

PD-AAN-01073

5250191/17

ISN-31254

PANAMA WATERSHED MANAGEMENT
EVALUATION REPORT

Project No. 525-0191

ARD



Project No. 525-0191

**PANAMA WATERSHED MANAGEMENT
EVALUATION REPORT**

Prepared by:

**Associates in Rural Development, Inc.
362 Main Street
Burlington, VT 05401 U. S. A.
Under AID contract number 525-0191-C-00-3020-00**

Date: June, 1983

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
<u>Preface</u>	i
<u>Acronyms</u>	ii
<u>Map of the Watershed Area</u>	iii
I. <u>Executive Summary</u>	I-1
II. <u>Introduction</u>	II-1
A. Evaluation Objectives	II-1
B. Evaluation Methodology	II-2
C. Data Limitations	II-3
D. Organization of This Report	II-4
III. <u>Evaluation of Individual Project Components</u>	III-1
A. RENARE Institutional Development	III-1
1. Reorganization of RENARE	III-1
2. Strengthening RENARE's Management System	III-3
3. Training	III-4
4. Technical Assistance	III-6
5. Personnel, Equipment and Facilities	III-11
B. Education and Research	III-12
1. Education and Information Activities	III-12
2. Applied Research	III-13
C. Watershed Management Program	III-14
1. Canal Watershed	III-14
2. La Villa Watershed	III-26
3. La Caldera Watershed	III-31
IV. <u>Evaluation of Overall Project Performance</u>	IV-1
A. Balance of Project Strategy and Components	IV-1
B. Project Management	IV-4
C. Reforestation	IV-6
D. Soil Conservation and Pasture Management	IV-9
E. Parks and Reserves Management	IV-9
V. <u>Findings and Recommendations Concerning Current Project Implementation</u>	V-1
VI. <u>Recommendations for Future Natural Resource Management Programs</u>	VI-1

PREFACE

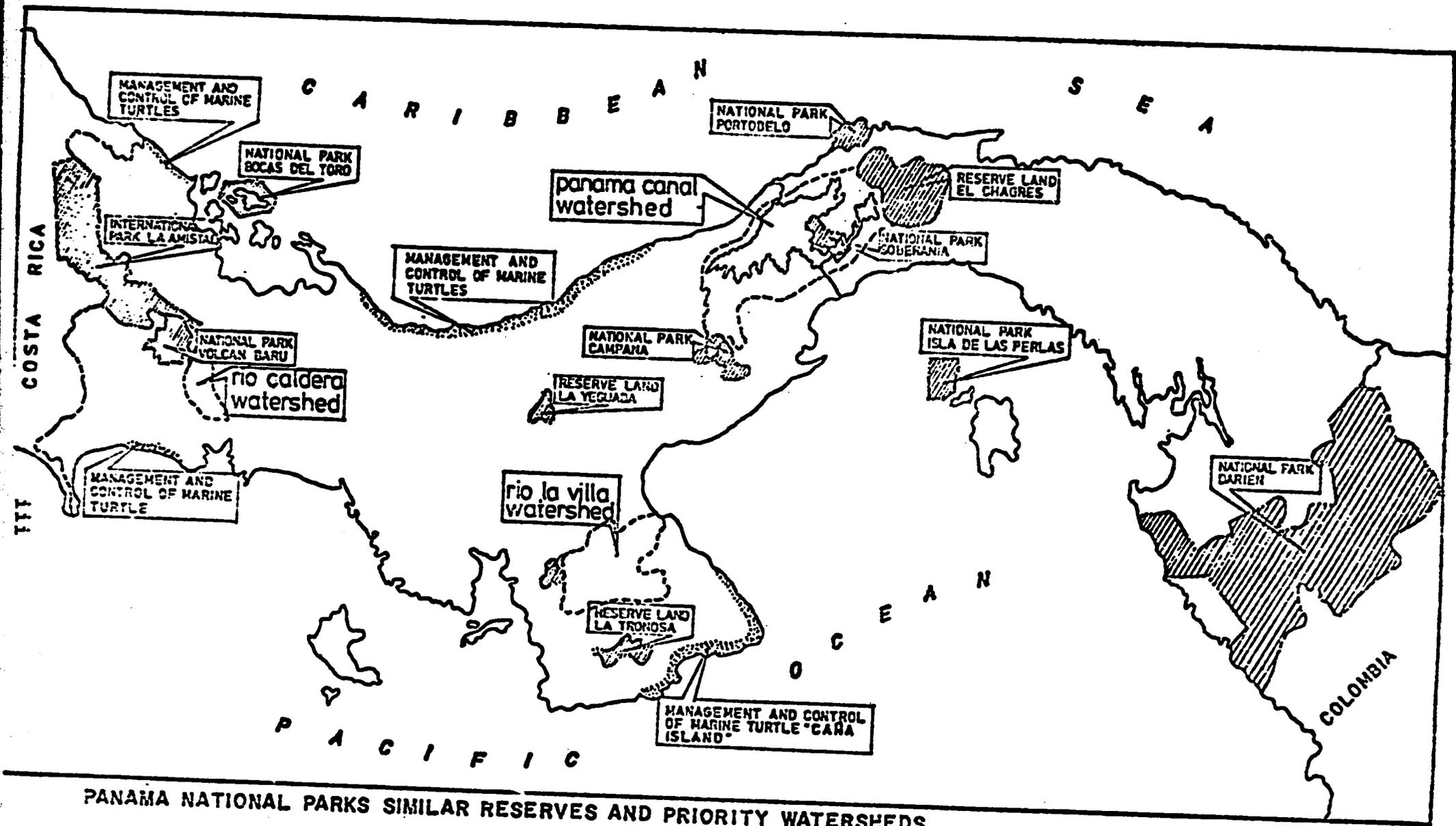
The Panama Watershed Management project was evaluated by a team from Associates in Rural Development, Inc. (ARD), which included: Dr. Joshua D. Dickinson, III, a watershed management specialist; Mr. Richard Donovan, a natural resources management and administration specialist; Mr. Alan Randall, a forestry and natural resources management specialist; and Mr. John Shores, a wildland management specialist.

The team was in Panama for four weeks starting May 1, 1983, except Mr. Shores, who was present for only the first two weeks to collect data and prepared a draft report. The final report was produced at the ARD office in Burlington, Vermont.

The team wishes to thank the staff of the Directorate of Renewable Natural Resources of Panama (RENARE) and the Agency for International Development (AID) for their assistance and encouragement throughout the evaluation study.

ACRONYMS

AID	U. S. Agency for International Development
ARD	Associates in Rural Development, Inc.
CATIE	Center for Tropical Agricultural Research and Training
DPNVS	Department of National Parks and Wildlife
EI	Experience, Incorporated
FAO	Food and Agriculture Organization of the United Nations
GOP	government of Panama
ICAITI	Central American Institute for Research in Industrial Technology
IRHE	Institute for Hydrological Resources and Electrification
JCE	Joint Commission on the Environment of the Panama Canal Commission
MIDA	Ministry of Agricultural Development
MIPPE	Ministry of Planning and Economic Policy
MOP	Ministry of Public Works
NGO	nongovernmental organization
PCC	Panama Canal Commission
PVO	private voluntary organization
RENARE	Directorate of Renewable Natural Resources
STRI	Smithsonian Tropical Research Institute
WWF	World Wildlife Fund



PANAMA NATIONAL PARKS SIMILAR RESERVES AND PRIORITY WATERSHEDS

LEGEND

-  PANAMA NATIONAL PARK AND SIMILAR RESERVE.
-  MANAGEMENT AND CONTROL OF MARINE TURTLE.
-  NATIONAL PARK OR RESERVE LIMIT.
-  PANAMA CANAL WATERSHED LIMIT.



I. EXECUTIVE SUMMARY

The Watershed Management project has its origins in the concern of the governments of both Panama and the United States to conserve and develop Panama's natural resources. During project design, three goals were established:

- strengthen the technical, managerial and administrative capabilities of the National Directorate of Renewable Natural Resources (RENARE);
- increase awareness in Panama of the importance of natural resource conservation; and
- implement management programs in the watersheds of the Panama Canal, La Villa and Caldera river basins that included local residents in the resource management and conservation process.

Since RENARE's formation in 1973, its mandate has expanded from the management of Panama's forest resources to include activities in soil and water conservation, and the management of wildlife, watersheds and public lands (parks and reserves). The Watershed Management project was initiated in 1979 as a comprehensive program to assist RENARE and develop its capability to fulfill the mandate given the agency by the Government of Panama (GOP). The project has involved the acquisition of material resources (e.g., vehicles, offices, field equipment, etc.), short- and long-term training programs, extensive technical assistance in agro-forestry, watershed management, silviculture, and parks planning and management, and the addition of permanent and technical staff at RENARE headquarters and in the field.

This evaluation, performed by a technical assistance team from Associates in Rural Development, Inc. (ARD), found that impressive progress has been made in achieving the project's goals, particularly in terms of the institutional development of RENARE. The agency is now recognized nationally and its capability to undertake comprehensive programs in watershed management has been improved. However, the absence of monitoring data on both technical and nontechnical (e.g., local participation) aspects of the project, as well as numerous delays in the implementation of project activities, prevented the team from conducting a conclusive "impact" evaluation, as envisioned in the scope of work. In spite of these limitations, the evaluation team strongly recommends that the Watershed Management project be extended to utilize the loan funds that remain. Such an extension will enable both RENARE and AID/Panama to capitalize on the capabilities developed and experience gained during the past four years of project implementation, and will help to further establish RENARE's presence in the three priority watersheds--the Panama Canal, La Villa and Caldera.

The following subsections present the team's major findings and recommendations concerning current and future project activities:

General Findings

- The Watershed Management Project has made a vital contribution to the development of RENARE's technical and administrative capabilities through the addition of eighty-four professional, and two hundred and three subprofessional staff at the field and headquarters level. However, it should be noted that roughly 66 percent of the additional staff are located in the central office versus 34 percent in the field offices. The original project design planned for placement of 47 percent in the headquarters versus 53 percent in the field.
- The financial administration and procedural problems experienced during the first three years of the Watershed Management project have been resolved and are no longer a major impediment to operational activities. These problems were caused by faulty project design and poor project management by both AID/Panama and RENARE, and have been remedied only with high levels of input from AID/Panama staff and the addition of qualified personnel at RENARE. However, budget uncertainties in the Panamanian government and administrative delays within RENARE still unfavorably affect the delivery of resources to the field offices and the implementation of project activities.

General Recommendations

- The continual changes in RENARE leadership have limited the implementation of many management system improvements, and it is essential that stable leadership be maintained at RENARE in the future so that the improvements envisioned in the project design can occur.
- Watershed project staff at headquarters who have been assigned as counterparts to technical assistance personnel should be placed in appropriate technical departments to reinforce the coordination and support of watershed project field activities.

Technical Assistance Findings

- The technical assistance financed by the AID loan has had a limited degree of success in reinforcing RENARE's capabilities in watershed management project implementation. The delays in contracting the experts, how they were contracted, their individual qualifications, and their utilization within RENARE were all factors in the effectiveness of these individuals.

Technical Assistance Recommendations

- The current long-term technical assistance contract with Experience, Inc. should not be extended. RENARE and AID should review proposed short-term technical assistance missions under the existing contract to make sure that each consultant will address priority issues in watershed management identified by RENARE and that, if possible, the activities of the consultants focus on field support within the three watersheds.
- The technical assistance assignment of the parks management specialist should be extended by RENARE to assure continuity and support to the Department of National Parks and Wildlife. Throughout the extension his efforts should be concentrated on a transfer of his technical knowledge and experience to counterparts.
- Technical assistance during the remainder of the Watershed Management project should focus on natural resources planning and administration (to work at the level of the Director and Sub-director of RENARE). Other assistance may be useful in the areas of conservation education, rural extension, watershed management, and geomorphology.

Training Findings

- The training component of the project has been successful in increasing the technical competence of RENARE's staff as well as in developing individual self-confidence and an "esprit de corps," especially within the Department of National Parks and Wildlife. On-the-job training in administrative procedures and financial documentation was instrumental in improving the financial management of the AID loan.

Training Recommendations

- Continue short-term training activities at the technical level in those skills required by field activities, relating practical training to technical assistance wherever possible.
- Long-term participant training should focus on the development of natural resources administration and planning (including monitoring and evaluation) skills. During the project extension, RENARE and AID should work together on a long-term training plan that will reflect current and expected future needs.

AID Management Findings

- AID/Panama's management of the Watershed Management

4

project emphasized administrative and financial processing rather than providing overall managerial and programatic support. AID's efforts to accelerate project implementation and, in particular technical assistance, contributed to planning and coordination problems in RENARE's administration of the Watershed Management project and subsequent problems in use of long-term consultants for technical assistance.

AID Management Recommendation

- During the recommended extention of this project, the AID project manager should spend as much time as possible visiting activities in the field. He should also provide assistance to RENARE in its efforts to effectively monitor and evaluate project performance.
- During the project extention AID should encourage the use of technical assistance and other project resources for activities that directly relate to the field programs in watershed management, particularly in the Caldera and La Villa watersheds.
- AID should immediately consult with the Department of Parks and Wildlife and the Ministry of Public Works on the proposed construction of the Cerro Punta-Boquete road and the probable encroachment and illegal timber extraction which would occur withing the Volcan Barú protected area if this road is completed.

Education and Research Findings

- Information dissemination activities from RENARE headquarters have not made much progress although they are essential to the success of the watershed management program. At the present there is limited staff available for this activity, and to date few funds in the project loan for this purpose have been utilized.
- RENARE has not yet begun a systematic program of participation in, and cooperation with, the wide variety of research activities currently being undertaken by other institutions throughout the country and necessary for guiding future program activities in natural resources and watershed management.

Recommendations

- A natural resource conservation educational program should be developed that would inform people on the issues and problems in watershed management, wild-land development, and environmental protection issues. Programs should be designed for delivery at four different levels:

1) ministerial and business leaders, 2) professional and technical personnel of other agencies (the Guardia Nacional, MOP, MIDA, MPPE, etc.), 3) the general public, and 4) cooperating farmers and other residents of the priority watersheds.

- Aerial photography and/or remote sensing data should be acquired as soon as possible, as recommended in the project paper and the Zadroga, et al mid-project evaluation. The photography and remote sensing should be used for management planning, land use studies and as a base line for subsequent monitoring of the results of soil conservation and forest rehabilitation programs.

Watershed Management Program Findings

- Although RENARE has implemented separate activities in reforestation, pasture improvement and soil conservation, it has not yet practiced integrated watershed management, nor has it developed a sound, consistent strategy for introducing or continuing this type of program at the level of local farmers and ranchers.
- Given the limited resources available to the La Villa and Caldera watersheds, an excellent start has been made in both areas to organize a qualified project staff, begin a program of community education and public relations, and coordinate activities with other agencies and technical assistance programs. In the Caldera watershed, soil conservation and tree planting activities have been implemented by farmers on their own land, rather than by contracted labor. The programs in these watersheds may serve as the basis for RENARE's strategy to implement other integrated watershed management programs.
- Reforestation in the canal watershed has not been cost-effective, and it is doubtful whether the program should continue in its present form. Large-scale planting programs should have specific industrial or fuelwood supply objectives, be subject to economic analysis, and include funds for the management and protection of forest stands through to their maturity.
- Of all the management activities, the protection of parks and reserves is the most certain, cost-effective means of maintaining water quality downstream. The success of the Department of the National Parks and Wildlife (DPNVS) in limiting encroachment on park lands is of great value to watershed protection.

