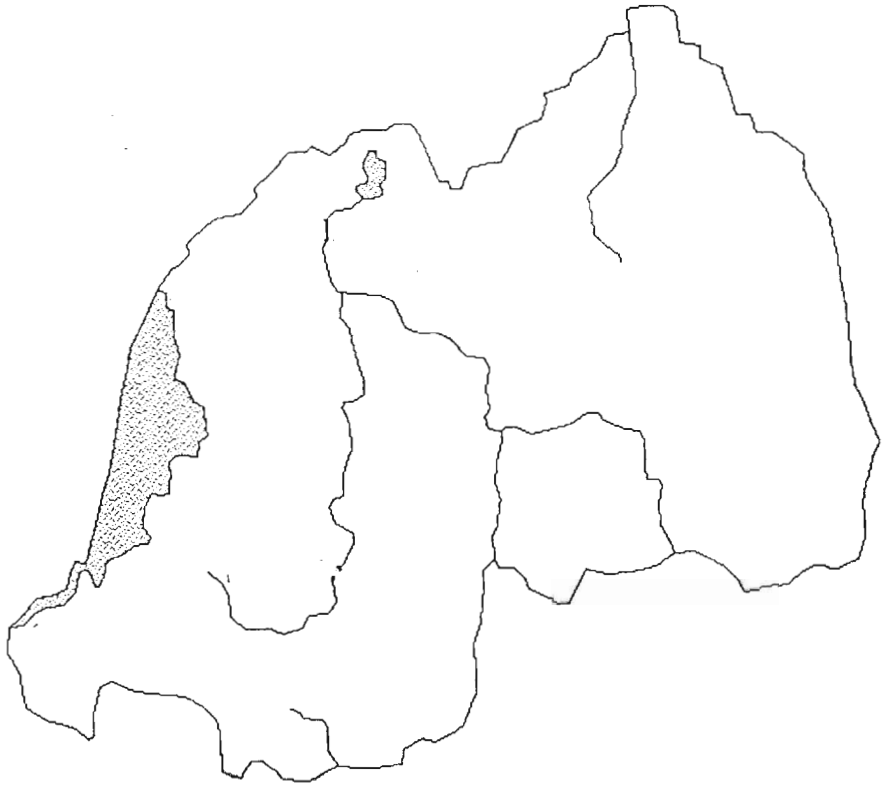
Mid-term Evaluation:

Natural Resources Management Project for Rwanda

(A.I.D. project number 696-0129)



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(A.I.D. project number 696-0129)

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Abbreviations

ABS	Annual budgets submission
ADO	Agricultural development officer
AFDB	African Development Bank
AFRENA	Agroforestry Research Network for Africa for the Bimodal Highlands
AFRICARE	United States-based private voluntary organization and nongovernmental organization
AICAAE	Associate, International Center for Aquaculture and Aquatic Environments
ARAMET	Association de Recherhe et d'Appui en Aménagement du Territoire.
ARDI	Association Rwandaise pour la Promotion du Développement Intégré
ARN	Aménagement des Ressources Naturelles
BP	Popular Bank
BRD	Rwanda Development Bank
CARE	United States-based private voluntary organization
CC	Coordination committee
CCDFP	Community Center for Development and Permanent Training
CFD	Caisse Francaise de Developpement (ex. Caisse Centrale CCCE)
CCO	Accounting and Organization Center
CIDA	Canadian International Development Agency
CERAI	Center for Integrated Rural and Artisanal Industries
CERAR	Center for Rural and Artisanal Training
CFP	Communal forestry plan
CDSS	Country developpment strategy statement
COSAF	Conservation of soils and agroforestry unit
CPA	Centre de Perfectionnement Agricole
CPSP	Country Program Strategy Plan
CSC	Centre de Service aux Coopératives
CU	NRMP coordination unit
DAI	Development Alternatives,Inc.
DAHA	Division Amenagements Hydro-Agricoles
DFGF	Dian Fossey Gorilla Fund
DGRCS	Direction Génie Rural et de la Conservation des Sols / MINAGRI
DGF	Direction General of Forests (Direccion génerale de Forêts)
EA	Expatriate advisor
EEC/CZN	European Economic Community/Zaire-Nile Divide

