1977-1981. PASC has had two major difficulties. First, the wildlands staff of two is already heavily loaded with work and cannot cover more than 30-40% of the needs and requests from the countries in wildlands technical assistance, training, research and education. The project proposed in this study will help substantially to improve that situation because wildlands fall well within and are an integral part of watershed resources management. Virtually all of the components of this project will directly and/or indirectly deal with wildlands within watersheds. Secondly, the watershed management portion of PASC has suffered from a lack of strength and external support throughout the life of PASC, although the close relationship of watershed, multiple-use and wildland management has been recognized clearly since the start. From 1977 until early 1981 PASC employed a part-time watershed specialist to teach M.S. level courses, guide M.S. student thesis investigations and develop a few regional seminars and training events, but his time was severely limited.

From early 1981 until September 15, 1982 no watershed specialist was at CATIE, until just recently when a Hydrologist - Watershed/Natural Resources Planning and Management Specialist was added with ROCAP support. Over the next two years that individual will have the task of strengthening and building up PASC's watershed management capabilities in M.S. courses, regional short-term training events, guiding M.S. graduate student research, developing a pilot watershed management project near CATIE and collaborating in technical assistance to fulfill needs in the region.

ANNEX 2

PROPOSED PROJECT SPECIALISTS - TERMS OF REFERENCE

Watershed Management Specialist/Coordinator of Project (5 years)

Ph. D. or Masters level with various years of experience in watershed resources management. Latin American (preferably Central American) work experience. Spanish fluency. Administrative and Training experience. Good writing abilities.

a) Will coordinate entire project, and with team, set priorities, work schedule, write work plans, monitor progress, handle public and political relations especially at the decision - making level (consciousness-raising component), and insure that objectives are met.

b) Will contribute to technical assistance consulting group in the field of watershed management planning.

c) Will design and conduct short courses, seminars, and congresses in watershed resources administration.

d) Will design needed investigation projects at national level in collaboration with other staff members and students.

- Land-Use Specialist (4 years)

Ph. D. or Master's - level with 5 years experience and background in ecology, environmental geography, land use. Spanish fluency. Work experience in Central America. Field experience in small farming systems. Teaching Credentials.

a) Will provide input on curriculum development in each of the

countries in his/her field.

b) Will teach courses and seminars at CATIE and in countries on land capability and utilization.

c) Will assess needs for technical assistance and institution building in relative institutions in each country.

d) Will assist in the preparation of instructional materials with that specialist.

- Natural Resources Policy Specialist (3 years)

Ph. D. or Masters-level interdisciplinary with natural resources planning/ environmental policy background. Latin American experience. Spanish fluency. Familiarity with Latin American Natural resources and land tenure laws. Teaching credentials.

a) Will provide input on curriculum development in each of the countries in his/her field.

b) Will teach courses and seminars at CATIE and in countries on natural resource policy.

c) Will assess needs for technical assistance and institution building in relative institutions in each of the countries and will establish a counterpart with whom he/she will work to develop any needed regulations, agreements, policy changes, contracts, etc. to strengthen the policy base for optimal watershed management (including organic laws and land tenure).

d) Will assist in the preparation of instructional materials with that specialist.

- Soil Conservation/Land Reclamation Specialist (3 years)

Ph. D. or Master's level with background in soil erosion control, land reclamation, etc. Spanish fluency. Field experience in Latin (preferably Central America) America in small farming systems. Teaching credentials especially in field methods.

a) Will provide input on curriculum development in each of the countries in his/her field.

b) Will teach courses and seminars at CATIE and in countries on land reclamation, soil erosion control, and appropriate hillside cultivation measures.

c) Will assess needs for technical assistance and institution building in relative institutions in each country.

d) Will assist in the preparation of instructional materials with the specialist.