Watershed Management Program Recommendations

- RENARE should coordinate watershed management activities, particularly in the Canal watershed, with the programs of the Panama Canal Commission, the Guardia Nacional, and other concerned public and private institutions. This would facilitate cooperative efforts and foster better understanding of RENARE's natural resource management programs.
- RENARE should concentrate its watershed management activities--tree planting, pasture improvement, soil conservation practices and protection--at the level of individual farms to avoid fragmentation of its effort, and increase the program's visibility and impact on resource deterioration problems.
- RENARE should give priority to the establishment and maintenance of protection forests in areas susceptible to erosion. Priority should also be given to natural regeneration, as opposed to planting, except on slopes, watercourses and river banks that are too damaged for vegetation to take hold on its own.
- Social and agro-forestry programs should be reviewed to assure that cooperating farmers are allowed to participate in project planning, both site and species are appropriate for the activities contemplated, and individual farmers are committed to providing the necessary maintenance.
- Given the location, stand condition and uncertain market for the cashew plantations in the Canal watershed, RENARE should carefully weigh the costs of their management and protection against the potential benefits before investing further in these crops.
- RENARE should explicitly recognize the importance the El Montuoso and Volcan Baru parks and reserves in the La Villa and Caldera watersheds, as part of its integrated watershed management scheme for these areas. Additional resources for operations and the hiring of field staff should be allocated to the parks and reserves in the three watersheds. In addition, an educational campaign should be implemented in the priority watersheds to build awareness of and support for the multiple values of wild-lands in water production, erosion control and recreation.

II. INTRODUCTION

The design of the Panama Watershed Management project was completed in 1979 with input from AID/Panama, AID/Washington, the U. S. Department of Agriculture (USDA), the Panama Directorate of Renewable Natural Resources (RENARE), the Panama Ministry of Planning and Political Economy (MIPPE) and a number of private consultants. In the original design, two different evaluations were to occur during the project. The first, a mid-project process (formative) evaluation, was done in 1981 by a four-person team that included Frank Zadroga, an environmental management specialist from AID's Regional Office for Central America and Panama (ROCAP); Rafael Franco, a financial management specialist from ROCAP; Dwight Walker, an assistant agricultural development officer from AID/Panama; and Alberto Saenz, then Watershed Management Project Coordinator from RENARE.

The second and present evaluation was to be performed at the end of the Watershed Management project. It was to be an "impact" (summative) evaluation of the project's performance during its four-and-a-half-year life. AID/Panama developed the scope of work for the evaluation and selected the contractor. In late April, 1983, ARD was contracted by AID/Panama to conduct the evaluation required by the project paper (PP), with funds for the study provided through AID's loan to RENARE. The ARD team established a close relationship with RENARE during the evaluation.

A. Evaluation Objectives

As stipulated in the scope of work (see Appendix A), the evaluation study had four objectives:

- to undertake a comprehensive review of the project, including an assessment of the effectiveness of both its individual components and the program as a whole;
- to review the management processes and procedures that have affected project activities;
- to conduct an impact assessment of the project to date; and
- to make recommendations concerning elements in the original project design that should be continued in current and future natural resources projects of this type, as well as components that should be redesigned or eliminated entirely.

A review of these objectives indicates that the evaluation study, conducted near the end of project implementation, examines past project performance as well as anticipated future activities.

From the beginning of the evaluation, AID/Panama made it clear that, in all likelihood, the project would either be extended and/or a new, though similar, natural resources management project would follow completion of the Watershed Management Project. In general, this reflects the increasing importance attached to natural resource management and watershed protection in Panama, particularly the Panama Canal watershed, and AID/Panama's long-term commitment to assisting the government of Panama (GOP) in its efforts to arrest short-sighted, wasteful exploitation of land and water resources. Thus, this evaluation aims to provide both a critical analysis of past project activities and a basis for using this experience to plan future programs.

B. Evaluation Methodology

To address the requirements of the scope of work, the evaluation team:

- clarified AID/Panama's and RENARE's needs, relative to the evaluation's orientation and emphasis;
- conducted personal interviews to review the availability of relevant data (e.g., aerial photographs, reports, etc.); and
- prepared a work plan for the study, taking into consideration the scope of work and data limitations.

The evaluation was organized around the three original purposes of the project, which are reflected in its three major components:

- RENARE institutional development, intended to strengthen the technical, managerial and administrative capabilities of that institution;
- education and research, aimed at increasing awareness in Panama of the importance of natural resource conservation; and
- the field-level watershed management program, designed to establish watershed management programs in the Panama Canal and two other priority watersheds that would involve the people in these areas in the resource management and conservation process to the greatest extent possible.

The first step in the evaluation was to review the purposes of the three major project components, which involved using the logical framework (log frame) found in the project paper. To identify important issues for each project component, project documents, such as annual plans, quarterly reports, financial

statements and technical reports, were reviewed. The issues and questions noted during this review then served as the basis for interviews of a wide range of individuals who were either directly involved in the project and/or had relevant perspectives on watershed management and natural resources in Panama. (See Appendix B for a complete list of those interviewed.)

Evaluation of the success or failure of each project component was only the first step in evaluating the performance of the project as a whole. Each component was examined from two different perspectives:

- the first focused on expectations for the component at the time of the original project design, based on the log frame included in the project paper; and
- the second capitalized on the experience and capabilities of the evaluation team members, in a review of the quality of the work being done as they observed it in the field.

In this way, project components were reviewed in a context that incorporated, but were not limited by, the project log frame. The discussion of each project component begins with the inputs and outputs listed in the project paper and compared them with what has occurred during implementation. Then the current status, impact and conclusions for all project activities within each component are presented.

Upon completing the review and written analysis of each project component, the team reviewed the specific findings for each component, and extracted results and recommendations of importance for the evaluation of the project as a whole. Emphasis was placed on a thorough analysis of how the particular project components and activities interrelated to meet the project's overall goal of achieving rational, productive, economic and equitable use of Panama's renewable natural resources.

C. Data Limitations

When this evaluation study was conceived during project design, it was expected that certain types of data would be available to enable the evaluation team to conduct a comprehensive "impact" evaluation. Project designers envisioned data gathering during project implementation in the form of project monitoring. This was to include aerial photographs taken during the first and fifth years of the project for "before-and-after" comparisons of erosion and forest cover, as well as small-scale research activities in the priority watersheds to measure such things as sediment yield and water quality over time. Unfortunately, this type of technical monitoring was not carried out, and neither was the gathering of nontechnical information, in terms of measures

of local participation in conservation activities and surveys of conservation awareness. The project monitoring and evaluation system within RENARE, envisioned by project designers and recommended again in the mid-term evaluation by Zadroga, et al, was never established, and the lack of accurate data on project activities clearly affected the degree to which this evaluation can draw conclusions regarding the cumulative effects of the project.

D. Organization of This Report

The format of this evaluation report reflects the overall evaluation methodology. Section III presents an analysis of the three major components of the Panama Watershed Management project--RENARE institutional development, education and research activities and field-level watershed management--and their related activities. Section IV examines the combined effect, both positive and negative, of all project components and activities taken as a whole. This section is particularly important for those seeking an overall perspective on the original project strategy, as articulated in the project paper, and the degree to which it has been successful. Section V offers specific recommendations to AID/Panama and RENARE for use of remaining project funds, given the likelihood of a project extension. Finally, Section VI presents the ARD team's suggestions for the follow-up natural resources management project that AID is considering. Appendix A contains the scope of work for this evaluation, and Appendix B, a list of persons interviewed during the course of the study.

III. EVALUATION OF INDIVIDUAL PROJECT COMPONENTS

A. RENARE Institutional Development

To improve the management of Panama's natural resources, the Watershed Management Project embarked on a comprehensive program to strengthen the capacity of RENARE to design and implement watershed management programs. RENARE was established in 1973, and from an initial focus on the management of Panama's forest resources (as the Forest Service within MIDA before 1973), its mandate has expanded to include activities in soil and water conservation, wildlife and integrated watershed management, and the management of public lands, including parks and reserves.

The specific goal of the institutional development component was "to strengthen the technical, managerial and administrative capabilities of the Directorate of Natural Renewable Resources." To accomplish this objective, the project component included reorganization, a strengthening of the management system, technical assistance, training, and additional personnel, equipment and facilities.

1. Reorganization of RENARE

Based on suggestions offered during project design by a management consultant (see Ormasa, 1978), RENARE was to be reorganized at the start of the watershed management project in an attempt to improve its administrative and technical support capabilities at the central headquarters. RENARE's central office was then expected to provide overall support for field-level project activities implemented by the regional offices. To best use the project's technical and financial assistance, efforts during implementation were to concentrate on three regional offices within the priority watersheds--the Panama Canal, La Villa and La Caldera. The management consultant's specific recommendation included:

- structuring RENARE using four major subdivisions-- leadership and overall direction (Office of the Director); support services (the Programming and Evaluation, Administrative, Accounting and Auditing Departments, Legal Office and Equipment Center); technical services (Forestry, Water and Land, National Parks and Wildlife, and Information and Community Relations Departments); and program execution (Regional Offices);
- establishing two assistant director positions--one for technical services, the other for administration; and

- drawing up "Delegations of Authority" that would enable different offices to take action on specific matters, such as personnel appointments, issuing water permits, lumber concessions, procurement, etc.

The first recommendation concerning the restructuring of RENARE has been implemented with some important exceptions. The first of these is that the Department of Agrometeorologia has not been integrated into the Department of Land and Waters. RENARE's reason for this is that the department functions well as an independent entity. In addition, despite admittedly limited resources, the Department of Agrometeorologia still has a distinct identity and the political strength within RENARE to retain its independent status.

The second deviation from the recommendation for restructuring is that new offices outside the Regional Offices were created to implement watershed management activities for two different reasons. First, there was not enough working space in the regional offices for the staff hired since the project began. Second, if the project was located in the regional office, project staff would fall within the regional MIDA structure directly. This would place bureaucratic constraints on the project's field activities and risk having project material and technical resources absorbed by the MIDA office. In practice, the Regional Offices now look to the watershed management offices for support because the project offices have some, though often limited, material and technical support. As a result, project activities have not enhanced the Regional Offices' project execution capabilities, and the future of the newly created project offices when project funds cease is a major issue.

The second recommendation--the appointment of assistant directors--has been implemented. This has freed the RENARE director to concentrate on policy and planning issues, while the assistant directors handle field implementation activities.

Finally, the restructuring of RENARE and accompanying improvements in its management system, which are discussed in the next section, have helped clarify the responsibilities and mandates of the institution's different departments and offices. However, the authority for program execution in the field remains unclear, and the ability of office managers at all levels to take action on many matters continues to be hampered by their lack of authority outside RENARE. Thus, although efforts have been made to implement the management consultant's third recommendation, further clarification of authority both within and outside RENARE is needed.

2. Strengthening RENARE's Management System

Strengthening RENARE's management system during project implementation was intended to improve the responsiveness of administrative support systems to the needs of staff conducting field activities. Before the project began, it appears that management was very informal, and task responsibilities were unclear. In addition, RENARE did not have highly qualified or experienced administrative support personnel. Given the growth expected for the agency, the designers of the Watershed Management project recommended the creation of a series of management tools and new administrative positions to enable the administrative support system to keep pace with the institution's development.

Some measures suggested by the project designers included:

- consolidating RENARE's offices into one new office with more space and a better communication system (telephones);
- hiring technical and administrative deputy directors (one each), procurement, personnel and management specialists (also one each) and a lawyer;
- developing management manuals, functional job descriptions and other management tools;
- "on-the-job" training of administrative and technical personnel;
- developing and implementing employee orientation seminars to give new staff members an understanding of the organization, and its activities and functions; and,
- establishing a formal internal communication system, including an information bulletin, administrative instruction series, and manual of program and administrative policies and procedures.

Over the past four years, RENARE has implemented all of these recommendations to different degrees. RENARE headquarters has been moved to a central location outside Panama City with better telephone communications. The administrative support staff have been hired, with the exception of the management specialist. Some administrative guides have been prepared, but constant changes in personnel between offices and in and out of RENARE have hampered the establishment of stable administrative systems. During the last two and a half years, a few of RENARE's administrative personnel have taken short courses in administration and management.

Financial administration is one management area that plagued the project, especially during the first two years. Neither RENARE nor AID/Panama focused on financial management issues during the project design. As a result, project activities came to an almost complete halt about one and half years into the project. In October, 1981, a financial audit of the project by the AID Regional Inspector General's office was completed and a series of recommendations made, which may be found in Audit Report No. 1-525-82-7. Both during and after the audit, AID/Panama staff and private consultants spent substantial amounts of time at RENARE headquarters, where they helped to resolve administrative problems. Since that time, RENARE has hired personnel with stronger administrative skills and tried to address shortcomings in their record-keeping.

RENARE has contemplated purchasing a computer system for use in project management. Some applications that have been considered include project monitoring, financial management, processing research data and report production. Negotiations were conducted with several computer companies, but a system was never purchased. Still, there appears to be continued interest in acquiring a system.

Overall, the effectiveness of RENARE's management has been greatly affected by the management styles of its different directors, as well as constant changes in leadership. RENARE's director at the beginning of the project had an autocratic style. The next director was not so autocratic but held the position for only a short period and so, was unable to establish a strong management style. The new director has only been at RENARE for three months and may provide capable leadership, given time. As a result, the quality of RENARE's administration and management has reflected the lack of consistent leadership, and new directors have been faced with a series of immediate decisions--administrative and management "fire-fighting." This has detracted from their ability to proceed with activities such as employee orientation seminars, the development of administrative and policy manuals, etc.

3. Training

The project design included long- and short-term participant training programs, in Panama as well as other parts of Latin America and the Caribbean or the United States. Approximately 96 person-months of long-term training were contemplated in the areas of forestry, forest engineering, forest economics, and parks and reserve management. Short-term training was to include extended inspection trips of projects in other countries, short courses overseas and extensive in-country training programs. The short courses were expected to cover such topics as soil conservation, pasture management, forest protection, and parks and reserve management.

The programming of training within RENARE has been handled by the Department of Information and Community Relations. Until recently, the department also used an inter-departmental training committee, which included the team leader of Experience, Inc., to review candidates for training and develop training schedules, as part of formulating annual implementation plans. The committee was recently disbanded, and department heads are now responsible for providing input to and reviewing training activities.

Since the project began, RENARE has spent \$140,000, out of a total budget of \$230,000, to send 45 people to 16 different courses in the United States, Puerto Rico, Colombia, Honduras, Costa Rica, the Dominican Republic, Venezuela, Ecuador, Mexico and Brazil. Study topics have included photo-interpretation, wood technology, chain saw use, fire control, watershed management, wildlife export and import, forest technician school, parks planning management, community forestry, arid-zone forest management, water resources planning and administration, forest plantations and reforestation, genetic resources conservation, and tropical forests literature search.

Of those attending the courses, 42 have returned to positions with RENARE. Six individuals are still participating in long-term training programs--three as forest technicians, one each studying for master's degrees in ecology, tropical forest management, and natural resources planning and administration. Currently, one candidate is waiting to start a master's program in forestry and another in agricultural extension. Other staff at RENARE have shown interest in studying natural resources planning and administration, and forestry.

Those who were interviewed regarding the training programs had very favorable responses. A travelling short course in the United States, arranged by the parks and reserves consultant, was particularly successful. This course, which focused on parks planning and management, helped give participants a perspective on existing parks, and form a sense of commitment and teamwork within the Department of Parks and Wildlife. According to the deputy directors and department heads, other training courses funded by the project and outside donors have succeeded in raising the level of staff members' technical skills, particularly in the areas of soil and water conservation, forestry and wood technology. An important result of the training has been improved morale among agency staff. To date, management and administration have been a minor focus of the training activities, although these had been substantially improved through short, very practical courses.

4. Technical Assistance

To upgrade RENARE's capacity to plan and implement watershed management projects, the project design included a technical assistance component of about 140 months of short- and long-term experts during the project's four-and-a-half year life. Two different mechanisms were used to procure this expertise. The greater portion was contracted by AID/Panama to a private U. S. consulting firm--Experience, Incorporated--using loan money, while the remainder was awarded directly by RENARE, with AID/Panama's approval, via personal services contracts.

In the Experience, Inc.'s contract for this project, the statement of work's general objective is assistance to RENARE in implementing the Watershed Management project. More specific objectives include:

- strengthening RENARE's technical capacity, direction and administrative capability;
- deepening the understanding of the importance of proper administration and conservation of Panama's renewable natural resources; and
- establishing programs for the proper employment and preservation of the Panama Canal, Rio La Villa and Rio Caldera watersheds, that involve the population of each locale in the integral development of the area.