EIA	Environmental-impact assessment
EIA	End of project status
EPAT	Environment and Natural Resources Policy and Training Project
FSIP	Farming Systems Improvement Project
FSRP	Farming Systems Research Project
GCES	Gestion Conservatoire de l'Eau et de la Fertilité des Sols
GOR	Government of Rwanda
GRENARWA	National Grain Warehouse of Rwanda
ICRAF	International Council for Research and Agroforestry
IDS	Intensive Development Sites
IEC	Information, education and communication
ILO	International Labour Organization
INADES	National Institute for Social and Economic Development
IMF	International Monetary Fund
INR	National Research Institute
ISAR	Rwandan Institute for Agronomic Sciences (Institut des Sciences Agronomiques du Rwanda)
IGCP	International Gorilla Conservation Program
IQC	Indefinite Quantity Contract
IWACU	Cooperative Training Center
JOC	Catholic Working Youth
KORA	Confederation of Kigali Artisans
KRC	Karisoke Research Center
LOP	Life of project
MET	Mid-term evaluation team
MINAFFET	Ministry of Foreign Affairs
MINAGRI	Ministry of Agriculture
MINEPRISEC	Ministry of Primary and Secondary Education
MINETO	Ministry of Environment and Tourism
MINIFINECO	Ministry of Finance and Economy
MINIFOP	Ministry of Public Office and Professional Training
MIJEUMA	Ministry of Youth and Cooperatives
MINIMART	Ministry of Industry, Mines, Artisanry and Crafts
MININTER	Ministry of the Interior and Communal Development
MINIPLAN	Ministry of Planning
MINIPRISEC	Ministry of Primary and Secondary Education
MINISANTE	Ministry of Health
MINISAPASO	Ministry of Public Health and Social Affairs
MINISUPRES	Ministry of Higher Education and Scientific Research
MINITRAPE	Ministry of Public Works and Energy
MONAGRIS	Moniteurs d'Agriculture (Agricultural Extension Agents)
MRND	National Revolutionary Movement for Development

NC	National coordinator
NFR	Nyungwe Forest Reserve
NGO	Nongovernemental organization
NR	Natural resources
NRMP	Natural Resources Management Project
IFPRI	International Food Policy Research Institute
INADES	National Institute for Social and Economic Development
OPROVIA	National Office for the Development and Marketing of Food Crops and Animal Products
ORTPN	Rwanda Office of Tourism and National Parks (Office Rwanda de Tourisme et Parcs Nationale)
PARN	Projet d'Aménagement des Resources Naturelles
PAP	Projet Agro-Pastoral
PCFN	Nyungwe Forest Conservation Project
PCV	Peace Corps Volunteer
PNV	Parc National des Volcans
PPC	Program and Policy Coordination
PPF	Pilot Forestry Project
PPN	National Pisciculture Project
PRIME	Policy Reform Initiatives in Manufacturing and Employment
PVO	Private voluntary organization
RFC	Regional Finance Center, Paris
RRAM	Ruhengeri Resource Analysis and Management
RWF	Rwandan Franc
RTI	Research Triangle Institute
SIP	Social and Institutional Profile
SNER/PAE	Rwanda's National Environmental Strategy/Environmental Action Plan
SME	Small - and medium-scale enterprise
SPN	Service Pisciculture National (Service Pisciulture Nationale)
T&V	Training and visit
TFR	Total fertility rate
TR&D	Tropical Research and Development, Inc.
UNDP	United Nations Development Project
UNEP	United Nations Environment Project
UNR	National University of Rwanda
USAID	United States Agency for International Development
VVC	Volcano Veterinary Center
WCS	Wildlife Conservation Society

Contents

Executive summary

A seven-member team, fielded by Tropical Research & Development, Inc., evaluated the Rwanda Natural Resources Management Project (NRMP) from November 12 through December 10, 1992.

This executive summary provides a brief description of the project's five components, organization concerns, and the evaluation's major findings and recommendations related to each component.

The NRMP is a multi-component undertaking. A coordination unit, guided by a coordination committee, is responsible for overall project management and implementation. The NRMP's five components are:

(1) research and management of *marais* (lowlands);
(2) fish culture in the *marais*;
(3) soil conservation and agroforestry;
(4) natural-forest management; and
(5) environmental planning.

The NRMP has been slow in establishing itself. Individual components have managed to conduct their specific functions with varying degrees of success. For example, the research and management of *marais* has suceeded in establishing the foundation for basic research and development of the lowlands. While less successful, the fish culture component could prove viable for small holder production. The natural forest mangement component has encouraged the participation of professional Rwandan nationals. The environment planning component has made substantial progress in completing the technical and scientific support activities, including the implementation of the National Environmental Strategy and Environmental Action plan. However, an effective project-management system has yet to be established. This lack of overall project management from the coordination unit has detracted from performance at the component level. The coordination unit is mandated to define and operationalize the project's structure. These responsibilities should involve assisting components with administrative, accounting and reporting methods and procedures necessary to keep the Government of Rwanda (GOR) and the United States Agency for International Development Rwanda Mission (USAID/Rwanda) informed of progress and problems.

In the absence of a project-wide management, reporting, evaluation, and feedback system, the NRMP components have interacted directly with the USAID Agricultural Development Officer (ADO). NRMP personnel perceived this arrangement as micro-management on the part of USAID. The USAID perspective was one of growing concern over an unanticipated, increased - work load for a limited Mission staff. This situation continued unresolved because USAID and the coordination unit did not meet to establish a mutually acceptable division of roles and

responsibilities. The coordination unit's mandate explicitly indicates that the unit will manage the project. Effective discussions between the coordination unit and the project officer would have been helpful to clarify exactly how management should proceed.