- Socio-Economist (2 years)

Ph. D. or Master's level with background in sociology and economics of Latin American Systems. Spanish fluency. Work experience in Latin America. Experience in small farming systems and small farmers. Teaching credentials.

a) Will provide input on curriculum development in each of the countries in his/her field.

b) Will teach courses and seminars in CATIE and in countries on aspects of sociology and economy as they relate to nature resources utilization in Central American and Panamá.

c) Will develop a bank of information on the economic viability of watershed management in the region.

d) Will research and develop monographs on the incentives and disincentives to rational watershed resource management with empha-

sis on small farming systems. Will seek collaboration in the Department of "Producción Vegetal" of CATIE.

e) Will assist in the preparation of instructional materials with that specialist.

- Natural Resources Information Specialist (3 years)

Ph. D. or Master's level with background in natural resource inventories, cartography, computer sciences and pertinent software for information management. Spanish fluency. Teaching ability.

a) Will provide technical assistance as needed to designated natural resource information collection organizations in each country.

b) Will help develop and/or improve natural resources information collection, analysis, and management systems in each country (especially building on CRIES and PIADIC experience).

c) Will collaborate directly with IICA and INFORAT in all aspects of work and play.

d) Will teach courses and seminars at CATIE and in countries on infomation management for providing a better planning base for natural resources utilization.

e) Will assist in the preparation of instructional materials with that specialist.

f) Will strive to increase the efficiency on natural resources information collection and management at CATIE.

- Instructional Resources Specialist (4 years)

Master's level with background in preparation of instructional materials, audio-visual aids, public relations and propaganda, photography, publications and layout work. Spanish fluency. Latin American experience preferred.

a) Will develop an instructional resources laboratory or expand that now operating at CATIE, to include equipment and physical plant necessary to produce instructional modules or training packages of audio-visual and textual design.

b) Will visit field sites and photograph as much material as is necessary to produce these instructional modules.

c) Will collaborate and work in tandem with other staff specialists to determine theme and content of instructional modules.

d) Based on theme, will produce, direct, layout, edit, etc. as necessary to develop these modules.

e) Will give short courses and contribute to seminars in photography, publications development, and audio-visual productions at CATIE.

f) Will design multi-media presentations as needed for project support and "road shows."

g) Will collaborate with the public relations department already working at CATIE.

ANNEX 3

PRINCIPAL CONTACTS - COSTA RICA

Name	Function	Organization	Address	Telephone
Claudio Antonio Volio	Minister	OFIPLAN	Avenida 3 y 5, Calle 4, San José	22-68-22
Lic. Dennis Sánchez	Director	División de Planificación y Coordinación Sectorial, OFIPLAN	" "	" "
Ing. Alfonso Ramírez	Jefe	Sección Agropecuaria y de Recursos Naturales Renovables, OFIPLAN	" "	" "
Ing. Eladio Prado Castro	Jefe	Oficina de Planificación ICAA	San José	33-21-55
Lic. Teófilo de la Torre	Presidente	ICE	La Sabana, San José Apartado 10032	32-72-77
Ing. Augustín Rodríguez	Jefe	Departamento de Estudios Especiales, ICE	" "	32-72-77
Lic. Francisco Morales	Minister	Ministerio de Agricultura y Ganadería, (MAG)	La Sabana, San José	31-23-41
Ing. Jorge Rodríguez	Director	DGF	Apartado 10094 San José	21-95-33
Ing. Raúl Solórzano	Sub-Director/ Director	DGF/Proyecto de Conservación de Recursos Naturales	" "	" "
Ing. Samuel Pérez	Responsible	Rio Parrita Watershed Management Plan	" "	" "
Ing. José Ramón Mora	Jefe	Departamento de Conservación de Suelos y Aguas, DGF	" "	" "
Ing. Eduardo López	Jefe	División de Conservación, Departamento de Vida Silvestre-DGF	" "	" "