Since the very beginning of the project, contracting the major portion of the technical assistance to a U. S. consulting firm using RENARE loan money, as opposed to grand funds, has proven problematic for various reasons:

- RENARE was reluctant to use loan funds for technical assistance that they regarded as inordinately expensive. Because AID/Panama felt the assistance was needed and formed an integral element of the project, they applied strong pressure over a long period to push the technical package through. The ensuing process of contractor selection created additional friction with RENARE because, in spite of the fact that the loan money was being used for technical assistance, RENARE was not given a major role in the process.
- The time required for AID/Panama's negotiation with RENARE and contracting (solicitation and review of technical and cost bids, negotiations, etc.) pushed the signing of the technical assistance contract to July, 1981. Thus, the Experience, Inc. team did not arrive until September, 1981, when the project was already half over.

- Upon their arrival, the team--three consultants whose technical specialties were agro-forestry, tropical silvi-culture and watershed management--were not warmly received by RENARE. RENARE's director continued to resent their high cost and the lack of his organization's input into the process for selecting the technical consultants. This resentment and the failure of the project design to provide a clear structure for the team's functioning within RENARE, combined to effectively place the consultants outside the mainstream of day-to-day management and decision-making at the agency.
- When the EI consultants arrived, administrative problems at RENARE were at their worst. This limited the team's ability to get out in the field with their counterparts, and thus poor use was made of their technical skills.
- Finally, the frustration of the technical assistance team with RENARE was compounded by the makeup of the team, for none of the consultants had past experience as a team leader for a similar project. From all reports, it appears that the consultants formed a loosely knit group that lacked both focus and leadership from the beginning--a real team was never formed.

The following subsections compare the consultants accomplishments to date, with their scopes of work. The watershed management expert:

- helped prepare and revise management plans for the La Villa and Caldera watersheds;
- assisted in the preparation of basic land capability studies for the priority watersheds;
- provided limited technical assistance to canal watershed activities and extremely limited field support to the La Villa and Caldera watersheds;
- helped identify possible uses of small computers for project and programs activities at RENARE;
- was unable to establish a system for collecting and analyzing data on water production, quality, sedimentation, etc. at the sub-watershed level, as requested in the original scope of work; and
- did not participate in the preparation of training plans for field and headquarters technical personnel, as originally requested.

The tropical forester:

- assisted in the placement of RENARE staff in long-term training programs in natural resources management, although this was not included in the scope of work;
- assisted in the development of forestry development projects proposed by the Japanese government, World Bank and RENARE, as requested;
- participated in the implementation of reforestation activities in the canal watershed;
- participated in discussions on updating Panama's forest legislation, as specified;
- gave advice on the selection and cultivation of forest species suitable for use in the canal watershed management program;
- was unable to update or evaluate the forest inventories of the Panama Canal, La Villa and Caldera watersheds, as specified in the scope of work; and
- did not develop technical information manuals on forestry planning, management and use, as originally requested.

The agro-forestry specialist:

- developed an agro-forestry manual for watershed management and reforestation programs in Panama, in conjunction with his RENARE counterpart;
- to a very limited extent, helped develop plans and programs to reorient current agricultural practices in project areas, particularly the canal watershed; and
- because of the consultants' late arrival, was unable to assist in the preparation of work plans and programs for agro-forestry during the establishment of forest plantations in the canal watershed.

In August, 1982, the agro-forester and team leader resigned from the project, citing lack of material support and leadership within RENARE, and frustration with the project's progress. As a result, the tropical forester was assigned responsibility

for team leadership. In addition, RENARE and Experience, Inc. agreed that rather than filling the agro-forestry position with another long-term staff member, the months of consulting time remaining in the EI contract would be used for short-term technical backstopping.

Experience, Inc. helped select consultants from the Tropical Science Center in Costa Rica to provide assistance in the development of the land use capability maps that form the basis for the long-term management plans for all three priority watersheds. The Tropical Science Center's work is perceived as particularly important for watershed management activities in these three priority areas, and a positive addition to the project, despite its late occurrence. As of May 1983, a number of short-term consultants are in Panama under contracts with Experience, Inc., and over the next three months, approximately 17 months of short-term consulting time will be spent on the watershed management project. A soil and water conservation expert is in Panama for two months to help RENARE develop soil conservation programs in the three priority watersheds. Through subcontracts with CATIE, two other consultants are in the country for one month to assist RENARE with the conservation and multiplication of germ plasm. During interview, some RENARE staff mentioned that all three consultancies could have been better coordinated with project staff working on the three priority watersheds. The influx of short-term consultants seems motivated by the fact that EI's contract will soon expire and their desire to fully utilize the budget allotted for short-term technical assistance, rather than any initiative on RENARE's part.

The initial project design suggested hiring a forest parks and reserve consultant for a period of two years to assist in the design and implementation of management plans for reserves and parks in the canal watershed. After discussions with and recommendations from CATIE in Costa Rica, a reserves and parks consultant was hired directly by RENARE on a personal services contract that started in August, 1981. Since that time, the consultant has worked directly with the Department of National Parks and Wildlife (DPNVS). Everyone commented favorably on the parks and reserves consultant. The reasons for this include the consultant's work habits and personality, the fact that RENARE was in charge of the selection process for this consultant, and his integration, from the outset, into a RENARE department, that has had consistent leadership during the project.

In retrospect, the stark contrast between the work of the Experience, Inc. team and the parks and reserves consultant seems to be a product of conditions within RENARE and the procedure for consultant selection, as well as the individuals involved.

Recollections about even earlier consultants are very dim, and consultant reports are not kept in a central retrieval area. According to RENARE, some consultancy reports were never received. The responsibility for coordinating consultants' timing and work has shifted during the project, and it seems clear that the best use of short-term consultants has not been made. In terms of long- and short-term assistance, AID/Panama and RENARE have both played a role in limiting the effectiveness of the individuals involved.

5. Personnel, Equipment and Facilities

During the past four years, the institutional development component has included very important activities in increasing RENARE's human and material resources. The following table compares the number of staff to be added through the Watershed Management loan, as specified in the project paper, the actual staff hired through either direct loan or counterpart ("contrapartida") monies, and finally, the number of staff members that are part of RENARE's permanent budget and not paid with loan funds:

	<u>Planned</u>	<u>Actual</u>	<u>Permanent</u>	<u>Loan</u>
<u>Field</u>				
professional	11	34	27	7
sub-professional	46	156	68	88
<u>Central/Technical</u>				
professional	8	36	31	5
sub-professional	6	28	18	10
<u>Central/Administrative</u>				
professional	7	7	7	0
sub-professional	6	26	14	12
TOTAL:	84	287	165	122

The total number of RENARE employees has risen from about 200 to 720 since the Watershed Management project began in 1979. Of the 287 personnel added by the project, through either direct loan or counterpart funds, 66 percent are located at RENARE headquarters and 34 percent in the field. The project has also funded temporary labor, primarily for reforestation and soil conservation activities in the Panama Canal watershed.

In terms of equipment and materials, the project design included a total of \$830,000 in this category for institutional development, which was intended to include construction of a central RENARE office, the purchase of office furniture and equipment, and specialized equipment for applied research and monitoring. Rather than building a new headquarters, portions of a former school were acquired by RENARE and refurbished for office use. To date, only 37 percent of the construction, equipment and materials funds for the institutional development component have been spent.

B. Education and Research

As its second major component, the project design includes a series of activities in education and research with two elements:

- start-up of an education and information program in the priority watersheds; and
- initiation of an applied research program at RENARE.

1. Education and Information Activities

The project paper recognized the importance of an educational program for the successful implementation of watershed protection measures. The purpose of this component was to increase awareness of conservation issues and enlist the cooperation of watershed inhabitants. RENARE project staff were to implement this campaign as "promotores" with visits to farmers in rural communities to identify resource management problems and inform them of the watershed project's goals and actions. Regular meetings in schools, community centers, and other area public agencies were planned. This field activity was to be supported by headquarters staff specializing in public education, the preparation of training materials, and purchase of audiovisual equipment and supplies. An information center and library were to be financed to support this campaign, as well as backstop the research program. The AID loan budgeted \$300,000 for the public information and conservation education component.

RENARE has not had much experience mounting large community education and information programs. Therefore, field staff need specialized training in conservation education techniques before they can work effectively in this area. They will also require support in terms of teaching materials and equipment to implement activities with the cooperating farmers they have identified. RENARE needs technical assistance in environmental education and materials preparation to help plan and organize the program, and to support work already begun by the field staff.

Ideally, the public relations and information campaign should have been developed and initiated prior to the beginning of the project's conservation activities to prepare the way for their implementation. Thus far, little has been done to develop this component at the national level. RENARE's Department of Public Relations and Information has few staff members, and their activities have been limited to the preparation of pamphlets explaining the project and some soil conservation techniques. These materials

have not been printed in sufficient quantities for widespread distribution in the watersheds, and their format and content could be substantially improved. The Information Center has prepared lists of the publications and materials to be purchased, but the orders have not been processed. In addition, the purchase of audiovisual materials has been delayed, although they are provided for in the AID loan. These delays are partially due to the lack of financing for the staff recruitment at RENARE headquarters. However, an active public information program is being implemented in the Caldera and La Villa watersheds by field staff members. Material, equipment and training for this type of activity would increase their effectiveness, and this support is needed now.

2. Applied Research

The project paper proposed an applied research agenda for RENARE to study erosion rates, water quality and the technology of tropical hardwoods. These activities were to be closely linked with ongoing field activities in the watersheds, especially those connected with soil conservation and reforestation. The use of aerial photography to monitor "sheet and gully erosion" and measure changes in the area of forest cover was recommended. The total budget for research activities was \$200,000 in loan monies.

To date, research activities have had only a very minor role in the project. Field research on erosion rates and water quality has just begun and thus, has not yet been a factor in ongoing field activities. The relationship envisioned by the project designers between applied research and the prioritization of specific soil and water conservation measures has not developed. The Department of Agrometeorology has begun a series of soils run-off tests that may be useful in the future, but there has not been enough time to reach any important conclusion up to this point.

The only area where research has proceeded is wood technology. A wood technology laboratory with carpentry equipment has been set up and the potential commercial uses (e.g., furniture) of 14 tropical hardwoods found in Panama's Darien region are now being tested. This research is also capitalizing on experience gained in Costa Rica with the same hardwoods. Three RENARE staff members went to Brazil for a course in wood technology, and they have returned to put that training to use in the wood technology laboratory. In general, however, only limited tests have been performed to date, and no direct field applications have resulted from the research activities.

It is important to note that most of the research funds have not been expended. Thus, RENARE could have a substantial budget for research activities during the possible project extension. In addition, links with other research organizations in Panama have not yet been established which could enable RENARE to capitalize on the resources of groups such as the Smithsonian Institute. Both RENARE's leadership and technical staff recognize the importance of research, particularly in terms of identifying the mechanics of soil erosion and potential uses of certain Panamanian woods.

C. Watershed Management Program

1. Canal Watershed

The drainage basin of the Chagres River is the watershed that supplies the Panama Canal. Of its total area of 326,225 hectares, 10 percent consists of two manmade lakes--Gatun Lake, which ships navigate in crossing the isthmus, and Alajuela, which supplies water for 40 percent of canal operations, as well as power generation and municipal consumption. The watershed's topography is broken by hills and low mountains that do not exceed 1,000 meters. Over 63 percent of the land has a slope greater than 45 percent and is suitable only for permanent crops and forests.

The watershed lies within the tropical moist and wet forest life zones. An estimated 169,000 hectares is covered by primary or secondary forest, while the remainder is predominantly extensive pasture, with some 10,000 hectares in shifting agriculture. Both primary and secondary forests have been cleared and burned to permit agriculture. Although some land is returning to secondary forest (rastrojo), the trend is to reduce forest area by creating agricultural land, which in turn is converted to pasture. The project paper states that given the rate of clearing in 1978, the primary forest will disappear by the year 2000.

Advancing settlement in the canal watershed is a relatively recent phenomenon, begun mainly since World War II and increasing during the last 20 years. Several factors have caused the boom of migration into the watershed--the development of Panama City and Colon as employment and marketing centers, depletion of agricultural land and its conversion to cattle ranching, and the country's overall population growth.

Increasing population pressure is affecting areas cleared for shifting agriculture and subsequently converted to pasture. Forest cover has been removed from steep slopes, thus accelerating erosion. The sedimentation rate for Lake Alajuela has increased in recent years, apparently due to these changes in land use.

Studies referenced in the project paper estimate that the reservoir will have less than 20 percent of its original capacity by the year 2040, which will seriously affect canal operations, as well as water supplies and power production for Panama City and Colon.

The specific management objectives for the Panama Canal Watershed project include:

- providing adequate water supplies for canal operations, as well as Panama City and Colon;
- conserving habitats for flora and fauna;
- promoting commercial forestry through natural and plantation forest management; and
- encouraging environmentally compatible farming and ranching activities in suitable areas.

The activities funded to accomplish the above objectives were:

- (1) reforestation of 10,500 hectares, including 6,500 hectares of commercially valuable tree species, 2,500 hectares in agro-forestry and 1,500 hectares in permanent crops;
- (2) soil conservation treatments for up to 8,000 hectares, with site-specific erosion control measures;
- (3) pasture improvement demonstrations for 600 parcels of one-half to one hectare on cooperating farms, using improved pasture grasses and management techniques; and
- (4) reserve and park management of 90,000 hectares--one-third of the watershed.

Reforestation

Reforestation is a major activity in the canal watershed management project. The project design established ambitious objectives--returning 60 percent of the watershed area to forest cover to control erosion and reduce the sedimentation rate. In addition, it was expected that reforestation would provide a future source of raw material for wood processing and agro-industrial use, and steady employment for those who might otherwise enter the watershed to establish agriculture by clearing and burning the forest cover.

The project paper allocated a total of 5.8 million dollars for reforestation, with 55 percent programmed for the Canal watershed. Of this amount, \$3,650,000 was to be funded by an AID loan. The project design targeted 10,500 hectares for planting through the implementation of three types of reforestation activities:

- plantations of merchantable trees--6,500 hectares
- agro-forestry (taungya) plantings--2,500 hectares, and
- permanent tree and bush crops--1,500 hectares.

Native Panamanian species were recommended for the forest plantations in the project paper, including laurel (Cordia alliodora) Spanish cedar (Cedrela odorata), mahogany (Swietenia macrophylla) and spiny cedar (Bombacopsis quinatum). Laurel was recommended for most of the planting, with mahogany and Spanish cedar limited to less than 20 percent of the stand because of their susceptibility to shoot borer (Hypsipyla) attack.

Forest plantations of commercially valuable species were to be established in strategically located areas--slopes of more than 45 percent, and currently in pasture or denuded of vegetation. Local farmers, were to be hired to plant the trees, and perform the required weed control and stand improvement activities. In this way, employment was to be provided for those who would otherwise use the land for agriculture and conversion to pasture. The alternative of letting the land return to secondary forest was not considered practical in most cases because of potential value of commercial tree species. Also, such a program would not include employment opportunities, a secondary objective of the project.

Agro-forestry plantings were intended to address the current practice of slash-and-burn agriculture by small farmers in the watershed. Farmers were to be given incentives to plant fast-growing commercial trees in their corn and rice plots, paid for weeding and pruning the trees in subsequent years, and discouraged from planting grass to turn the land into pasture. Under this taungya system, which was to use fire-resistant species, farmers could continue to engage in shifting agriculture in a more profitable, yet ecologically sound manner.

Permanent crops reforestation was designed to establish coffee, cacao, and other crops that can be brought to maturity under shade trees of commercially valuable species. The project paper proposed that this activity be implemented on state land, with a community of 400 families established to farm parcels of three to four hectares.

It was intended to offer a more productive form of agriculture to slash-and-burn farmers, thereby drawing them away from critical areas in the watershed.

To provide seedlings for the planting programs, the project paper called for the establishment of seven nurseries in the watershed. For the forest plantations, RENARE's experience in establishing successful pine plantations in La Yeguada was to be utilized. Contract labor was to be guaranteed a certain amount of work each season and paid by the job, rather than on an hourly basis.