Inconsistencies in component agreements with USAID slowed the project's progress and contributed to confusion among component and USAID personnel.

Not all of the components are funded directly from USAID/Rwanda. The soil conservation and agroforestry project component (COSAF) is financed by and will be audited directly from AID/Washington.

Project management is further complicated by the wide range of components under the NRMP. The natural-forest component is largely concerned with conservation, biodiversity-oriented research and ecotourism. The components for *marais* and fish culture are classic production-oriented activities for small farmers. Each of the components falls into a separate professional, technical and developmental network and reports to a unique group of collaborators and partners. In addition, the coordination unit is in an ackward weak management position because it is not directly responsible for financial oversight of the project's components.

The terms of reference for the coordination unit provide for a sufficient level of management control over the project through monitoring impacts, tracking implementation and funding technical assistance and commodity procurement in support of component needs. If these key coordination-unit functions are implemented, the coordination unit will be able to assume an effective management role in the NRMP. This more effective role for the coordination unit will, in turn, alleviate administrative stress on the USAID/Rwanda Mission that is eager to develop and implement new programs.

A summary of this evaluation's major findings and recommendations for NRMP's components follows.

Coordination unit

Findings

Effective management of the project has been hampered by a series of disparate events. Since signing the project grant agreement in 1989, the NRMP has had three lead ministries, three presidents of the coordination committee, two national coordinators and two USAID project officers. The arrival of the expatriate advisor to the national coordinator some eight months after the signature of the project grant agreement also had an adverse impact on the functioning of the coordination unit.

The project coordination unit has not fully exercised its mandate to coordinate and monitor impacts and progress of the components. These functions are essential for successful implementation and evaluations. Monitoring and tracking of the components' progress also serves to rationalize expenditures for technical assistance and commodities. The ADO/USAID has become overly involved in aspects of project administration and management that should be undertaken by the coordination unit.

In general, progress has been slow for the NRMP because of administrative and communication problems that caused delays in the disbursement of USAID funds. Over each of the project's past two years, the coordination unit has spent less than 50 percent of its annual budget allocations.

Recommendations

a. The coordination committee should ensure that the coordination unit exercises its mandate for overall administration and management of the project.

b. The coordination unit's work plans should be monitored quarterly by the chairman of the coordination committee.

c. The coordination unit should receive copies of all correspondence and memoranda that pass between the components and USAID.

d. The coordination unit should continue its efforts to train an effective accounting staff at the component level. The accounting staff of the coordination unit should organize training sessions and establish an on-going program of follow-up for them. Component accountants should be encouraged to contact the coordination unit accounting staff when they have questions.

e. The technical committee should meet no less than quarterly quarterly. These meetings will provide an opportunity for host-country technicians and their advisors to review progress, exchange information, and determine implementation actions required.

f. USAID should direct the contractor to establish a project-wide management information system as an immediate, high priority requirement. This system would be built around a set of commonly recognized progress indicators for each component. The management information system should include a system for financial accountability tracking.

g. If the coordination unit does not demonstrate progress in establishing a management information system within three months and an operational system is not functioning within six months, the lead ministry and USAID should consider amending the project

grant agreement. This amendment will provide for a private firm to assume responsibility for maintaining financial records, for preparation of financial reports and for project monitoring and implementation.

h. The lead minister should ensure that a permanent national coordinator is appointed immediately.

j. The national coordinator, the expatriate advisor and the president of the coordination committee should meet annually with the leadership of USAID and with the ministers involved in the project. The annual meeting will serve to strengthen the commitment of all parties to the project.

k. There is confusion among host-country personnel about the content of the new Country Program Strategy Plan (CPSP) and how it affects the project. The Mission is urged to be sensitive to this concern and to discuss the CPSP with all parties involved.

Research and management of the *marais*

Findings

In Rwanda, *marais* lands (bottom lands) have the highest potential for agricultural expansion. In general, production from the *marais* is more market-oriented than is hillside agriculture, which is chiefly given to subsistence. The *marais* are also key sites for aquaculture. Agricultural development will largely depend upon sustainable use of this lowlands resource.

This project component completed the basic research and studies needed to develop the Nyamigogo *marais*. Twenty-one of 30 rural engineering technicians (of whom two are women) were being successfully trained. Otherwise, the technical skills they are learning are all but nonexistent in Rwanda.

Development of the Nyamigogo *marais* should proceed. This development will contribute a diversity of methods and procedures needed for the sustainable, socially equitable, market-driven development of lowlands.