PRINCIPAL CONTACTS - COSTA RICA

Name	Function	Organization	Address	Telephone
Ing. Guillermo Porras	Jefe	División de Bosques - DGF	Apartado 10094 San José	21-95-33
Ing. Mauro Rudín	Director	Instituto Geográfico Nacional	Avenida 20 y 22 Calle 9, San José	
Dr. Gilberto Paez	Director	CATIE	Turrialba, Costa Rica	56-07-55 56-64-31
Dr. Gerardo Budowski	Jefe	Departamento de Recursos Naturales Renovables-CATIE	" "	56-60-21
Craig MacFarland	Responsible	Programa de Areas Silvestres y Manejo de Cuencas-CATIE	" "	" "
Dr. Carlos Quesada	Watershed Specialist	" "	" "	" "
Roger Morales	Parks and Wildlands Specialist	" "	" "	" "
Ing. Jan Bauer	Coordinator	Fuelwood and Alternative Energy Sources Project-CATIE	" "	" "
Dr. Francisco Morillo	Director General	IICA	2200 Coronado San José, Costa Rica, Apartado 55	29-02-22
Dr. Finn Damtoft	Director	CIDIA-IICA	" "	" "
Lic. Alvaro Garro	Jefe	Unidad de Procesamiento de Datos IICA	" "	" "
Robert McCollough	Asst.Reg.Agr.Dev.Officer	ROCAP	Apartado 10053 San José 1000	23-60-42 23-56-38

PRINCIPAL CONTACTS - COSTA RICA

Name	Function	Organization	Address	Telephone
Dr. Henry Tschinkel	Regional Forestry Advisor	ROCAP	Apartado 10053 San José 1000	23-60-42 23-56-08
Ing. Francisco Rodríguez	Agricultural Consultant	USAID/Costa Rica	American Embassy San José	33-11-55 23-80-46
Dr. Joseph Tosi	Ecologist	Tropical Sciences Center	442 Calle 1a. Apto. 8, 3870 San José	22-62-41
Ing. Gilbert Ugalde	Associate Director	Peace Corps/Costa Rica	Apartado 1266	22-73-66 22-74-66
Ing. Julio César Calvo	Jefe	Departamento de Ingeniería Forestal, ITCR	Cartago	51-11-22

PRINCIPAL CONTACTS - NICARAGUA

Name	Function	Organization	Address	Telephone
Lic. Wladimir Pérez Leiva	Director	IRENA	1.5 Kms. al Este del Aeropuerto Managua, Nicaragua	31-1-10 to 31-1-15
Lic. Reynaldo Arostegui	Director	National Parks and Wildlife Programs, IRENA	" "	" "
Ing. Carlos Lainez Granados	Responsible	Departamento de Ordenamiento de Cuencas, IRENA	" "	" "
Ing. Lorbardo de Trinidad	Responsible	Departamento de Estudios Hidroeléctricos, División de Planificación, INE	Edificio IEM-Montoya Apartado 55, Managua	26-6-39 26-6-40
Nelson Sánchez Ortíz	Coordinator	Estudios Básicos, FINAPRI	Km 4,Carretera a Masaya Apartado 316,Managua	70-8-87 71-8-61
Ing. Augusto Otárola	Resident	Fuelwood Project (CATIE/ROCAP) CATIE	Belmonte No.50 Apartado 4830,Managua	51-7-57 51-4-43
Ing. Victor Tercero	Responsible	División de Ordenamiento Territorial Agropecuario, MIDINRA	Km 8, Carretera a Masaya, Managua	
Ing. Roger Román	Natural Resources Specialist	Division de Ordenamiento Territorial Agropecuario, MIDINRA	" "	
Ing. Alejandro Rodríguez	Director	INETER	Complejo Cívico Camilo Ortega, Apartado 2110 Managua	51-1-00 to 51-1-13
Ing. Manuel Morán	Responsible	Departamento de Planificación INETER	" "	" "
Lic. Hans Gutierrez	Director	Planificación Regional MIPLAN	Del INE una cuadra al sur,Apartado 4596 Managua	75-9-81