RENARE personnel assigned to Alejuela had experience in nursery operations and producing limited amounts of planting material for distribution to interested landowners. Thus, reforestation activities in the watershed project got off to a quick start, particularly since the largest area was planted with cashew trees, reproduced from seeds. RENARE reported the establishment of trees on 871 hectares in 1979, 1,710 in 1980 and 995 in 1981. During those three years, a total of 3,576 hectares were planted--1,380 hectares in commercially valuable species; chiefly teak and Caribbean pine, and 2,196 hectares in fruit/nut trees, almost entirely cashew (maranon) and peach palm (pixbae).

After this rapid beginning, reforestation activities during the 1982 planting season were greatly curtailed due to a lack of funds for laborers to do site preparation and planting. Nor was there money to pay laborers for weed control and protection on the plantations already established. Several hundred acres of the cashew and peach palm have reported been destroyed or damaged by fire, and weeds are threatening most of the cashew seedlings that have not yet reached a height where they can compete with grasses and other growth. The 1982 nursery production was also lost since no alternative ways of distributing the material could be found.

Thus far, out of the goal of 10,500 hectares, 3,576 hectares have been planted under the Canal watershed reforestation program, of which RENARE records show 1,380 hectares in commercially valuable species, chiefly teak, Caribbean pine and cedar. However, the emphasis in planting has been on fruit/nut trees--2,196 hectares, of which 1,703 are cashew and 241, peach palm. The predominance of cashews is a significant deviation from the project design, which was implemented without technical studies of cultural practices or economic feasibility.

The cashew plantings were made on public lands by contract labor in areas that would have been appropriate for commercial forests. In some cases, thick secondary vegetation was removed to plant them, but no cases of plantings on steep slopes in erosion areas have been reported.

One objective of the cashew stands was to delineate the boundaries of publicly owned land, that squatters were not to enter. The planting also employed those who were most likely to invade the Canal Zone, once the treaty was signed, before RENARE could mount a program to protect the public land. Planting cashews over this large an area was also intended to provide the means to supply a food-processing industry and generate export earnings. However, no studies were done on the feasibility of industrialization.

The cashew planting may not be capable of yielding a return in the future, regardless of any short-term social benefits. There is a danger that fire and weeds will destroy the plantation. In addition, planting and subsequent cultivation and protection carry heavy costs, so it is important to plant the best varietal stock available. The cashew has not proved as hardy as expected and growth has been slow, thus requiring greater expenses for weed control and maintenance than planned.

According to AID records, a total of \$4,178,425 of loan money has been spent in the canal watershed on the reforestation component. This is an investment of about \$1,168 per hectare, figuring on the basis of the full 3,576 hectares planted. The amount of RENARE funds spent on reforestation from the non-loan budget has not been calculated, but it is undoubtedly more than the \$2,000,000 listed in the project paper budget. Thus far, the reforestation program has not achieved its objectives in the canal watershed, and the cost of the work done to date has greatly exceeded the preliminary estimates of \$330 per hectare.

Since only a very small portion of the cashew and peach palm plantations can be thought of as providing soil protection, the primary objective of the reforestation program has not been achieved. Given the cost of the reforestation component of the canal watershed management project, the maintenance expenses and potential returns of the cashew and peach palm plantations should be studied carefully to determine if further treatment and protection are justified.

Twenty agro-forestry trial plots were established by the technical assistance team in conjunction with project staff counterparts. The results of these trials should be monitored and replication begun where appropriate. Consideration should also be given to locating existing agro-forestry parcels among small farmers that have "tree culture", generally migrants from the Atlantic coast of Columbia and local Indians, to determine what traditional practices have been successful or could be improved.

There has been no effort by RENARE to implement the permanent crops project component, although some shade-tree permanent crops have been distributed and discussions held with settlements (asentamientos) near Alajuela on the canal's east side. The nurseries have additional plants to distribute for this program, and further enrichment planting of small holdings can continue. This activity should be extended as more cooperating farmers are located and education and field experience support the extension work.

Soil Conservation

Soil conservation activities are directed primarily at reducing the sedimentation of lakes Alajuela and Gatun, but this does not necessarily conflict with the secondary objective of involving farmers in soil conservation activities that have economic benefits. The project paper's watershed management plan identifies critical areas in the watershed, and proposes standard measures for corrective and preventive action. No consideration was given to cost, the area's physical characteristics and culture, or land tenure. Basic information concerning these goals and objectives was collected, and the Tropical Science Center used it to prepare a land capability document and maps. These data are being compared with maps of actual land use to define areas of conflict, which will be covered in Experience, Inc.'s final report.

In the field, soil conservation work has been carried out in the western part of the watershed, concentrating on the Cerro Cama area. The project paper's goal was to implement activities that would directly affect 8,000 hectares. So far, only several hundred hectares have been affected by gully erosion control structures that were built, but have not been maintained. A short-term soil conservation consultant is reviewing these activities and should be able to provide a detailed technical assessment of work in the three watersheds.

The demonstration effect and involvement of farmers in soil conservation has been virtually nil. The work was carried out by day laborers who had little interest in the activities and would receive no long-term benefits.

The sedimentation of Lake Alajuela, with its consequent effects on canal operation, energy generation and water supplies, has presumably not been reduced by the scattered erosion control treatments in the Gatun watershed. The following conclusions are based on the premise that controlling sedimentation of the Alajuela reservoir was the first priority, followed by Lake Gatun. On-farm benefits and employment generation were important, though secondary, considerations.

- The project paper failed to recognize the need to first determine how sediment is getting to the reservoirs. The problem could be soil eroding from crop and pasture land that is carried directly to the reservoir. Or, the primary problem might be accelerated run-off from cleared land that can then more effectively excavate material from river bed and banks. Deforestation immediately adjacent to major streams and rivers could be resulting in massive slumping and landslides, thus producing the bulk of sedimentation. Or, the sedimentation might be caused primarily by unusual natural events, such as the 1966 flood peak on the Chagres river which reached 42 feet above normal and produced a 13-foot rise in Lake Alajuela in 15 hours. The failure to address these issues has resulted in proposed on-farm conservation measures whose importance in terms of location and overall priority in sedimentation management is unknown.
- Soil conservation measures are an important part of canal watershed management, but those proposed and implemented were not integrated with other activities, either geographically or conceptually. For example, the complementary relationship between the protection of upstream slopes too steep for pasture, causes and control of gully erosion, and establishment of improved pastures as an alternative to inappropriate uses of upper slopes was not recognized.
- Gully control was apparently limited to stone structures, and with one exception, gullies were not protected from grazing. No effort has been made to plant or encourage ground cover or trees to take advantage of soil collected behind check dams and thus, begin the process of stabilizing and healing the gully. No channel terraces or other measures to reduce the speed of overland run-off entering the gully were in evidence.
- The critically important stabilization of stream banks as a means of reducing downstream sedimentation has been neglected. This involves: elements of soil conservation, in terms of both on-farm and stream-side sediment trapping with terraces and vegetation strips; protection through the establishment of gallery forest reserves of sufficient width; in extreme cases, the construction of in-stream structures to alter stream velocity and trap sediments; and reforestation/revegetation of stream banks, in conjunction with other protection measures.
- The gully control program did result in short-term employment, but was not used as a demonstration to improve overall soil management on a self-sustaining basis.

Pasture Improvement

The project paper recognized that cattle production is not the optimal use of land in the watershed, but is culturally entrenched and so, must be accommodated while minimizing its impacts. The problem is the use of faragua grass (Hyparhenia rufa) for pastures. A bunch grass reproduced from seed, faragua does not provide adequate soil cover on steeper slopes to prevent erosion. The use of fire to clear broad-leaf competition and renew the grass palatability further complicates soil conservation. The use of stoloniferous grasses under more intensive management on slopes up to 45 percent is proposed as a means of establishing a ground cover that is more resistant to erosion. The program requires RENARE inputs of technical assistance, transportation and a tractor, while the landowner provides fuel, pays for the tractor driver, land and labor.

Activities in pasture improvement have been successful, although numerically, the achievements have not been highly significant. The rate of new pasture establishment appears to be limited by the availability of only one RENARE tractor and lack of seed grass at the end of an extremely long dry season. It is too early to tell whether overgrazing will decrease on steep pastures, and larger areas of improved pasture on individual farms are needed.

The small number of parcels planted to date cannot be expected to have a quantifiable impact on sedimentation. In fact, the plowing of relatively steep slopes to plant the new pasture grass may accelerate erosion unless contour plowing is used and planting is rapid. It is not clear whether the shift to more intensive pasture management will be economically or culturally attractive to some of the cooperating farmers--those with large holdings and outside incomes, such as doctors. Two conclusions can be drawn at this point:

- the pasture improvement program has the potential to reduce sediment generation if it is more closely linked with other measures, such as the protection of steep slopes by shifting land use to forestry and applying soil conservation measures in plowed areas and gully recuperation;
- while pasture improvement is one of RENARE's ongoing activities, it may be a program that should be developed cooperatively with MIDA and IDIAP; and
- experience has shown that programs with perceived benefits for the individual landholder are the easiest to implement.

Parks and Reserves

The parks and reserves sub-component of the Canal watershed program focuses on three established areas, each of which is discussed separately below.

The Altos de Campana National Park was created in 1966 and expanded in 1977 to 4,816 hectares. In addition to its obvious value for watershed protection and production, there are important biological and recreational reasons for its existence. The site is a unique meeting ground for North, Central and South American flora and fauna, where vegetation is varied and fauna abundant. It also constitutes one of the few remaining habitats for the golden toad (Atelepus zeteki), a species in danger of extinction. The park's recreational potential is very high, as it is within easy driving distance of major urban centers and the refreshing climate of the upper slopes provides an attractive setting for outdoor recreation. Several summer houses have been built in and near the park, and the current access road was constructed as part of a sub-development scheme which preceded the park. Although Campana was chosen as the pilot national park for Panama, this role passed to Soberania National Park with the signing of the Canal Treaties, because Soberania had more facilities and is closer to Panama City.

Protection is the major management activity in Altos de Campana. For the most part, the small ranger staff of three has been able to halt the felling of primary forest to open new lands for agriculture and grazing. Within park boundaries, however, there are major expanses of lands already under cultivation or pasture--corn, rice, fruits and vegetables are the principal crops. The expansion of such activities has been stopped, but burning during the dry season and overgrazing, two causes of erosion, continue. The rangers have been only marginally effective in convincing local users of park land to employ practices more appropriate for hillside agriculture.

Material support for Campana that was programmed in the project design, has not been received. Rangers do not have uniforms, radios or transportation, other than one motorcycle for three individuals. Their cabins and entrance stations have not been constructed, and a small control post beside the access road burned along with the entrance sign. A building at a tree nursery within the park is being used as a ranger cabin, but needs remodeling and is not suitably located. Although appropriate sites for the ranger cabins and guard posts have been identified, counterpart funding for land acquisition has not been available. (Most park land is held under rights-of-possession, not fee-simple title).

Using the target objectives in the project paper, annex III, exhibit B, specific findings for Campana National Park are as follows:

- the development of Campana as a pilot park was abandoned after Soberania was transferred to the GOP, and as a result, many of the objectives listed below were dropped;
- the admission office burned to the ground along with the park's entrance sign;
- a watchtower has not been constructed;
- the biological laboratory was not created, and neither were funds forthcoming to remodel facilities at the existing tree nursery;
- the visitor center was not constructed;
- paths and roads have not been constructed or maintained by park staff;
- the voluntary relocation of residents to areas outside park boundaries has not been accomplished, and no incentives for such moves exist;
- education programs have not been developed; and,
- the ranger corps includes only three of the planned six rangers.

Soberania National Park was created as a result of the Canal Treaties, which transferred control of the Pipeline Road area to Panama. Until fairly recently, strict protection of this area was maintained by the Government of the Canal Zone and supported by the U.S. Military presence. Soberania continues to enjoy the most complete protection of any national park in Panama, but there have been border incursions and major problems in maintaining patrol access to the park's more remote areas. The Guardia Nacional routinely flies over the area, and RENARE personnel have participated in some of these flights on an informal basis. However, the reserve's borders are not monitored on a systematic, routine and detailed basis.

In addition to being the most accessible national park in the Central American region, Soberania has an impressive history relative to long-term ecological research and monitoring. Through the efforts of the Smithsonian Tropical Research Institute, and other national and international organizations, Soberania includes some of the most intensively studied areas of tropical moist forest in the world.

Species richness within the park is very high, and habitat diversity is a key factor in maintaining the large number of species and individuals. More than 560 bird species are found in the park-- in fact, the highest one-day bird census in the world, 333 species, was conducted along Pipeline Road in 1976. Seventeen species protected by Panamanian law and six others covered by the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora are also found there.

The findings for the Soberania National Park, relative to the target objectives listed in the project paper, are as follows:

- the admission center was not constructed, and while existing facilities are usable, remodeling or new construction is desirable;
- the park's boundaries have not been fenced, nor clearly marked, except where teak (an exotic) has been planted in rows along the area's northeast border;
- patrols are hampered by a lack of transportation and trails;
- interpretive materials have been developed, and displays are periodically changed in the visitor's center at Summit Park;
- ranger cabins continue to be a problem--no personnel live at the park;
- the ranger squad's equipment is limited to the bare essentials of field gear; and
- only 50 percent of the ranger corps of eight guardaparques has been hired.

Chagres Reserve consists of the watershed above Alajuela Lake (Madden Lake), although a careful study by a planning team from the Departamento de Parques Nacionales y Vida Silvestre concluded that a more appropriate designation for this area would be a national park. Land use capability studies suggest that agriculture, grazing and lumbering are inappropriate for the steep slopes and fragile soil. However, the primary forest has already been removed from approximately 15,650 hectares--20 percent of the total area--and only recently have efforts begun to enforce prohibitions on felling and burning within the reserve. Much of the land now in use is located on the shores of Lake Alajuela, but settlement pressure is starting to be felt along the upper reaches of the rivers as well, and major conversion of reserve lands to sites for summer/weekend homes is occurring along the area's southeast border in the Cerro Azul region.

A summary of findings for Chagres Reserve to date refers to the target objectives in the project paper:

- protection in the reserve has been difficult to ensure, and the felling of trees and burning of forest and pasture land continues, as the ranger squad of eight is still too small, under-equipped and lacks transportation;
- the acquisition of titled lands has been stalled because 1.4 million dollars in GOP counterpart funds have not been available;
- ranger quarters have not been constructed (although some existing facilities have been used as is or slightly remodeled because acquisition funds have not even been sufficient to acquire individual lots for ranger cabins;
- reconnaissance flights over the reserve have not been funded;
- patrols within the area must be conducted on foot, since there are no mules or horses and Jeeps are only rarely available for ranger use, besides the need for trails; and,
- the regulation of farming and animal husbandry within the reserve has not been successful, for the rangers lack training in agriculture and agro-forestry technology transfer, and the necessary logistical support and inputs, such as seeds, have not been available.

Social Impacts and Participation

Several general conclusions can be drawn about the social implications of the canal watershed management program:

- project activities have been limited in extent and effect;
- individual benefits from reforestation and protection were precluded by the fact that project activities were carried out on state land;
- only a minimum of reforestation, agro-forestry and soil conservation activities in the watershed were identified because of the emphasis on wage labor contracts (using time sheets) to generate employment;
- there has been no consistent program for extension, field days and media promotion of conservation, and the publications that have been prepared are not part of an integrated program.

2. La Villa Watershed

The La Villa Watershed is located in the provinces of Los Santos and Herrera on the Azuero Peninsula and provides water to a population of 72,000 for domestic and industrial use and irrigated agriculture, as well as a productive estuary. Annual rainfall ranges from 1,000 to 2,500 millimeters, with only limited areas at upper elevations receiving the higher amounts. There is a prolonged dry season from October through March, and most of the Azuero Peninsula falls within the dry tropical forest life zone. Severe drought conditions were observed throughout the watershed of 122,000 hectares during this record year of six months without rain, and there are many reports of cattle dying from lack of water and forage.