Recommendations

a. Original development of 50 ha at the Nyamigogo *marais* should be increased to a more cost-effective target of 150 ha.

b. A market-driven approach to *marais* development should be employed. The success of this approach will depend upon development of farmer-based institutions needed for

marketing and production support. Such institution building will be of interest to USAID/Rwanda's new Private Voluntary Organization (PVO) project.

c. Training of 30 more rural technicians is recommended in order to meet anticipated demand. Training toward a master's degree for engineers is also recommended.

d. Financial support for equipment, maintenance and support-staff salaries at Génie Rural should continue.

Fish culture in the *marais*

Findings

All project elements and activities were implemented. Significant progress toward attainment of the component's goals has been made although no national aquaculture plan has yet been produced. The evaluation team identified a number of significant constraints to aquaculture development. These constraints include: (1) traditional use of inappropriate technologies for artisanal and small-scale commercial production; (2) lack of infrastructure for transportation, processing and for value-added conditioning; (3) market-related constraints; and (4) a lack of credit needed for aquaculture capital plant expansion.

Recommendations

a. A national aquaculture plan must be completed as soon as possible. USAID financing should be minimized until an acceptable comprehensive plan has been established.

b. The Service Pisciculture National (SPN) should reevaluate methods and approaches. SPN should abandon duplication of applied research and focus on promoting economically viable aquaculture technologies for artisanal and small-scale commercial production. There is a role for PVO Project involvement in the areas of credit, marketing and producer institutions.

c. SPN should improve contact with extension agents and implement an adequate system of data collection and analysis.

d. The coordination unit should coordinate with SPN to establish an operational monitoring program that is needed for timely execution of contracts.

Soil conservation and agroforestry

Findings

This component, known as COSAF, is implemented with the participation of Africare and the Rwandan Ministry of Agriculture (MINAGRI). With a budget of $1.6 million over three years, this component is one of the largest of the NRMP's five components. Almost $1 million has been spent. However, it is unlikely that this component will attain its end of project status.

Recommendations

a. COSAF should continue extension activities in Ruhengeri until November 1993. After this date, an evaluation is recommended. An assessment of that performance should bear in mind the recommendations of this evaluation before any extension of additional funds is made.

b. COSAF should continue its activities on a reduced scale in three of the original five communes.

c. The nurseries in these communes should be reduced to a few proven agroforestry, fruit tree and grass species.

d. These nurseries should be fully privatized as soon as possible in the true sense and not passed on to contract producers. Production of other agroforestry species should be left to the care of MINAGRI or the communes themselves.

e. The extension of soil-conservation and agroforestry techniques on degraded or fragile soils must be given top priority. The GOR should encourage farmers to adopt these techniques by providing incentives, such as tax concessions or easy access to credit.

Natural-forest management

Findings

Rwanda's ecotourism industry is significant and ranks high in foreign-exchange earnings. Forest management and conservation are central to maintaining the economic potential of this ecotourism, and USAID is positioned to play an important role. The NRMP includes support for ecotourism development, education and training in the Volcano National Park and in the Nyungwe Forest.

Recommendations

a. The level of Rwandan involvement should be increased in order to assure continuity and consistency of conservation in parks and reserves.

b. Decisions on park and reserve management must be based on sound, applied research. Research priorities, such as an examination of relationships between human populations and the park or reserve, should be agreed upon jointly by the park/reserve personnel, the GOR and USAID, through the NRMP Coordination Committee

c. USAID and the coordination unit should carefully consider the possibility of increasing NRMP the level of support for Nyungwe Forest Conservation Project (PCFN) and Karisoke Research Center (KRC). This increase in funding would be based on PCFN and KRC research and staff needs, as well as operational and infrastructure requirements.

d. USAID should consider expansion of this component to include Akagera National Park.

Environmental planning

Findings

The Rwandan Ministry of Environment and Tourism (MINETO), created earlier this year, is responsible for policy development and for issues related to sustainable use of natural resources and environmental quality. MINETO is a small ministry with very limited capacity and an ill-defined mandate vis-à-vis other ministries with environmental concerns.

The advisor provided to MINETO successfully completed his technical and scientific support activities. These activities included assistance in implementation of the National Environmental Strategy and Environmental Action Plan, assistance with the organization of an administration unit, identification of institutional mechanisms needed to conduct the environmental mandate, and support to technical departments.

The current position of the long-term technical advisor provided by NRMP is structurally inconsistent with his capabilities and is inappropriate for MINETO's needs.

Recommendations

a. The project should encourage development of a national environmental council that can identify and consolidate intra-ministerial responsibilities as well as a wide range of sectoral responsibilities at the appropriate administrative level. Once a national system

of environmental management has been defined and consolidated, functions may be transferred to MINETO.

b. The long-term advisor should be retained and his terms of reference revised. He should be situated in an appropriate structural position in the director general's office at MINETO.

c. Training is the first priority for MINETO. Training in environmental-impact assessment, environmental protection and management is recommended.