PRINCIPAL CONTACTS - NICARAGUA

Name	Function	Organization	Address	Telephone
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Licda. Elda García de Palma	Director	Escuela de Ecología y Recursos Naturales, Universidad Centro-Americana	Apartado 69	70-3-52
Ing. Claudio Gutierrez	Responsible	Programa Manejo de Cuencas Universidad Centroamericana	Apartado 69	70-3-52
Mr. Frank Heilemann	Rural Development Officer	USAID	c/o American Embassy Managua	23-88-15
Ing. Julio Gaitán	Responsible	Natural Resources USAID	" "	" "

PRINCIPAL CONTACTS - PANAMA

Name	Function	Organization	Address	Telephone
Dr. Menalco Solis	Minister	MIPPE	Apartado 6983	69-14-61 69-35-45
Lic. José M. Díaz	Director	Asesoría y Coordinación de Cooperación Técnica e Internacional MIPPE	" "	" "
Lic. Carlos Sánchez	Planner for Natural Resources	" "	" "	" "
Dr. Alfredo Bernal	Dean	Facultad de Agronomía Universidad de Panamá	Universidad de Panamá, David, Chiriquí	
Dr. Rodrigo Tarte	Director	IDIAP	Apartado 6-4391 El Dorado Panamá City	69-77-11
Ing. Tomás Vásquez	Responsible	Departamento de Estudios Especiales IDIAP	" "	" "
Dr. Ira Rubinoff	Director	Smithsonian Tropical Research	Apartado 2072 Balboa, Panamá	52-58-89 22-02-11
Dr. Nicholas Smythe	Responsible	Conservation and Enviromental Education, STRI	" "	" "
Dr. Donald Windsor	Responsible	Barro Colorado Environmental Studies	" "	" "
Lic. Everardo Bertoli	Director	RENARE	Paraiso, Apartado 2016	32-27-18 32-47-75
Ing. Efrain Lolo	Sub-Director	RENARE	" "	" "

PRINCIPAL CONTACTS - PANAMA

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Ing. Gerardo Cáceres	Jefe	Departamento de Suelos y Aguas RENARE	Paraiso. Apartado 2016	32-27-18 32-47-75
Ing. Omar Peña	Responsible	Watershed Management Project RENARE	" "	" "
Dr. Buford Briscoe	Agroforestry Expert	" " "	" "	" "
Dr. Waldemar Albertin	Tropical Forestry Expert	" "	" "	" "
Ing. Arturo Romero	Resident	Fuelwood Project CATIE/RENARE	" "	" "
Lic. Edwin Fabrega	Director	IRHE	Apartado 5285, Panamá 5, Panamá	25-63-67
Dr. Alcides Salas	Jefe	Departamento de Manejo de Cuencas IRHE	" "	" "
Ing. Dionisio Batista	Responsible	Programa de Protección de Cuencas IRHE	" "	" "
	Director	Instituto Geográfico Nacional "Tommy Guardia"	Calle 57 Oeste Melchor Lasso de Vega, Ave.63 Norte Tomás, Guardia	64-17-05
Mr. Harlan Davis	Rural Development Officer	USAID	Edificios Cementos de Panamá, c/o American Embassy, Panamá	64-40-11
Mr. Dwight Walker	Responsible	Natural Resources Sector	" "	" "

ANNEX 4

CHRONOGRAPH OF PROJECT ACTIVITIES

ACTIVITY	Year 1	Year 2	Year 3	Year 4	Year 5
Contract: Coordinator/Watershed Mngmt. Spec.					
Contract: Land-Use Spec.					
Contract: Natural Res. Policy Specialist					
Contract: Soil Conservation Spec.					
Contract: Socio-Econ. Spec.					
Contract: Nat. Resources Info. Spec.					
Contract: Instruc. Resources Spec.					
Component: -Technical Assistance					
-Inventory of Existing Info.					
-Preliminary Watershed Diagnosis					
-National Watershed Mngmt. Plans					
Component: Curriculum Develop.					
-Visit coutries, diagnostic for counterpart institutions					
-Provision of Professors					
-Provision of Instruction resources					
-Scholarships, research assistanships					
-Establishment of Pilot Watersheds					
-Instruction at CATIE by project specialists					
Component: Instructional Resources Develop.					
-Develop Instruc. res. Lab.					
-Identification of needed instructional materials					
-Develop instructional materials for CATIE and each country					