The topography of the watershed is broken, with grades of 40 to 70 percent common on the higher slopes of the El Montuoso and Canajagua areas, which have elevations of up to 1,000 meters. The predominant land use in the critical upper watershed, where virtually all the forest has been removed, is cattle grazing by small holders. Overgrazing and the lack of permanent ground cover reduce water infiltration and accelerate run-off. Severe flooding has occurred in the past, and the area is extremely susceptible to erosion during the rainy season. Degradation of the land will continue without a broad-based effort by the local populace and supporting agencies to protect vegetation and soil in the upper watershed.

The most serious impediment to introducing soil and water conservation practices is the combination of a dense population (and resulting scarcity of land) and the long tradition of cattle ranching. Areas that should be forested, as well as those more suitable for intensive agriculture, are in pasture with the consequent problems of resource degradation and under-utilization of the land. It is difficult to convince people with a limited land base and united perception of their land use options that conservation measures should be implemented.

Overall Project Activities

The project paper established a limited framework for programs in the La Villa watershed. Activities were to be directed toward solving the problems of low river flow during the dry season and extensive erosion and flooding during the wet months, both due to the lack of forest cover. Planned activities include:

- developing a management plan and creating a pilot soil and water conservation district, on an inventory of land use and problems--loan funds of \$100,000 and technical assistance were budgeted; and

- reforestation and soil conservation, as set forth in the management plan, although reforestation of approximately 1,000 hectares in the El Montuoso Reserve was anticipated-\$600,000 in loan money.

To implement the La Villa watershed management project, RENARE first prepared the management plan. The methodology used included identifying major management objectives and gathering information on the area's physical resources, current land use and other relevant topics. The problems causing the deterioration in the resource base were specified to provide a basis for protection and rehabilitation activities, and a technical organization best suited to administer a soil and water conservation district was established on a pilot basis.

The specific management objectives were established in conformity with the watershed management project's overall goal. The initial strategy for the watershed designated five management zones for specific programming--protection, agro-silviculture and grazing, annual cropping and cattle production, market gardening and horticulture, and mangrove and "albinas" areas. Four administrative areas were created for operational efficiency, and a program with six components planned:

- organization and technical administrative development,
- social development and community action,
- reforestation,
- pasture improvement and management,
- soil and water conservation, and
- conservation and protection of the environment.

Apparently, only three copies of the management plan were made due to a lack of resources for publication and distribution. Because copies of the plan are not available for reference and to serve as a guide for operations, the effectiveness of the planning exercise is limited.

Annual operating plans are prepared for La Villa on the basis of the management plan and existing information on the watershed's resources. The operating plans establish specific targets for each program component, and list the personnel and equipment required for implementation. The total budget for fiscal year 1982-1983 was B/811,206, of which B/93,158 was to be financed by the GOP and B/718,048 by AID loan funds.

An office to manage the La Villa watershed was established in Los Santos and field staff assigned by RENARE beginning in May, 1980. The project became operational in late 1981 with the recruitment of technical staff, paid with GOP funds, and the receipt of vehicles and some other equipment, purchased with AID loan money. Area chiefs have been designated for three of the administrative areas and program implementation begun.

Beyond the preparation of the management and operational plans, and mobilization of a team of technical personnel, few field activities have been possible. Despite the line items budgeted in the AID loan for activities in La Villa, project staff have not received sufficient funds to implement field operations. As of March 31, 1983, only about \$8,000 of the more than \$700,000 earmarked for this area was available. Project staff have been forced to operate under the credo that "they cannot count on headquarters for anything." While vehicles and some equipment for the nursery have been received, funds to hire technical staff and laborers have not. Coordination and central office support of field activities has been limited. There are indications that this situation will improve, particularly with the promotion of the La Villa project chief to the post of sub-director of RENARE.

So far, the chief organizational success of the La Villa watershed project has been the formation of a cadre of technical personnel. They have profited from short courses and training, and display an enthusiasm and "esprit de corps" that is remarkable given the circumstances. The younger staff members have shown a great deal of initiative in implementing a campaign of social development and public relations, establishing nurseries and distributing some planting material, despite minimal logistical support.

Additional evidence of the La Villa watershed staff's capability comes from their involvement in other projects--the FAO's World Food Program for Reforestation, CATIES's Firewood and Alternative Sources of Energy Project and ICAITI's Stove and Alternate Energy Project. The coordination and cooperation of these projects has enabled the La Villa staff to begin implementation, even though little of the resources allocated in the AID loan has been received.

Reforestation

The reforestation target of the operating plan for 1982-1983 was 350 hectares of commercial tree species. An additional 80 hectares was to be planted with fruit trees and orchard crops. To provide the material for reforestation, one nursery in each of the four administrative areas was planned, as well as four satellite nurseries.

The La Villa watershed project is fortunate to have the experience of the La Yeguada pine plantation as a pattern for reforestation activities. In addition, FAO species trials in the watershed have now been going on for 12 years and thus, can provide information on species suitable for the region. More recent demonstrations of fast-growing species have been done by CATIE in its regional wood energy program. Two plant nurseries are now in operation. The major one, at Macaracas, was established with some project-financed equipment in combination with resources from the CATIE fuelwood for energy program. This nursery has labor for plant production, an irrigation system, electricity and the capacity to produce up to 200,000 plants per season. Species that will be ready this year include leucaena (30,000 plants), eucalyptus (70,000 plants), teak, mahogany and Caribbean pine. The leucaena and eucalyptus are intended for firewood plantations, while the precious woods (teak and mahogany) will be distributed or sold for general reforestation activities and commercial planting purposes.

La Villa reforestation activities can begin using material from the Macaracas nursery and pine seedlings being produced at higher elevations for planting in the El Montuoso Reserve. Some interested landowners in the area have been contacted who will accept the quick-growing species as material for live fences or are interested in the teak and other valuable species as ornamentals. Unless funds are made available to pay for the labor to plant areas subject to erosion, as well as to distribute and protect the seedlings after planting, it is doubtful that watershed protection reforestation will be possible this year. Planting using paid labor should concentrate on the El Montuoso Reserve in the communal forests, gullies and other areas of erosion. On private lands, the work should be done by the landowner with RENARE support and assistance.

Soil Conservation

To date, there have been no soil conservation construction activities in the La Villa watershed basin. This is partially due to the focus on planning and establishing the management unit, but principally to the fact that operating funds to implement field activities and hire workers have not been made available. Under the circumstances, the staff has concentrated on activities designed to pave the way for cooperative activities with small farmers and landowners in the watershed. Project staff have conducted a survey of 200 examples of improved pasture use in the area to identify individuals who would participate in a program to expand the use of better grasses.

Parks and Reserves

At the very upper reaches of the La Villa watershed, the remains of a majestic primary forest can be found in small remnants within El Montuoso Forest Reserve. Created in 1972, the reserve consists

of 12,800 hectares at the headwaters of major watersheds in the Azuero Peninsula. Today, most of the area has been converted to pasture with some cultivated crops. Less than 800 hectares of the original natural forest remain. Although designated as a reserve, the area would be more appropriate as a national park, for it contains important archaeological sites as well as the remnants of native forests that covered the province. Its role in the conservation and production of water for the La Villa River and provincial capital of Chitre is obvious to the region's residents, but the people who live in the watershed's upper reaches are not convinced of the effects their activities have on water quality and quantity, or are unwilling or unable to change their behavior.

The management objectives for El Montuoso are similar to those stated in the project paper for the protected areas of the canal watershed. Specific findings for the reserve include:

- a management plan has been prepared and is in draft stage;
- an operational plan has been prepared;
- patrols have been marginally successful in halting the felling of primary forest to open land for agriculture and grazing;
- the ranger corps is trained, but consists of only three people; and
- the rangers' equipment is insufficient.

It is recommended that the El Montuoso Reserve be considered for designation as a national park. While this determination is made, the La Villa watershed project staff, as personnel of the Department of National Parks and Wildlife, should protect the reserve's vegetative cover from further destruction. In addition, the land along stream beds and steep slopes subject to erosion should be reforested.

Social Impacts and Participation

The program of social development outlined in the operating plan is a minor activity in terms of resource allocation. The objective is to inform those living in the watershed about conservation and organize them for cooperation in soil conservation and reforestation activities. The program is also intended to serve as a public relations and information service.

Project staff are working on a public relations campaign that appears to be successful in reaching small farmers and inhabitants of the upper watershed. A series of public meetings

have been held with rural school parent clubs and other community organizations. The area chiefs spoke of their success in "entertaining" campesinos in remote areas on the one occasion when they could offer a slide show using borrowed equipment. Audio visual equipment and informational materials (provided for in the AID loan budget) would immediately increase the effectiveness of this program in preparing the local populace to participate in soil conservation, reforestation and pasture improvement activities when they are implemented.

A half-hour radio program broadcast twice-a-week at 5:30 a.m. has been successful in presenting local opinions and information on the watershed and soil protection that concern watershed inhabitants. This broadcast is reportedly effective and reaches small farmers at a convenient time. The staff member responsible prepares the program using his personal tape recorder. Better equipment and training in public information techniques would increase his effectiveness and is needed by all the young field staff.

3. La Caldera Watershed

The 22,000-hectare Caldera watershed is located in the Boquete District of Chiriqui Province in northwestern Panama. Rio Caldera originates on the slopes of Volcan Baru (3,247 meters in elevation) and empties into Rio Chiriqui at an elevation of 250 meters. The topography is extremely rugged. Soils are derived from volcanic material and vary widely in age, type and subsequent geological modification. Of particular interest to the project are small areas of fertile soil, often on steep slopes, that are now being used for intensive vegetable production for the national market. Also of concern are extensive areas on the east side of the Caldera which are highly susceptible to erosion when even moderately sloping sites are cleared for pastures. Serious floods have been caused by rapid run-off, which is accentuated by cleared land on steep slopes in and below the Volcan Baru National Park. Sedimentation and changes in flow also affect the operation of the IRHE hydroelectric project located in the middle portion of the watershed. Rainfall is high, ranging from 2,500 to over 4,000 millimeters per year. Life zones range from wet tropical forest in the lowlands to Montane rain forest in the higher elevations.

Watershed management is directed toward alleviating the soil erosion caused by agriculture and other human activities. Activities include:

- design of a management plan, based on an inventory of land use and problems, organization of a pilot soil and water conservation district, and establishment of a 150-hectare area for demonstrating conservation practices and a nursery for producing tree seedlings--loan funds are \$150,000; and

- additional soil and water conservation. Specific activities to be identified in the watershed management plan-- \$400,000 in loan money.

Overall Program Focus

There are major differences between the focus envisioned for the Caldeara watershed program in the project paper and what has actually occurred. A diagnostic study of the watershed was completed in 1980, but as of May, 1983, field personnel had not received a management plan. A study, including a map indicating major land use capabilities, was carried out by the Tropical Science Center between April and November, 1982, and published in January, 1983. Again, as of May, 1983, this study had not yet been received by RENARE staff working in the Caldera watershed. Satisfactory completion of the land use management plan was supposed to have been a prerequisite for the disbursement of loan funds. As a result, activities undertaken in the watershed have not benefited from the direction and integration that a management plan can afford. The Plan Operativo 1982-83 states that the AID Watershed Project seeks to "order land use so that it is utilized in accord with its vocation; protecting in this manner sources of water, agricultural soils and the flora and fauna of the area."

Despite a general lack of technical and financial support, project staff are implementing management activities with dedication, enthusiasm and considerable ingenuity. The degree to which these activities are being carried out in isolation reflects the absence of an integrated focus for the implementation of the entire project.

Reforestation

The project paper states that a nursery will be established to produce seedlings for distribution to farmers, and the RENARE operating plan for 1982-1983 establishes the reforestation of 2,000 hectares of degraded land as a basic objective for the program. Specific goals for 1982-1983 are the production of 200,000 seedlings and reforestation of 80 hectares.

A lack of funds for contract labor forced RENARE to contract with landowners to plant trees. RENARE supplies seedling, transportation and technical assistance, while the farmers provide the labor for planting and maintenance. In 1982, the watershed program contracted with 30 farmers to reforest approximately 70 hectares, and with 40 in 1983. According to field staff, the emphasis has shifted from maximizing the area planted to improving the program's public exposure by increasing the number of cooperating farmers. Seedling production for 1982 appeared to meet the demand. The nursery has the capacity to produce 100,000 seedlings, which will cover the 40 contracts for 1983 of one hectare per farmer. The seedlings are predominantly Pinus caribea and Pinus oocarpa.

Broad acceptance of reforestation has been achieved through the planting campaign and reinforced by various public information programs. AID/Panama staff stated that IRHE plantations in the area were inspired by the RENARE program. The actual effects on erosion are variable depending on site and slope; however, protection from overgrazing and fire during tree establishment may be more important in terms of soil conservation than the trees themselves. One possible future problem is wood yield--farmers establishing plantations may be quite disappointed in the economic results, for many of the pine trees show poor form.

Soil Conservation

The project paper envisioned the establishment of a soil and water conservation district, based on a 150-hectare pilot area used for the demonstration of conservation practices. This activity has been transformed into demonstrations involving cooperating farmers. In 1982, 140 hectares on 45 farms were treated, primarily with drains, to reduce run-off. A recent survey conducted by project staff indicates 60 participants of which about 25 are new, for a projected total of 217 hectares of treated farm land.

Two specific objectives of the soil conservation program were the establishment of five hectares of pasture on different farms as a source of seed and test plots for four species of improved grasses. During 1981-1982, four hectares of seed pasture were established on eight farms and an additional four hectares on four farms during 1982-1983. A demonstration plot with five species was established in 1982, and its road-side location has facilitated public exposure.

The project's impact to date cannot be measured quantitatively, but staff members have a high degree of confidence that they are reaching farmers and having significant success in reducing soil loss. A significant public information effort has been made. These activities include:

- a half-hour, conservation-related, radio program is broadcast each week;
- programs have been carried out at all levels of the school system--525 "trees of life" ("arboles de la vida") were distributed to primary school students; talks given to teachers, and project staff are preparing materials for use in 15 elementary schools;
- good relationships have been established with 16 groups, including "Amigos de la Naturaleza;"
- professors and students from the university in Chirique have published a plant list, and lists of birds and reptiles are being prepared.

The soil conservation program has benefited directly from project support in the form of salaries for long-term personnel and a jeep.

General complaints at the watershed level are as follows:

- contracts for short-term labor have been out of phase with the tree planting cycles;
- less than 40 percent of the budget items requested have been received;
- technical assistance visits by consultants have been rare and short, with no written feedback after the visit; and
- there is a general sense of isolation from other watershed management activities.

Parks and Reserves

The highest mountain in Panama is located in Volcan Baru National Park. Volcan Baru (or Volcan de Chirique) was dedicated as a national park in 1976, and the massive volcano, rising to 3,247 meters, is the focus of much recreational and tourist interest in the 13,345-hectare park. Major watersheds, including the Rio Chiriqui, Rio Caldera, Rio Chiriqui Viejo and Rio Macho de Monte, begin on the slopes of Baru. In addition to the area's considerable importance as a watershed protection zone, the park offers a unique, refreshing environment for recreation, a wide variety of flora and fauna, and an important concentration of montane life zones, including lower montane moist, wet and rain forest, and montane wet and rain forest. A sixth life zone--tropical subalpine rain paramo--may exist on the summit of Baru (Tosi, 1967).

Approximately 5,000 hectares of the park are officially registered as state lands--the rest is held privately or claimed under rights of possession. Although the Department of National Parks and Wildlife has been remarkably effective in halting the expansion of agricultural land use within the park, serious problems persist with the illegal cutting of commercial timber and unauthorized incursions onto park lands by other institutions, supposedly acting in the public's best interests.

The commanding elevation of Baru's summit makes it an attractive site for telecommunications equipment, and at last count, 18 towers--many with several antennas--had been installed. Construction of the access road, and creation of a flat site at the top for buildings, fuel tanks and towers have had major and lasting impacts on the fragile montane ecosystems. A major ridge top was bulldozed to create the building site, and serious erosion can be seen along the access road.

No specific objectives were established for Volcan Baru National Park in the project paper, because it was not contemplated as a target area. It is a credit to DPNVS and RENARE staff that this was not allowed to preclude action in the area. Although the original project design does not include funds for Volcan Baru, RENARE staff sought creative mechanisms to ensure that this important protected area at the headwaters of the Caldera watershed received additional support. AID/Panama staff cooperated in this endeavor.