1. Introduction

Mid-term evaluation of the Natural Resources Management Project (NRMP) was undertaken in Rwanda from November 12 through December 10, 1992. Tropical Research & Development, Inc., of Gainesville, Florida, assembled a seven-member team under contract number PCD-5517-I-00-0105-00.

The team was composed of Frederick Brusberg, team leader and socioeconomist; Jean LeBloas, land-development specialist; Philippe Vergne, fish-culture specialist; Nousbassem Nanas Nande, soil-conservation scientist; Craig Sholley, parks-management specialist; Robert MacAlister, management specialist; and Paul Wolf, environmental scientist. In order to complete this evaluation, team members reviewed all available project documentation from USAID and relevant material from other donors. They interviewd a large goup of people (Annex II). In Addition, team members visited field sites to assess project implementation aspects, problems and constraints.

The project grant agreement between the GOR and the United States was signed on June 7, 1989. The NRMP commenced with a USAID contribution of approximately $7.9 million and a GOR contribution of $3.5 million. In July, 1991, the budget was increased in a fourth amendment to $13,545,000 over the life of this 5-and-1/2-year project. The total project budget with the GOR contribution is more than $17 million.

The project paper defines the goal of the NRMP as:

> "sustained long-term agricultural production. Achievement of this goal is through a fourfold purpose: (1) reduced erosion on Rwanda's hill-sides; (2) sustainable use of the country's wetlands; (3) protection of its natural forests; (4) greater coordination by the GOR of activities affecting the natural resources base.
>
> The project will work toward this goal at two levels. On one level, it will undertake specific measures to: increase the awareness among Rwandan decision makers of the importance of natural resources conservation; strengthen the GOR's capacity to effectively control natural resource use and protect the natural resource base; and improve coordination among the various government bodies responsible for environmental management.
>
> On another level, the project will support activities in several discrete areas within the natural resources sector. These activities include, the management of small *marais*, particularly the promotion of fish culture in the *marais*; soil conservation and agroforestry in the highlands of northwestern Rwanda; and the conservation of the remaining afromontane forests of the country." (Project paper, p.1)

The NRMP consists of five distinct components:

1.1. Training and Research in the *Marais*. This component includes training of 30 rural engineering technicians, applied research on *marais* development and development of a small experimental *marais*.

1.2. Integrated Fish Culture in the *Marais*. This component builds upon an existing fish-culture project (696-0112). The component supports integrated aquaculture in the *marais* in order to expand economic benefits of fish farming.

1.3. Agroforestry and Soil Conservation. This component is to identify and promote soil conservation and agroforestry measures that permit farmers to cultivate hillsides and maintain or increase agricultural productivity.

1.4. Natural Forest Management. This component supports efforts by the Rwanda Office of Tourism and National Parks (ORTPN) and the Direction General of Forests (DGF) to manage and protect the two most important afromontane forests in Rwanda.

1.5. Environmental Planning and Coordination. This component provides technical assistance and support to the GOR in the area of environmental planning and policy.

NRMP implementation and management is undertaken through a coordination unit (CU). Technical assistance to the CU was provided by Development Alternatives, Inc. (DAI), a U.S. consulting firm, and other subcontractors based in the United States.

The NRMP is a diverse group of activities that share a common concern with management of natural resources and the natural environment. Thus far, the project's *marais* and fish-culture components have focused primarily on technical and, to a much lesser degree, on socioeconomic aspects of production. The project component for natural-forest management is directed to biodiversity-related research and to the impact of local populations on biological reserves. The agroforestry and soil-conservation component is essentially an effort to transfer soil-conservation techniques to people cultivating Rwanda's precipitous terrain. The environmental planning and coordination component hinges largely on the work of an expatriate advisor to the MINETO, a newly formed and institutionally weak entity.

The evaluation team found that NRMP confronts two problems. The first problem is external and concerns the recent orientation of USAID/Rwanda's strategy toward private sector, market-oriented development. This orientation contrasts with a previous development strategy that employed a more classic, production-support approach. This production-support approach is evident in the project paper and its logical framework.

The second problem is internal to the NRMP; it is the weak performance of the project's coordination unit and coordination committee.

Ultimately, the NRMP will require a full redesign if it is to be brought in line with the new CPSP. Although this evaluation assessed progress to date on the basis of benchmarks and measures from the original design, the team endeavored to identify ways in which the components could better contribute to sustainable, private-sector-driven development.

The evaluation team did not undertake a redesign -- which would include a revision of the logical framework. But the team did make substantive assessments of the coordination unit and of project components that would be central to the redesign process.

Although the NRMP has a production-oriented goal and purpose, its widely disparate components can be brought into a supportive role for the new private-sector-oriented CPSP.

The *marais* component is designed to produce environmentally sound and economically sustainable processes for the economic development of humid lowlands. If agroindustries, new value-added activities and off-farm employment are to grow, new or improved markets are needed for small-holder and commercial agriculture. The existence and capacities of domestic and export markets are not known.