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ACTIVITY	Year 1	Year 2	Year 3	Year 4	Year 5
- Consolidate and disseminate needed publications					
Component: Natural Res. Information Management					
- Assess info. mngmt needs in each country and designate counterpart					
- Establish CRIES, and other systems					
- Consolidate Available info. and put into system					
- Seminars, short courses					
Component: Natural Resources Policy Support					
- Select counterpart, review existing laws & make diagnostic					
- Prepare briefs, promote needed policy changes in each country					
- Seminars, short courses					
Component: Institutions Conciousness Raising					
- Preparation of Strategy					
- Develop info. modules					
- Preparation of newsletter					
- Field trips, seminars, congresses					
Evaluations					
Cocktail Party					

ANNEX 5

GUIDELINES FOR THE PREPARATION OF PROJECT IDENTIFICATION DOCUMENT AND PROJECT PAPER

Guidelines for Project Identification Document (PID)

1. ROCAP/Guatemala prepares draft PID by October 10, 1982

2. Send draft to RDO's in Central American Countries, H. Tschinkel of ROCAP/Costa Rica, and CATIE for Review. Receive comments from all involved (esp. RDO's) by October 20, 1982 and seek letters or cables of support to send up with PID.

3. Meeting at CATIE (or in San José) of 1-2 days with Zadroga, Tschinkel, McFarland, and Quesada to finalize PID.

4. Submit PID to USAID/Washington November 1, 1982.

Guidelines for Project Paper

1. Select Team of five consultants to research and prepare project paper with coordination through PASC/CATIE.

   Suggested Team:

   Coordinator - Dr. Carlos Quesada
   Natural Resource Economist - Dr. Luis García
   Natural Resources Policy and Management Specialist - Claudio Gutiérrez
   Renewable Natural Resources Planner - Roger Morales
   Curriculum/Training Specialist - Dr. T.C. Sheng (or someone from CIDIAT).

Contract Period: 3 months

2. Principal Activities of Team

   a) Detailed profile of institutions in relation to project objectives, their current programs, activities and key personnel;
   b) develop project components in detail necessary for PP, including: organization, administration, infrastructure, human resources, equipment needs, etc.;
   c) develop project personnel list, terms of reference, etc. needed for project implementation;

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SUGGESTED FURTHER READING IN PREPARATION OF PROJECT PAPER

General

- Watershed Resources Management and Environmental Monitoring Regional Training Course (Manuals) MAB/USAID, 1979 to 1981.
- Physical Resource Investigations for Economic Development - A Casebook of OAS Field Experience in Latin America. OAS. 1969.
- Agroforestry for the Humid Tropics - Short Course (Proceedings) CATIE/AID. 1982.
- Ordenación Integrada de Cuencas Hidrográficas - Proyecto PNUD - FAO - Honduras/77/006 (Documentos de Trabajo Nos. 1-10).
- Estrategia para la Capacitación en Recursos Naturales y Medio Ambiente. World Wildlife Fund. 1980.
- Natural Resource Inventories in Developing Countries: the Case of Central America. Paul Dulin. CATIE. Turrialba, Costa Rica. 1981.
- Recursos Naturales Renovables de América Latina y el Caribe: Situación y Tendencias. M.J. Dourojeanni. World Wildlife Fund. 1980.
- Guías para Investigadores (de Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua y Panama). Instituto Panamericano de Geografía e Historia (OEA). 1977.