Early project efforts in the area were met with administrative resistance, for the regional sub-director of MIDA was also serving as director of the park. There were some political and legal problems, including illegal timber harvesting within the park, and poor coordination within RENARE between the watershed program and parks sub-component, implemented by the project and DPNVS. After the departure of the park director, renewed activity was more coordinated.

Specific findings to date for Volcan Baru are stated relative to target objectives derived from similar objectives stated in the project paper, for parks and reserves in the canal watershed:

- the management plan is now being revised;
- patrols have essentially eliminated the felling of primary forest to open land for agricultural use;
- the ranger corps of three is 50 percent of the programmed minimum;
- facilities have not been constructed due to a lack of funds to acquire sites and purchase materials;
- boundaries have been marked only along the border within the Caldera watershed; and
- an operational plan has been prepared.

IV. EVALUATION OF OVERALL PROJECT PERFORMANCE

A. Balance of Project Strategy and Components

According to the project paper, the Panama Watershed Management project's strategy is based on three elements-- institution-building, conservation education, and the design and implementation of watershed management programs in selected priority watersheds. Given RENARE's limited capabilities and resources when the project began, the simultaneous initiation of three complex, yet complementary, activities compromised the performance of the project. In practice, the strategy was undermined by poor initial leadership at RENARE, the failure to deliver necessary management assistance, and more fundamentally, weaknesses in the project's design.

For example, the design's institution-building component failed to identify the critical need for financial management assistance to RENARE. The education and research component received only cursory treatment in the project design, and was not sufficiently specific in stipulating the kinds of technical assistance, indicating how the component would fit into the overall project or providing a detailed implementation plan. The last major component, watershed management field programs, did not give an approach for service delivery at the farmer level, besides direct, short-term, paid labor.

From the outset, many of these shortcomings reflected the focus on working and dealing with the Panama Canal watershed's immediate problems, an emphasis which detracted from the project's coherence. In retrospect, project activities seem to have been "tacked on," rather than developed conceptually as part of an overall watershed management approach. The primary goals for managing the canal watershed are clearly stated in the project paper--providing adequate water supplies for canal operations, Panama City and Colon. Elsewhere in the project paper, the sedimentation of Lake Alajuela is described in detail as the problem which threatens the achievement of the water supply goals. Some causes of this problem, such as inappropriate land use in the watershed, are also described. As presented in the project design and log frame, however, project activities in protection, reforestation, soil conservation and pasture improvement became ends in themselves, with only a tenuous relationship to each other and the overall watershed management goals.

The lack of appropriate technical assistance in natural resources planning and administration to guide loan expenditures in the field was a major factor in the failure to integrate activities. An analysis of the mechanisms causing erosion and sedimentation of the reservoir, and how farmers and residents might be involved in conservation activities, should have dictated

the types and optimal locations of field activities. Without this direction and guidance:

- a parks and reserves management and protection effort was carried out in isolation, but was successful in initiating protection of the upper reaches of each watershed;
- reforestation activity was spatially separated and conceptually unrelated to other activities, and had no effect on water quality or quantity;
- isolated soil conservation activities (e.g., stone walls in gullies) were executed with no attempt to exclude animals, plant trees and encourage succession, or manage the land use which caused the gullies in the first place, and thus, had very limited effects on watershed improvement; and
- the pasture improvement program, again separate from other project activities, involved the participation of local farmers and ranchers, and could have been used as an incentive to promote integrated, farm-level erosion management.

The failure to focus on the overall watershed management problem has resulted in funds being expended with no tangible control of sedimentation, nor a sound and convincing plan for such control, especially in the canal watershed. This has negatively affected RENARE's credibility with institutions directly concerned with canal operations, and water supply and hydro-electric power generation in the watershed.

In contrast, the modest activities in both the Caldera and La Villa watersheds have been characterized by ingenuity, the participation of local farmers, and effective cooperation with other international projects administered by CATIE, FAO and the French assistance mission. In the Caldera watershed, a specific development problem was identified--the rapid erosion of fertile soils used for vegetable production. RENARE's program of introducing simple soil conservation practices has been accepted and expanded upon by landholders. Because of a lack of funds to hire laborers, reforestation and soil conservation activities were implemented with considerable local input, which complemented RENARE's limited technical assistance. In both Caldera and La Villa, radio broadcasts and school programs have been developed to increase public support and participation.

In the Canal watershed, on the other hand, most of the reforestation has taken place on public land, thus limiting local participation to hired laborers; and erosion control on private land, in the form of gully repair, has involved little more than the owners' consent. However, pasture improvement requires a greater commitment of time and money from the ranchers and could prove to be a valuable "entrée" for RENARE now and in the future.

Ironically, project activities in the Canal watershed, which have received most of the direct technical and material support from the AID loan, have failed to establish mechanisms for involving local farmers and other residents in the watershed management program, an essential ingredient of long-term project success. In the other two watersheds, where loan support has been minimal, RENARE has initiated a participatory process that includes local residents and many require less financial support in the long run for the continuation of watershed management activities.

In conclusion, the elements of a balanced project strategy existed in the project design, but were neither sufficiently detailed nor integrated. As a result, certain highly specific progress indicators (e.g., hectares reforested, conservation treatments, improved pasture plots) became RENARE's goals. In the canal watershed, where material and financial resources were immediately available, reforestation and soil conservation were accomplished by hired laborers. In the other two watersheds, where resources were limited, project staff were forced to seek other means of accomplishing reforestation and conservation goals, and in doing so, established precedents that will help them reach their objectives and better use the resources provided by the AID loan.

As a major point of departure in the recommended project extension, RENARE should seek credibility and acceptance within each of the watersheds by engaging local residents in conservation activities more effectively. In working toward its overall goal of watershed management, RENARE should offer incentives and actively involve farmers and ranchers. Unfortunately, the process of technology transfer and conservation extension has been neglected during project implementation to date.

B. Project Management

An assessment of Watershed Management Project implementation must consider both the RENARE and AID/Panama staffs as project management. As the host-country agency, RENARE has had primary management responsibility for all project activities. AID/Panama's involvement in project management has included technical assistance contracting, assigning long- and short-term participant training, monitoring project expenditures and assisting in the management of the project's rotating fund, and assisting in RENARE's day-to-day activities at its headquarters near Panama City. This project--the first comprehensive watershed management project to be implemented by AID in this hemisphere--has been a high priority with the AID/Panama mission, and their interest has been demonstrated by very active involvement in almost all project activities.

An analysis of RENARE and AID project management must begin with the project design, which was formulated by RENARE, AID and consultants under the direction of AID/Panama. The ARD evaluation team believes that, to a large extent, the major administrative/management problems confronted during project implementation reflect flaws in the project design.

The major design flaws affecting project management were:

- inadequate procedures for the administration of project funds by RENARE during implementation; and
- no clear plan for contracting and integrating the long-term technical assistance team into RENARE.

The implications of using loan money to contract technical assistance must also be analyzed.

During the first two and a half years, RENARE mismanaged project monies and the rotating fund, which resulted in an almost complete suspension of field activities at various times. The project design failed to include sound financial management capability within RENARE as a condition for initiating project implementation, and during implementation, AID's monitoring system was slow to respond to financial management problems and to recommend immediate assistance to resolve them.

The responsibility for identifying and responding to problems falls on both RENARE's management at the time and AID/Panama. AID/Panama's project manager was inexperienced and did not receive needed support and guidance from his direct superiors at the mission during the crisis. Thus, the financial management problem "snowballed" for a year and a half until project activities ground to a halt. With auditing assistance from AID's Regional Office of the Inspector General, many person-months of work by AID/Panama's project manager and his financial management support staff, and technical assistance from private consultants, the major problems were resolved. Only after this intense effort by AID and RENARE's recruitment of qualified financial management staff members were the problems of handling project funds corrected.

The second major management problem involving both RENARE and AID/Panama has been the use of technical assistance. Again, its beginnings can be traced to design flaws that were aggravated by poor project management on the part of both RENARE and AID/Panama. The initial design flaw was the absence of any discussion or a tacit agreement between RENARE and AID on the procedure for contracting technical assistance. Because loan, rather than grant, funds were to be used for technical assistance, the involvement of the host-country agency should have been considered in more detail during project design and covered explicitly in the project paper. Because of this oversight, the use of the loan monies for relatively high-priced, U. S.-based technical assistance appears to have caused resentment within RENARE. This was further complicated by AID/Panama's contracting process, which received limited input from RENARE during proposal review and, more critically, actual selection of the technical assistance team. The absence of a plan in the project design to integrate consultants into RENARE, the technical assistance teams' lack of a true leader and RENARE's resentment over the particular consulting group chosen resulted in very poor utilization of technical assistance resources. The conclusions to be drawn from this experience are:

- when loan funds are being used, AID should take every measure necessary to explain the bidding process beforehand and then involve host-country agencies in the final selection of technical assistance teams;
- AID project designers should clarify the role of consultants in the project and specify how they will fit into the host-country organization; and

in any institution-building project, AID and the host-country agency should consider the need for management and leadership skills in the selection of technical assistance teams.

In spite of the numerous management difficulties this project has encountered, RENARE has recently demonstrated a growing ability to establish and manage effective natural resource management programs. A critical factor in this progress has been the formation of a new management team within the agency. With sound, consistent leadership, RENARE may be able to capitalize on the assistance offered by the AID-funded Watershed Management Project, which has already helped RENARE upgrade its material and personnel resources, reorganize the institution and initiate field programs that are starting to give the agency credibility in its role of encouraging the sound use of Panama's natural resources. Using the Esman model to assess institutional development, it is clear that RENARE now has the beginnings of leadership, resources, internal structures and programs needed to enable it to systematically and deliberately change attitudes toward the natural resource management in this country. With assistance from AID and other donor-technical assistance agencies, RENARE must start to establish a common understanding of its mandate both within the agency and throughout Panama. This will require clarification of its legal authority and the formation of working relationships with other important public and private organizations (e.g., MOP, MIPPE, private lumber companies, etc.).

C. Reforestation

In recognition of the rapid invasion and conversion of forests through slash-and-burn agriculture, including areas in parks and reserves, particularly in the Canal watershed, reforestation activities received a very high priority in the Watershed Management Project. The AID loan budgeted \$3,750,000 for extensive reforestation in the Canal watershed, and the overall project goal for reforestation was 6,500 hectares, primarily in the Canal watershed.

To date, the implementation of the reforestation component has not followed the project design's guidelines. RENARE quickly began reforestation in the Canal watershed and reported a total of 3,576 hectares planted during the first three years. The primary effort was aimed at the planting of cashew and peach palm in extensive plantations on public (as opposed to private) land, using contracted labor. In general, the planting sites chosen were neither eroded slopes nor overgrazed pastures, as recommended in the original project design. In many cases, the areas selected were covered with secondary forest--thus, the land had to be cleared before planting, which entailed very high labor costs. No management plans or agreements with local residents for plantation maintenance were drawn up, and the funding of contract labor to carry out maintenance and protection activities (e.g., weeding) has been very limited. During the fourth year

of the project, the planting rate dropped off because budget limitations and administrative problems prevented RENARE from contracting the labor for site preparation and planting. The present condition of the plantations in the Canal watershed (e.g., location, health and growth rate) raises questions about whether further maintenance of the stands is justified.

The total cost for reforestation in the Canal watershed has not been calculated, but records for the AID loan portion alone amount to \$4.2 million--an average of \$1,175 per hectare. This does not include RENARE's operating and capital budget allocations for this activity. The cost of reforestation, as currently implemented, is obviously too high to be sustained, particularly when the investment may be lost if protection and maintenance funding is not available.

An overall problem in the reforestation component may lie in the program's name, for it emphasizes planting trees, rather than forestry practices and the protection of natural vegetation. The project design team did not think that letting land revert to natural brush and secondary forest was a practical alternative in cases where the slopes were too deeply eroded to hold vegetation. This may be correct, but the major problem in the watershed is to stop the spread of destructive land use patterns and allow natural vegetation to return where it can. If the existing forest cover cannot be maintained and protected, particularly on the steeper slopes, it is unwise to invest in plantations that also cannot be protected.

More than anything else, problems in the implementation of the reforestation component are due to the failure to:

- plan the activity in terms of site selection,
- allocate species to the most suitable locations, and
- follow-up on stands to assure that protection and weeding treatments were carried out.

In addition, the very speed with which RENARE began reforestation activity in the project's first years--before staff members were recruited, equipment and technical assistance were put in place and experience was gained in the agroforestry and permanent crop programs--probably contributed to the component's lack of success.

To date, the impact of reforestation activities on erosion control, soil conservation and the establishment of a productive base for agroforestry and wood processing has been negligible, especially in view of the money invested in the activity. This has raised questions at AID and RENARE as to whether the reforestation component should be continued. Currently, the RENARE field

staff are considering ways to reduce reforestation costs and make the activity more effective.

The reforestation component's failure is as much due to shortcomings in implementation as in the project's overall design. The design did not give sufficient consideration to the high initial and recurrent costs of the planned reforestation activities, especially the use of contract labor. However, it should also be pointed out that many of the recommendations and guidelines in the reforestation section of the project paper were not generally followed during implementation.

The design called for the establishment of forest plantations of valuable species on slopes of more than 45 percent that were either already severely eroded or overgrazed and susceptible to erosion. During implementation, large-scale plantations of fruit/nut trees were planted in areas with heavy vegetative cover. Thus, no reforestation and soil conservation benefits accrued, and excessive costs were incurred in site preparation and subsequent brush control.

In addition, valuable tree species were to be planted by farmers living on the fringes of public land, who were practicing slash-and-burn agriculture. In this system, the farmers were to enter agreements with RENARE to plant and cultivate the trees along with their own annual crops in exchange for the tree seedlings and a labor payment. Fruit trees and other permanent crops were to be introduced to agriculturists to change and upgrade their farming methods, and increase their income. This type of agroforestry has not been implemented in the Canal watershed in any significant way, and local residents have only been minimally involved, except on a contracted basis. In actual practice, fruit/nut trees have been planted on public land by contract labor, and no plans drawn up for the use of the fruit produced or protection of the stands.

It is clear that forestry and reforestation activities should continue to be a part of the watershed project, and the cultivation of trees and other perennial vegetation can be one of a number of economical soil stabilization practices. In general, the maintenance of existing vegetation and, where possible, replanting of eroded areas to trees and permanent ground cover can help to accomplish the project's goals of enhancing water quality and reducing sedimentation. However, the project's reforestation activities to date in the Canal watershed should not serve as a model for future work because the costs incurred were too high and the strategy chosen, ineffectual. On the other hand, reforestation in the La Villa and Caldera watersheds appears to be gaining momentum. As a result of limited financial and material resources, field staff had to encourage local residents to volunteer their labor for planting and maintenance. This was accomplished through publicity and daily contact with

the farmers and ranchers. With public education and local input, reforestation may continue with limited material and financial aid, but a desire for additional technical forestry assistance has been expressed.

D. Soil Conservation and Pasture Management

In project activities to date, soil conservation and pasture management have not received the highest priority, especially compared to reforestation. As mentioned, reforestation has had only minimal effects on soil and water conservation, and, thus, its contribution to improved watershed management has been small. Other types of soil conservation activities in the watersheds (e.g., check dams) have been implemented in the absence of an overall watershed management plan and generally with short-term employment generation as the highest priority goal. As was the case with reforestation, expenditures were made to institute the elements of soil conservation, but no funds were available to maintain the various structures. The project design was at fault in its failure to provide an approach for the continuing involvement of watershed residents. As a result, the value of the project's early activities in soil conservation relative to watershed management is largely limited to the experience gained, not any actual reduction in soil loss, heavy surface run-off, etc.