A revised approach to *marais* development would begin with identifying markets and the role of the private sector in production and processing to meet market demands. Assuming that markets are found and windows of opportunity identified, there remains needs for organization among producers and linkages to markets remains.
The *marais* component has completed the basic research and training needed to develop the *marais*. It should now focus on realizing this economic potential through marketing and the development of appropriate institutions at the field level.

Fish culture has obvious market potential; but production is minimal, less than 800 tonnes per year for the entire country. The evaluation report examines this potential, suggests ways in which fish-culture development can be more cost-effective and recommends a small, farmer-level model for fish-culture development.

Because of the critical role that natural forests play in ecotourism, the project's natural-forest component has been a significant earner of foreign exchange for Rwanda. Potential for private-sector participation in ecotourism is substantial. The report assesses the diverse activities of the natural-forest component and encourages increased levels of support. The ongoing civil war does not provide ideal circumstances for international tourism. Nevertheless, Rwanda's forests merit protection and support during this period of conflict.

The project component for agroforestry and soils conservation is essentially an environmental- or ecological-maintenance activity that functions directly at the level of land, the chief factor of production. Ideally, the component should have salutary effects on production. This component's activities are far removed from the private sector and from market-linked concerns.

Privatization of nurseries is a side issue. If private nurseries enjoyed real demand from farmers, one would expect to see more of them. The report provides recommendations on the question of private plant material nurseries. Apart from this secondary issue of private nurseries, the question of the component's relevance to the new country strategy remains.

Agroforestry and soil-conservation activities in Rwanda do not offer important opportunities for private-sector development. A private-sector approach to these activities may be appropriate later, when and if market demand encourages farmers to reinvest in the land.

The role of an environmental advisor to MINETO is important but bears no direct links to private-sector development. This report reviews progress at MINETO and recommends training as the first priority in this new institution's development.

This evaluation report begins with a review of the operations of the coordination unit and provides recommendations for its improved performance. This unit is mandated to provide central-management and monitoring functions. The ultimate success of a redesigned NRMP will depend heavily on the CU's capability to execute its management functions.

Subsequent sections of this report evaluate each component on the basis of its accomplishments to date. Performance is assessed and recommendations are made for future orientation and for improvements to the components' operations.

2. Project coordination unit

This section focuses on the work of the CC and the CU. It examines relations between the CU and the project's five components, relations between the CU and USAID, and relations between USAID and the project components.

Findings, recommendations and lessons learned are based on the evaluation team's management specialist's meetings with members of the coordination committee, with the former and present national coordinators, the expatriate advisor to the coordination unit, coordinators for each of the five components, as well as ADO and the Mission director. Documents reviewed include the project paper, project grant agreement and its amendments, project implementation letters, the contract between DAI and USAID and work plans for the coordination unit.

In 1988, USAID/Rwanda grouped several natural-resource-related activities under one project -- the Natural Resources Management Project (696-0129). The NRMP builds on a number of earlier USAID/Rwanda efforts, including projects for the following: development of *marais* (humid bottom lands), fish culture, soil conservation and agro-forestry, environmental planning, short- and long-term training for improving natural-resource management and assistance with drafting a National Environmental Strategy. The design of the project also took into account proposals received from the Dian Fossey Gorilla Foundation and Wildlife Conservation Society for financing activities for the protection of national parks.

With the exception of the Natural Forest Management Component ([1]), each of the project's five components has a Rwandan coordinator who is responsible for its functions.

The NRMP was authorized in 1989 and the project grant agreement with the GOR was signed on June 7, 1989. The project grant agreement provided that the overall administrative coordination and management of the project would be the responsibility of a project coordinating committee. The CC was to include representatives of the Ministry of Planning (MINIPLAN), the Ministry of Agriculture (MINAGRI), the Office of Tourism and National Parks (ORTPN), USAID, the Rwandan Institute for Agronomic Science (ISAR), the Ministry of the Interior and Communal Development (MININTER), the Ministry of Foreign Affairs (MINAFFET), an official from Ruhengeri Prefecture and representatives of the communes in which the Agroforestry and Soil Conservation Component would be active. The coordination committee was to be chaired by a representative of MINIPLAN, which was originally designated as the lead ministry.

The committee is comprised as follows:

[1] The Karisoke Research Center and The Nyungwe Forest Conservation activity are both run by expatriates.

director general of the Ministry of Environment and Tourism (MINETO), who serves as committee president;

director of forests, Ministry of Agriculture (MINAGRI);

director of rural engineering and soil conservation (MINAGRI);

representative of the Ministry of Planning (MINIPLAN);

representative of the Ministry of the Interior and Communal Development (MININTER);

the ORTPN is represented by the chief of the National Park Service ;

a representative of the Ruhengeri Prefecture;

a representative of the commune in which COSAF operates;

a representative of ISAR; and

the ADO of USAID/Rwanda.