Further Reading - Panamá

- Environmental Profile - Panamá (Draft) (USAID)
- Panamá Watershed Management Project - Project Paper (USAID)
- Review Watershed Management Project, trimestre reports and publications

Further Reading - Costa Rica

- Costa Rica Natural Resources Project - Project Paper (USAID)
- Costa Rica Environmental Profile (draft) (Tropical Sciences Center/USAID)
- Plan Nacional de Desarrollo Forestal (DGF)
- Situación Forestal de Costa Rica, 1950 - 1977 (Pérez, SEPSA)
- Estudio Ecológico de la Cuenca del Proyecto Arenal (Tropical Sciences Center/ICE)

FURTHER READING - REGIONAL INSTITUTIONS

- PIADIC MANUALS and Publications (IICA)
- CRIES User's Manual; Publications concerning Geographic information system (IICA)
- "Situación Leñera en los Países Centroamericanos" y "Areas Climáticas Análogas para Ciertas Especies leñosas en los países Centroamericanos" (CATIE)
- Soils Analogs Program Publications (CATIE)
- Fuelwood Project publications and trimestre reports (CATIE)
- Fuelwood and Alternative Energy Sources Project - Project Paper (CATIE/ROCAP)
- Términos de Referencia para la Elaboración del Plan de Manejo del Parque Internacional de la Amistad (CATIE)
- Review Publications produced by CATIE and IICA.
- Planificación y Manejo de los Recursos Silvestres en Centro América: Estrategia para una Década Crítica.
  C. McFarland and R. Morales. CATIE. 1981

ANNEX 6

LIST OF APPENDIXES APART FROM THIS REPORT

Costa Rica

Appendix	CR-1	Organizational Chart-OFIPLAN
	CR-2	Inventario de las Principales Cuencas
	CR-3	Ley Forestal-MAG/DGF
	CR-4	Estructura Orgánica-DGF
	CR-5	Personnel List - Natural Resources Project (MAG/AID)
	CR-6	Ley Orgánica-ICE
	CR-7	Organizational Chart-ICE
	CR-8	Plan Propuesto de Desarrollo Eléctrico-IN
	CR-9	Projectos Planificados-ICE
	CR-10	Organizational Chart-ICAA
	CR-11	Ley Orgánica-ICAA
	CR-12	Censo de Cuencas-ICAA
	CR-13	Inventario de Cuencas-ICAA
	CR-14	Curriculum de Depto.Forestal/ITCR

Nicaragua

Appendix	N-1	Ley de Creación-IRENA
	N-2	Organizational Chart-IRENA
	N-3	Organizational Chart-Depto.de Cuencas, IRENA
	N-4	Depto. de Ordenamiento de Cuencas, IRENA
	N-5	Estudio de Prioritización de Cuencas, FINAPRI
	N-6	Ley Orgánica-INE
	N-7	Organizational Chart-INE
	N-8	Energy Mix Projections-INE
	N-9	Location of Hydroelectric Projects-INE
	N-10	Organizational Chart-MIDINRA
	N-11	Ley de Creación-INETER
	N-12	Organizational Chart-INETER
	N-13	Curriculum - UCA

Panama

Appendix	P-1	Organization Chart - MIPPE
	P-2	Ley Orgánica Forestal
	P-3	Ley Orgánica de Aguas
	P-4	Reporte Anual - RENARE
	P-5	Lista de Proyectos Financiados-RENARE

Appendix	P-6	Watershed Management Project Quarterly Report
	P-7	Reporte Anual-IRHE
	P-8	Hydroelectric Projects in Panama
	P-9	Organization Chart-IGN
	P-10	Curriculum-Univ. Panama
	P-11	Annual Report-IDIAP
	P-12	Annual Reports-STRI
	P-13	Guide to STRI Library

Regional Institutions

Appendix	R-1	Boletín Interno-IICA
	R-2	PIADIC Experience in Central America
	R-3	Organization Chart-CATIE
	R-4	Annual Report-DRNR/CATIE
	R-5	Annual Report-PASC/DRNR/CATIE
	R-6	Report to Rockefeller Fund-PASC
	R-7	Planificación y Manejo de los Recursos Silvestres en América Central.