The absence of an overall watershed management plan/strategy during the project's first months was an important factor in the scattered nature of conservation activities. However, the project has allowed RENARE to gain valuable experience in implementing different conservation measures on an isolated basis in the three watersheds. In the Canal watershed, improved pasture management activities have been well-received by a number of farmers and ranchers, and RENARE has achieved some credibility within the watershed as a land manager. In the Caldera watershed, RENARE's work with farmers to check surface runoff and keep fertile soil in place has also been accepted and could have additional positive effects in the future. For RENARE, the end result of this experience is that project staff are learning what techniques are effective in the field and will be received favorably by farmers and ranchers. With better leadership and technical assistance, and well-planned financial support from RENARE headquarters, field staff can expand on this experience to integrate complementary activities.

E. Parks and Reserves Management

The role of natural vegetation in watershed management for protected areas, especially those given legal protection through their status as parks or reserves, was not adequately considered (or perhaps, even understood) in the design of the project and beginning of its implementation. Apparently, the parks and reserves

component was added in response to suggestions from AID/Washington and concerned conservation groups. Thus, the original project paper failed to fully consider the need for protective management and, in fact, ignored important protected areas in two of the three priority watersheds--El Montuoso in La Villa and Volcan Baru in La Caldera.

It is important to note that to date, specific management objectives for parks and reserves have been established on a case-by-case basis, for Panama lacks a national strategy/plan for the creation and management of protected areas. Without a systematic appraisal of all wild-lands and a determination of their appropriate designations, (parks and reserves are two types of "protected areas"), it will be difficult to ensure that protected area management in Panama follows the best course and resource management activities adequately consider the role of areas such as parks and reserves in priority watersheds.

There are significant precedents from other Latin American countries where wild-lands and protected areas have been systematically evaluated, and the role of these areas in supporting sustainable development has been clarified. (See References for work in Brazil, Costa Rica and Ecuador.) For Panama in general and this project in particular, RENARE is just beginning to understand the role of parks and reserves in watershed management. Outside RENARE, they are still apparently perceived solely as wildlife refuges and/or limited-access recreational areas. So far, the public education elements of this component and the overall watershed management project have received very little attention. However, critical portions of each priority watershed could be protected, if activities in this component focus on public education and cooperation with other concerned institutions during the remainder of the project.

V. FINDINGS AND RECOMMENDATIONS CONCERNING CURRENT PROJECT IMPLEMENTATION

Overall Project Findings

- The Watershed Management Project Loan has been a major factor in increasing the technical capabilities and material resources of RENARE and in increasing national recognition of the role of that agency in natural resources.

Overall Project Recommendations

- The Watershed Management Loan agreement and project should be extended to capitalize on the capabilities and experience gained by RENARE and AID in implementing this project.
- During the remainder of the project and throughout the proposed extension, RENARE/AID programming should give priority to field activities in critical areas at the three priority watersheds. Concentration of field efforts in the priority watersheds can demonstrate RENARE's competence in implementing watershed management and conservation programs.

Institutional Development Findings

- The Watershed Management project has made a vital contribution to the development of RENARE's technical and administrative capabilities through the addition of eighty-four professional, and two hundred and three sub-professional staff at the field and headquarters level. However, it should be noted that roughly 66 percent of the additional staff are located in the central office versus 34 percent in the field offices. The original project design planned for placement of 47 percent in the headquarters versus 53 percent in the field.
- The financial administration and procedural problems experienced during the first three years of the Watershed Management project have been resolved and are no longer a major impediment to operational activities. These problems were caused by faulty project design and poor project management by both AID/Panama and RENARE and have been remedied only with high levels of input from AID/Panama staff and the addition of qualified personnel at RENARE. However, budget uncertainties in the Panamanian government and administrative delays within RENARE still unfavorably affect the delivery of resources to the field offices and the implementation of project activities.

- The project design failed to adequately address day-to-day management and administration activities. This resulted in bringing the project to a point where administrative and financial problems seriously affected the quality of implementation.
- The changes to increase the capability of the regional offices of RENARE in project management, as recommended in the project paper, has not been accomplished during the implementation of the watershed project. Rather, separate offices have been set up for project activities and upon project completion these may be difficult for RENARE to sustain and/or integrate into the agency.
- The project staff at RENARE, Experience, inc., and AID/Panama delayed bringing in technical assistance in public administration, included in the project paper, the ensuing technical assistance contract, and recommended by the mid-project evaluation. This assistance might have helped to minimize the effects of project administration difficulties on project activities.
- RENARE's preparation of annual implementation plans, as currently practiced, is not very helpful to operations and management. The document is too general to serve as a management tool or work schedule, and is concerned mainly with procurement needs (inputs) rather than on what will be achieved (outputs) in the coming year.

Institutional Development Recommendations

- The continual changes in RENARE leadership have limited the implementation of many management system improvements (i.e. purchase of computers), and it is essential that stable leadership be maintained at RENARE in the future so that the improvements envisioned in the project design can occur.
- RENARE should install a monitoring and evaluation system to improve the program management capabilities of the Director and senior staff. This system should be incorporated into the existing periodic programming and reporting functions.
- Watershed project staff at headquarters who have been assigned as counterparts to technical assistance personnel should be placed, in appropriate technical departments to reinforce the coordination and support of watershed project field activities.
- RENARE should consider integration of the resources of the regional offices and Watershed Management Project

Offices. Every effort should be made to assure that the project resources for field offices are delivered on a timely basis during the proposed project extension.

- RENARE should reexamine the purchase of a computer system for project management. For many different applications, including project administration, research, and report production, a computer system could be an excellent addition to RENARE's capabilities.

Technical Assistance Findings

- The technical assistance financed by the AID loan has had a limited degree of success in reinforcing RENARE's capabilities in Watershed Management project implementation. The delays in contracting the experts, how they were contracted, their individual qualifications, and their utilization within RENARE were all factors in the effective use of these individuals.
- RENARE has not used effectively most of the technical assistance provided through the loan agreement. Counterparts provided by RENARE were generally new graduates hired for that purpose from outside the agency and not members of the existing departments. With the exception of the long-term assistance in the Department of Parks and Wildlife, the other resident technicians have not been well integrated into the work of the agency nor have they had a significant impact on operations in the field.

Technical Assistance Recommendations

- The technical assistance assignment of the parks management specialist should be extended by RENARE for an additional year to assure continuity and support to the Department of National Parks and Wildlife. Throughout the one year extension his efforts should be concentrated on a transfer of his technical knowledge and experience to counterparts.
- The current long-term technical assistance contract with Experience, Inc. should not be extended. RENARE and AID should review proposed short-term technical assistance missions under the existing contract to make sure that each consultant will address priority issues in watershed management identified by RENARE and that, if possible, the activities of the consultants focus on field support within the three watersheds.
- Technical assistance during the remainder of the Watershed Management project should focus on natural resources planning and administration (to work at the level of the

Director and Sub-director of RENARE). Other assistance may be useful in the areas of conservation education, rural extension, watershed management, and geomorphology.

Training Findings

- The training component of the project has been successful in increasing the technical competence of RENARE's staff as well as in developing individual self-confidence and an "esprit de corps," especially within the Department of National Parks and Wildlife. "On-the-job" training in administrative procedures and financial documentation was instrumental in improving the financial management of the AID loan at RENARE.

Training Recommendations

- Long-term participant training should focus on the development of natural resources administration and planning (including monitoring and evaluation) skills. During the project extension, RENARE and AID should work together on a long-term training plan that will reflect current and expected future needs.
- Project management workshops should be held for field and headquarters professional staff to support the installation of the project monitoring and evaluation system. These workshops could be used to present administrative procedures and financial management requirements of the AID loan and other external cooperation agencies and could also help to create within RENARE a greater working spirit which would have a very positive effect on project implementation and overall needs.
- Continue short-term training activities at the technician level in those skills required during implementation of field activities, relating practical training to technical assistance wherever possible.

AID Management Findings

- AID/Panama's management emphasized administrative and financial processing rather than providing overall managerial and programmatic support. AID's efforts to accelerate project implementation and, in particular, technical assistance, may have contributed to planning and coordination problems in RENARE's administration of the Watershed Management Project, and subsequent problems in use of long-term consultants for technical assistance.

- AID, in its support of the rural roads program, has not made sure that this program is coordinated with the natural resource management and conservation responsibilities of RENARE. In the case of the Cerro Punta-Boquette in the Rio Caldera watershed, a road is being built which enters the national park and is in direct conflict with RENARE's activities in the area.

AID Management Recommendation

- During the project extension AID should encourage the use of technical assistance and other project resources for activities that directly relate to the field programs in watershed management, particularly in the Caldera and La Villa watersheds.
- The Rural Roads program of AID with the Ministry of the Public Works should discuss with the Department of National Parks and Wildlife at RENARE the probable encroachment and illegal timber extraction which will result from construction of the Cerro Punta-Boquette Road in the Volcan Baru National Park. AID, RENARE and the Ministry of Public Works should take every necessary step to ensure the integrity of the Volcan Baru National Park.
- During the recommended extension of this project, the AID project manager should spend as much time as possible visiting activities in the field. He should also provide assistance to RENARE in its efforts to effectively monitor and evaluate project performance.
- It is recommended that AID consider longer implementation periods for major institution building projects and that evaluations and technical assistance for such projects should preferably be financed by the grant portions of project funds.

RENARE Project Management Findings

- Overall coordination and support of the Watershed Management Project by RENARE has been provided through a Project Coordinator reporting to the Director/Subdirector. Coordination and support of the project by RENARE's technical departments and regional offices as recommended in the project design have been very limited.
- Vehicles and equipment purchased through the project frequently have not been effectively utilized in the field for project implementation. This is due in part to lack of operating funds for vehicles as well as the utilization of much of the equipment at RENARE headquarters in Paraiso.

65

Education and Research Findings

- Information dissemination activities from RENARE headquarters have not made much progress although they are essential to the success of the watershed management program. At the present there is limited staff available for this activity, and to date few funds in the project loan for this purpose have been utilized.
- The research activity has similarly been slow to begin implementation with the exception of equipment purchases and ongoing research at the Wood Technology Center. RENARE has not had a systematic program of participation in, and cooperation with, the wide variety of research activities currently being undertaken by other institutions throughout the country and necessary for guiding future program activities in natural resources and watershed management.

Education and Research Recommendations

- A natural resource conservation educational program should be developed that would inform people on the issues and problems in watershed management, wildland development, and environmental protection issues. Programs should be designed for delivery at four different levels: 1) to ministerial and business leaders; 2) to professional and technical personnel in other agencies (the Guardia Nacional, MOP, MIDA, MPPE, etc.); 3) to the general public, and 4) to cooperating farmers and other residents in the priority watersheds.
- Aerial photography and/or remote sensing data for the three critical watersheds should be acquired as soon as possible as recommended in the project paper and the Zadroga, et al, mid-project evaluation. This photography and remote sensing should be used for management planning, land use studies, and to provide a base line for subsequent monitoring of the results of soil conservation and forest rehabilitation programs.
- A program should be started to collect and prepare technical information, staff studies and research results, and the field reports of technical assistance experts for reproduction and distribution to field personnel and other interested technicians. Such a program would provide an organizational memory, make more efficient use of short-term consultants who might otherwise repeat work that has already been done, and increase the knowledge of the professional and technical staff of RENARE and other resource agencies.

Watershed Management Findings

- Though RENARE has successfully implemented separate activities in reforestation, pasture improvement and soil conservation, it has not yet practiced integrated watershed management nor developed a sound and consistent strategy for introducing or continuing this type of program at the level of the local farmer or rancher.
- Given the limited resources made available to the La Villa and Caldera watersheds, an excellent start has been made in each area to: organize a qualified project staff; begin a program of community education and public relations; and, coordinate with other agencies and technical assistance programs to stretch scarce resources. In the Caldera watershed, soil conservation and tree planting activities have been implemented on their own land by farmers rather than by contracted labor. The experience in these watersheds may be the basis on which RENARE can build a strategy for implementing integrated watershed management programs.
- Effective protection of parks and reserves is the most certain and cost effective way to maintain downstream water quality among all the management activities. The success of the Department of National Parks and Wildlife (DPNVS) in limiting encroachment on park lands has been of great value to watershed protection in the priority watersheds, particularly in light of the limited budget with which the department has worked. Important material resources such as transportation, housing, and communications equipment as well as overall personnel resources are still seriously short of what is needed to guarantee the protection of the existing parks and reserves.
- The Canal watershed reforestation has not been cost effective and it is doubtful whether the program should continue as currently implemented. Large-scale planting programs should have specific industrial or fuel wood supply objectives, be subject to economic analysis and include funds for management and protection through to maturity.
- Given the location, stand condition and uncertain market for the cashew plantations in the Canal watershed, RENARE should carefully investigate the costs of management and protection against the possible benefits before investing further in these crops.

Watershed Management Recommendations

- RENARE should integrate its package of watershed management activities (tree planting, pasture improvement, soil conservation practices and protection) at the individual farm level to avoid fragmentation of effort and to increase program visibility and impact on resource deterioration problems. It should also give priority to the establishment and maintenance of protection forests in areas susceptible to erosion. Priority should be given to natural regeneration rather than planting, except on slopes, water courses, and river bands too damaged for vegetation to take hold.
- RENARE should grant explicit recognition of the importance of El Montuoso and Volcán Barú protected areas in the integrated watershed management schemes for these areas. Additional resources (transportation, communications equipment, ranger cabins) for operations and the hiring of field staff should be allocated to the parks and reserves areas within the three watersheds. An educational campaign should be implemented within the priority watersheds to build awareness and support for the multiple values of wildlands in water production, erosion control and recreation.
- Social forestry and agroforestry programs should be reviewed to make sure that there is participation of the cooperating farmers in the project, that both site and species are appropriate for such activities and that there is commitment on the part of the individual farmer to continue with necessary maintenance.
- RENARE's pasture improvement activities have been well received. These activities have provided both valuable experience and needed credibility for RENARE. This successful "entree" should be used to gain acceptance for a complementary package of farm level conservation practices which include transformation of pastures on eroding step slopes to forest use.
- In each of the three watersheds, remaining project funds should be used to support on the application of integrated management techniques to specific problems: sedimentation control in the Alajeula watershed; park protection and soil conservation in vegetable producing areas in Caldera; and management of the upper La Villa watershed including El Montuoso reserve.
- RENARE should coordinate watershed management activities, particularly in the Canal watershed, with the programs of the Panama Canal Commission, the Guardia Nacional, and other relevant public and private institutions. This would facilitate cooperative efforts and foster a better understanding of the natural resources programs of RENARE in natural resource management.

This would facilitate cooperative efforts and foster better understanding of RENARE's natural resource management programs.

The achievement of watershed management goals will require RENARE to undertake a team approach to programming to provide continuity in both personnel and implementation strategies, and sufficient, timely funding.

VI. RECOMMENDATIONS FOR FUTURE NATURAL RESOURCE MANAGEMENT PROGRAMS

AID/Panama's long-term commitment to assisting the GOP in the development of programs in natural resources management and protection will undoubtedly require continued financial and technical assistance over the next few years. This section presents some preliminary ideas on the development of a follow-up project to be implemented on completion of the Watershed Management Project. These suggestions are based on discussions the evaluation team had with personnel at AID/Panama and RENARE, as well as other interested parties outside those two organizations.

The project's purpose would be to strengthen the GOP's institutional capacity to rationally plan and effectively manage the use of Panama's natural resources, and would aim to address a variety of interrelated problems. Panama's ability to sustain and improve the social and economic well-being of its people is seriously threatened by the current mismanagement and destructive exploitation of its natural resources. To reverse current trends, the GOP must confront problems such as limited understanding of the value of Panama's natural resources, wasteful forest exploitation, unending expansion of crop and cattle production into areas incapable of supporting such activity and lack of natural resources management expertise among farmers in rural areas. The effects of these problems include reduced soil fertility, increased costs for food and fiber production, seasonal scarcity of water for domestic use, energy generation, irrigation, industry and operation of the Panama Canal, silt accumulation in reservoirs, rising costs and declining availability of forest products, impairment of fisheries resources and loss of tourist revenues.

The project's scope would cover the rational management of Panama's forests, coastal marine resources and agricultural lands to provide the basis for a sustainable rural economy. The proposed project would be a broad-based effort, designed to direct the concern of both government and private organizations to critical resource management problems. Project efforts would focus on a number of areas.