With the exception of the Karisoke Research Center, each component is required to submit an annual work plan to the coordination committee. Each component is also required to provide an annual report of their activities. Quarterly reports will be required from each component in 1993.

The coordination unit's staff serves as the secretariat for the coordination committee. The project grant agreement stipulates that day-to-day coordination of the five components is the responsibility of the coordination unit. This unit is also responsible to the coordination committee for monitoring and evaluating the five components. The coordination unit is directed by the Rwandan National Coordinator.

On October 1, 1990, USAID signed a contract with DAI. The contract included provision for an expatriate senior advisor to collaborate with the Rwandan National Coordinator on the work of the coordination unit.

The duties of the advisor as stated in the contract include the following:

a. monitoring the progress of the project toward achieving its goals;

b. identifying and solving implementation problems as they arise;

c. ensuring that activities of the various governmental implementing agencies working with the five components are coordinated;

d. coordinating preparations of annual work plans and reviewing and making recommendations for work plans submitted by various participating institutions;

e. setting objectives and coordinating data collection for measurement of project impact;

f. interfacing between USAID and the GOR and reporting to USAID on project implementation, including providing work plans and financial reports;

g. identifying short-term technical-assistance needs and coordinating in-country, third-country and U.S. training; and

h. identification and procurement of selected commodities.

The project grant agreement also provides for a technical committee composed of the national coordinator of the coordination unit and his expatriate advisor, the coordinators of the five components and the USAID ADO. The coordination unit serves as the secretariat for the technical committee as it does for the coordination committee and arranges for its quarterly meetings. The committee discusses technical questions involved with implementation of the project. These meetings also provide an opportunity for each component to inform other components about their work.

In addition to providing an expatriate advisor to work with the National Coordinator, DAI subcontracted with International Resources Group to provide a senior advisor in environmental planning. In order to respond to needs of other components for technical assistance, DAI concluded subcontracts with Cornell University for work on *marais* development and with Auburn University for assistance with fish culture.

To assist with implementation of the Agroforestry and Soil-conservation Component, USAID also signed cooperative agreements with Africare, Committee for American Relief Everywhere (CARE) and the International Council for Research in Agroforestry (ICRAF). Cooperative agreements were also signed with Wildlife Conservation Society (WCS) and the Dian Fossey Gorilla Foundation (DFGF).

Initially budgeted for $7,700,000 over five years, the project was amended in July 1991, raising the total project budget to $13,545,000 and extending the project-completion date to December 31, 1995.

2.1. Background information on project implementation

Since the project grant agreement was signed in June 1989, the NRMP has experienced extensive turnover in project direction.

Three lead ministries -- MINIPLAN, MINAGRI and, currently, MINETO.

Three different presidents of the coordination committee.

Two different national coordinators. The first full-time national coordinator was not appointed until December 1990, six months after the project grant agreement was signed. He remained at his post until February 1992. His acting successor was not appointed until August 1992.

The expatriate advisor to the national coordinator did not arrive in country until February 1991, eight months after the project grant agreement was signed.

Two different USAID employees have served as project officers.

These changes created a difficult working environment that has had a negative impact on everyone involved with project implementation.

2.2. Findings

The coordination unit has yet to fully exercise its mandate to coordinate and monitor project components. An effective management information system has not been put into place. As a result of this management vacuum, the USAID project officer has become involved with detailed project management.

The senior advisor for the environmental planning component is not situated in an appropriate position in the hierarchy of the GOR. As a result, he is not able to fully perform the functions for which he was engaged.

2.3. Recommendations

The coordination committee should be instructed by the lead minister to fully exercise its mandate for overall administrative coordination and management of the project. The coordination committee should insist that the coordination unit conduct its day-to-day responsibilities for coordinating and monitoring. The lead minister should also ensure that a permanent national coordinator is appointed immediately.

In order to fully implement the coordination committee's responsibilities, the committee must meet at least quarterly. Accordingly, the lead minister will have to ensure that the president of

the coordination committee has adequate time to conduct his time-consuming duties with the coordination committee.

The coordination committee will have to allot adequate time to thoroughly review the annual work plans for the five components. It would also be appropriate if the coordination committee could visit at least one work site for each component in order to gain first hand knowledge of the work of each component.

USAID should request the contractor to implement a project-wide management information system. Specifically, this system would include the tasks outlined in the project grant agreement:

> "monitoring the progress of the project towards the achievement of its goals;" "ensuring that the activities of the various implementing agencies (e.g., PVOs, communes, MINAGRI, centrally-funded TA,) under the separate components of the project are coordinated;" and "setting objectives and coordinating data collection for measurement of project impact."