Natural resources policy activities would focus on clarifying the responsibilities of key Panamanian institutions involved in natural resources management and establishing a national conservation strategy. An analysis of current legislation affecting natural resource management would be carried out as a basis for policy decisions relating to protected areas management, responsibilities of forest concessionaires, and tax and other economic incentives for farmers and absentee landowners who undertake soil and water conservation and reforestation activities.

In the area of land use planning, an inventory of present land use and capability is required for the planning and programming of future natural resource management activities, and would provide the basis for setting priorities concerning the protection, rehabilitation, and management of land and water resources. At the end of the project, critical areas of Panama would be identified for improved land use management, practical criteria for guiding development activities made available to public and private groups, and a computerized clearinghouse for natural resources data established.

The natural resources education and information component would be designed to create an active constituency for sound natural resources management among private, public and nonprofit entities. This would involve the use of mass media (e.g., television, radio), the primary, secondary and university school systems, and local interest groups to promote programs that foster greater awareness of the importance of sound management of Panama's natural resources. The education and information programs would be directed at four distinct levels:

- top decision-makers at the ministerial level,
- professional and technical staff in related institutions,
- resources users, primarily in rural areas, through extension or technology transfer work, and
- the general public, particularly in support of private conservation organizations.

Upon completion of the project, there should be a measurable increase in awareness and appreciation of the contribution of land and water conservation and forest management to sustained economic development.

In terms of applied research and experimentation, Panamanian experience in land and water management and forestry has not been studied systematically to provide an information base for technology transfer and educational activity. The program of applied field research would be designed to identify, analyze and improve the actions of management agencies that have been effective in increasing the productive use of renewable natural resources. Specific practices would be studied to determine the costs and benefits of replicating them in the private sector, as well as to identify the type of public programs that could stimulate such activities. An important element of these research studies would be practical on-farm fieldwork. At the end of the project, the GOP should have a sound basis for public education/information programs aimed at small farmers and other rural people, as well as support for similar applied research efforts in the private sector.

In protected areas management, parks, reserves, wildlife refuges and other wildlands are key elements in integrated watershed management and local economic development, and their importance has only recently been recognized. This project component would include the development of a national protected areas management strategy. It would also support efforts to protect and comprehensively manage critical, sensitive ecosystems throughout Panama. The program would encourage the integration of neighboring communities in the park implementation process (i.e., construction-related employment, personnel needs, concessions, etc.). Upon completion of the project, a management strategy for protected areas would exist, and major parks and reserves would be adequately staffed and managed.

The soil and water conservation and forestry component would consist of the implementation of soil and water conservation and forestry activities that directly involve individual farmers in rural areas, within the context of an integrated regional or watershed management plan. Implicit in each activity would be optimal short- and long-term economic returns for the farmers. The program would also provide indirect benefits to water users downstream (i.e., fisheries, flood-prone areas, etc.). At the end of the project, functional models of sustainable, productive land management would be replicated on non-target farms, and on-farm and downstream improvements in water quality measured. In addition, experience would be gained in the development of incentives for on-farm conservation improvements.

Continuing training efforts would be made to upgrade the technical and management skills of those involved in natural resources programs. This would involve both short-term training workshops, conferences and study tours, as well as long-term courses, which could cover natural resources administration, forestry, soil science, parks planning, watershed and wildlife management, tropical ecology and resource economics. The cost of the training component is estimated at \$2,000,000. Upgrading Panama's institutional capacity to manage its natural resources is a key feature of AID/Panama's overall country strategy, as this affects most sectors of the economy. With limited undeveloped agricultural land available, it is critically important for Panama to make maximum productive use of its forest, land and water resources through rational planning and management. Both the World Bank and Inter-American Development Bank are interested in natural resources and forestry programs in Panama, and the possibility of a joint project between AID and another donor should be explored.

The direct recipients of project assistance would be institutions, particularly RENARE, whose technical and managerial capabilities are upgraded. The primary beneficiaries of the project would be the Panamanian public at large. Field activities in soil and water conservation and forestry would directly

benefit rural farmers, first, and other rural residents (e.g., fishermen and water users), second.

REFERENCES

- Anon., 1980. Strategy for training in natural resources and environment in Latin America and the Caribbean. A report prepared for WWF-U. S. by a team from the University of Michigan, supported by U. S. National Park Service with financing by AID; World Wildlife Fund-U. S., Washington, D. C.
- Anon., 1979. Seminario-Taller Operacionalización del Proyecto "Ordenación, Manejo, y Administración de los Recursos Naturales de la Cuenca del Canal de Panama" 23 Abril-11 Mayo 1979, MIPPE - MIDA - AID - IICA/OEA, Panama, Republica de Panama.
- Bernal Caballero, E. M., R. A. Martínez Gonzalez, and D. M. Reyes Castro, 1978. Parque Nacional de la region del Chagres. Trabajo de grado, Facultad de Arquitectura, Universidad de Panama, Republica de Panama.
- Capitaine, R. C., 1969. Estudio de fertilidad de suelos, conservación y mejoramiento de suelos, y recuperación de suelos salinos-alcalinos de albina: Proyestoc de Riego del río de La Villa. (BORRADOR) FAO/MAG, Proyecto FAO UNSF 216, Chitre, Panama.
- Experience, Incorporated. Var. Quarterly Reports, 1981 - May 1983.
- Heckadon, Stanley, 198? Socio-economic development in the canal watershed.
- Houseal, Brain S., Dwight Walker and Erasmo Vallester, 1982. The role of parks and reserves in Panama's watershed management. An unpublished manuscript. 20 p.
- Jones, J. R., 1982. Diagnóstico socio-económico sobre el consumo y producción de leña en finca pequeñas de la Península De Azuero, Panamá, Proyecto leña y fuentes alternas de energía. Turrialba, Costa Rica. Centre Agronómico Tropical de Investigación y Enseñanza, Serie Técnica. Informe Técnica No. 32, 1982. 85 p. 34 refs.
- International Science and Technology Institute, 1980. La República de Panama, perfil ambiental del país: un estudio de campo. ISTI, Inc., Washington, D. C.
- IUCN - WWF - FAO, 1980. World Conservation Strategy: living resource conservation for sustainable development. IUCN, Gland, Switzerland.
- Lieberman, Gerald A., 1983. Plan for the development of private sector initiative in natural resources and environment programs in the Republic of Panama. DRAFT, 47 p.
- MacFarland, Craig and Frank Zadroga, 1981. Plan de manejo del parque nacional Volcán Barú y recomendaciones sobre la ordenación de la region adyacente. PASC/PRNR/CATIE, Turrialba, Costa Rica.

- Miller, Kenton R., 1978. Planning national parks for ecodesvelopment: methods and cases from Latin America. (manuscript, third printing 1982) Center for Strategic Wildland Management Studies, School of Natural Resources, The University of Michigan, Ann Arbor, Michigan.
- Miller, Kenton R., 1980. Planificación de parques nacionales para el ecodesarrollo en Latinoamérica. Fundación para la ecología y la protección del medio ambiente (FEPMA), Madrid, España.
- Naciones Unidas, FAO, 1983. Proyecto del plan nacional de desarrollo forestal de Panama. Proyecto Desarrollo Forestal de Panama, FAO/PNUD - PAN/79/003, Panam, Abril 1983.
- Naciones Unidas, FAO, 1980. Evaluacion de Ensayos y Selecciones de Especies para Reforestaciones en Panama. Desarrollo Forestal de Panama. FAO/PNUD/PAN/79/003, Documento de Trabajo No. 9, Panama 1980. 123 p. Apéndice.
- Ogle, Richard A. and Jones, H. R., 1972. Parques nacionales: un plan de desarrollo (Panama). Informe preparado para el Gobierno de Panama, auspiciado por PNUD y FAO. Roma.
- Ormasa, Anthony J., 1978. Organization and management of RENARE. Unpublished report dated 12/8/78. 34 p.
- República de Panama, MIDA/RENARE, 1979. Manual de organización y funciones del proyecto de administración de la cuenca hidrográfica del Canal de Panama. Abril 1979. 32 p.
- República de Panama, MIDA/RENARE. var. Informe de actividades. Octubre 1981 - Agosto 1982. 60 p.
- Tosi, Joseph A., Jr., 1967. Life zones of Panama. Report prepared for FAO, United Nations.

APPENDIX A

Scope of Work

A. Objectives

The major objectives of the Watershed Management Project evaluation are to: (1) undertake a comprehensive review of the project including an assessment of the effectiveness of both individual and collective components; (2) review the management processes and procedures which have affected activities under the project; (3) conduct an impact assessment of the project to date, and (4) make recommendations concerning those elements of the original project design which should be continued under the current and any future natural resources project of this type, as well as those elements which should be revised or deleted entirely.

B. Evaluation Tasks

The following areas will be reviewed under the Watershed Management Project evaluation:

1. Assessment of Overall Progress

The project evaluation team will assess overall progress made thus far in meeting the original project purposes. These are: (1) to strengthen the technical, managerial and administrative capabilities of the Dirección Nacional de Recursos Naturales Renovables (RENARE)^{1/}; (2) to increase awareness (in Panama) of the importance of natural resource conservation; and (3) to establish watershed management programs in Panamá Canal and two other priority watersheds that, to the extent possible, incorporate the watershed population into the resource management/conservation process.

2. Status Report on Individual Project Components

The evaluation team will review and evaluate success of the major sub-activities under the project and document their progress to date.

3. Project Management

The evaluation team will also assess overall management of the project. Specifically, the team will review, evaluate and document efforts to date relating to:

- a. RENARE's preparation of annual implementation plans;
- b. management of the various components;

^{1/} RENARE is the institution responsible for the management of Panama's renewable natural resources.

- c. overall coordination and support provided to the project by RENARE;
- d. RENARE's utilization of technical assistance provided; and
- e. USAID's management role including its relationship with RENARE.

4. Natural Resources Protection and Management - Policy and Technical Considerations

The evaluation team will review the original Watershed Management strategy as described in the Project Paper to appraise the current validity of the design approach after four years experience. This portion of the evaluation will:

- a. examine those sub-activities which have best fulfilled the original project goals;
- b. determine if priorities among the various project goals have been clearly established and whether appropriate strategies were developed to meet these priorities;
- c. evaluate the training component of the current activity in terms of the contribution it has made to the technical upgrading of the RENARE staff;
- d. examine the concept of extensive reforestation on public land in terms of overall cost-effectiveness and the GOP's ability to sustain such activities in the future without external financial assistance;
- e. examine the feasibility of expanding less expensive land use, protection and management systems under the existing project and incorporating them into future projects of this nature. ^{2/}
- f. review and evaluate the GOP's overall natural resources policies, their effects on Watershed Project implementation and their likely influence on the design and implementation of future projects; and
- f. examine the role of both the Government and private groups in the area of natural resources information and education.

^{2/} Such activities include: (a) park and reserve management; (b) joint implementation of natural resources management activities on private land, and (c) increased emphasis on regulation and management of forested and other key natural resources areas.

5. Impact Assessment

To the extent possible, the evaluation team will assess the impact of the Watershed Project thus far. In this context, the following factors will be assessed: (1) the impact (effect) which individual components and the project as a whole have had on preserving the Canal Watershed or, at the very least, in reducing environmental encroachments^{3/}; (2) evidence that the various components constitute essential and constructive elements in RENARE's program and can play a useful role in Panama's overall natural resources management and protection effort; and (3) evidence that the project has contributed to Panama's overall goal of rational land use, management and protection.

6. Conclusions and Recommendations

The evaluation team will prepare a report of its conclusions and recommendations in response to paragraphs 1 through 5 above. Recommendations will be oriented towards providing operational guidance for consideration during the remaining period of the current project's implementation. The team will also render its opinion as to the continued validity and applicability of the current project design (or alternatives based on experience gained elsewhere) for future natural resources programs in Panama.

ARTICLE II - REPORTS

A. The contractor will submit a detailed workplan to USAID/Panama and RENARE within two (2) weeks after arriving in Panama. This workplan will specify the methodologies to be used in carrying out the different parts of the evaluation as well as a work schedule. This workplan will be reviewed by USAID/Panama and RENARE, which, in turn, will make recommendations to the contractor for modifying the plan, as appropriate.

B. A draft final report will be presented to USAID/Panama and RENARE for review/comment, not later than one (1) week prior to the end of the contract.

C. The final evaluation report (five (5) copies each in Spanish and English) will be submitted to both institutions prior to the team's departure from Panama. The final report will include: (1) a summary description of the data base and methodologies used to conduct the evaluation; (2) results of the analyses described in ARTICLE I above; and (3) the general findings of the evaluation and recommendations for future actions. If it is not possible to

^{3/} Key concerns are whether the Panama Canal Watershed is better off today than prior to the project's initiation and whether positive changes that have occurred can be traced to actions taken under the Watershed Project.

translate the final report in Spanish prior to the contractor's departure from Panama, an executive summary of the final report in Spanish will be acceptable. The contractor is allowed to expend up to four days of secretarial time in his home office after the team departs Panama to type the "polished" versions of the final report, three copies of which in English and Spanish shall be sent to the USAID Panama.

D. One copy of each report shall be sent directly to the Contracting Officer whose signature is affixed hereto. Two copies of each report shall be submitted to the Office of Development, Washington, D.C. 20523. The title page of all reports forwarded shall include the contract number, project number, and project title as set forth in the Schedule of the contract.

APPENDIX B

Persons Interviewed

Name	Agency	Position
Waldemar Albertin	Experience, Inc.	Agroforestry
Luis Alvarado	Canal Commission	Meteorology/Hydrology
Dimas Arcia	RENARE	Jefe, Depto. Programación y Evaluación
Rosa Barrilla	RENARE	Watershed Management Project Director
Samuel Bern	Grupo de Tecnología Apropiada	Director
Carlos Castillo	RENARE	La Villa Watershed project staff
Sergio Castillo	RENARE	Director, RENARE
John Champagne	AID/Panama	Assistant Agri. Development Officer
Rene Chang	RENARE	Director, El Montuoso
Harlan Davis	AID/Panama	Agriculture Development Officer
Lovelía de Castrejón	RENARE	Agroforester
Rosario de Rivera	RENARE	Proyecto de Cuencas
Sergio Ducreux	RENARE	Sub-Director, RENARE
Edward Finnegan	Experience, Inc.	Watershed Management
Arturo Garrido	AID/Panama	Engineering
Robin Gomez	AID/Panama	Mission Director
Camilo Grandi	ex RENARE	Cuenca Coordinator
James Hester	AID/Washington	Environmental Officer
Yariela Hidalgo	RENARE	Sub-Directora, Parques Nacionales
Brian Houseal	RENARE Consultant	Depto. Parques Nacionales
Alfredo Jaen	RENARE	Current Project Coordinator
Rodolfo Jaen	RENARE	Former Watershed Management Project Coordinator
Efraín Lao	RENARE	Watershed Management Project
Gerald Lieberman	RARE Consultant	NGO Program Advisor
Donald MacKenzie	AID/Panama	Loan Officer
Frank Miller	AID/Panama	Loan Officer
Blas Moran	RENARE	Jefe de Zona, Canal Watershed
Stella Patiño	AID/Panama	Comptroller for Watershed Management
Luis Pinto	RENARE	La Villa Watershed project staff
Lionel Quiroz	RENARE	Director, P.N. Volcán Barú
Frank Robinson	Canal Commission	Meteorology/Hydrology
Jose Rojas	RENARE	Jefe de Area, Cerro Azul
Pedro Rojas	RENARE	Guardabosque, Cerro Azul
Arturo Romero	FAO	Forestry Development Consultant
Gale Rozell	AID/Panama	Agric. Development Officer
Nicholas Smythe	Smithsonian Institute	Conservation Officer
Dario Tovar	MIDA	Planning Officer
Henry Tschinkel	AID/ROCAP	Forestry Advisor
Erasmus Vallester	RENARE	Jefe, Depto. Parques Nacionales
Carl van Haeften	Experience, Inc.	Home Office Project Manager
Benigno Villamonte	RENARE	Rio La Caldera
Dwight Walker	AID/Panama	Watershed Management Project Officer