The coordination unit's expatriate advisor was active in facilitating relations between USAID and the project components and assisting with short-term technical assistance, training and procurement of commodities. However, the expatriate advisor has not taken the initiative in establishing a system for monitoring the progress of the different components toward achieving their outputs. The expatriate advisor has not been involved with coordinating data collection for measuring project impacts.

The contractor and the coordination unit should establish a management information system. This information is also required for the project coordinator to justify and prioritize expenditures for short-term technical assistance, equipment and for other support for the components.

At a minimum, a monitoring system should involve either the national coordinator or the expatriate advisor visiting each component every quarter in order to compare actual accomplishments with those projected in the annual work plan.

After visiting the component, the national coordinator or the expatriate advisor should address a memorandum to the coordinator of the component to note which activities are being accomplished according to the time frame outlined in the work plan, as well as those activities that are falling behind. The memorandum should make suggestions for dealing with specific problems. Copies should automatically be sent to members of the coordination committee. These reports should be discussed at the quarterly meetings of the coordination committee.

The project as a whole requires installation of a project-wide management information system. That system should include indicators that can be used to measure project impacts. The end of

project status should be reviewed with the project officer and milestones set for reviewing progress toward these goals and outputs through the end of the project.

To establish a management information system, it will be necessary to: consult with component managers to assure cooperation in the management information system; engage short-term expertise in system design to assist the coordination unit; engage short-term field- or component-level technical assistance to establish a commonly understood set of indicators for each project for integration into the management information system; assess the needs of the coordination unit for the management information system; assess the technical assistance components and commodities needed for the management information system; determine actions necessary to meet the above needs; and activate the system.

USAID should request that the contractor to dispatch a technical-assistance team to Rwanda in the very near future. This two-person team will include:

a specialist in management information systems who can assist the coordination unit with necessary computer-based programs needed for financial tracking and implementation monitoring; and

a monitoring and evaluation specialist who is fieldwork-oriented and trained in the quantitative methods needed to establish objectively verifiable indicators of progress and impacts.

Monitoring and evaluation is of special interest where components have direct impacts on beneficiary populations or particular groups, such as women. This team of two will also consult with the coordination unit on personnel requirements.

Within three months after the recommendations are approved, GOR and the Mission should expect to have the management information system designed and well along in implementation. Within six months, the GOR and USAID should expect the management information system to be operational and used for project monitoring and impact evaluation. If these accomplishments have not been achieved, the team recommends that the lead ministry and USAID amend the project grant agreement to provide for a contract with a private firm to assume responsibility for maintaining the project's financial records, for preparing financial reports and for project monitoring and implementation.

Management problems seriously detract from implementing the technical objectives of the project. If the present situation continues, project outputs will continue to be affected.

To ensure that the coordination unit is fulfilling its intended coordination role, it should receive copies of written communications between the project components and USAID.

The support and cooperation of the USAID project officer is vital if the coordination unit is to perform its duties as they are defined in project documents. He must make sure that the coordination unit is completely informed and encourage the components to take routine questions to the coordination unit rather than to the project officer.

The coordination unit must play a central role in coordinating and ensuring that components keep to schedule in order to avoid lapses in cash flow. The national coordinator and the expatriate advisor should take the initiative in consulting with all components and the USAID project officer to determine whether the schedule and conditions pertaining to disbursement outlined in Project Implementation Letters 27, 28, 29, and 30 were followed. The result of this oversight will be that, at the beginning of the new work year, the components will have funds available. Once a realistic calendar is agreed upon, it should be circulated by the coordination unit to all components, to the lead ministry and to the USAID project officer.

Submitting work plans to the coordination committee after deadline is a self-defeating cycle that produces a chain reaction of late PIL's, late requests for advances and late arrival of checks. This cycle must be broken. Once a realistic calendar is agreed upon, the staff of the coordination unit should be pro-active in contacting components to remind them of different deadline dates and to help ensure that these dates are respected.

In turn, USAID/Rwanda should make every effort to expeditiously process work plans, requests for advance and final reports that are properly prepared. It is the team's understanding that if the ADO receives a properly prepared request for advance, the Mission can process it in one week and then FAX a request for a check to the Regional Finance Center (RFC) Paris. The team was informed that once the RFC receives the request from the Mission, a check should arrive in Kigali within two or three weeks.

To expedite obtaining a check, the coordination unit should make sure that the components know that they can prepare their requests for advance before the PIL for the year's budget is approved. These requests should be ready for submission as soon as the PIL is approved.

The coordination unit staff should review the annual work plans of each component before they are submitted to the coordination committee in order to make the best use of the committee's meeting time. In this regard, it should be noted that the annual work program of the Dian Fossey Gorilla Fund is not currently being submitted to the coordination committee for review. The DFGF plan for 1993 should be immediately submitted for review by the coordination unit and then forwarded to the committee.

The coordination unit's initial review of work plans for each component should ensure that the coordination committee will receive a document that provides the basic information needed to make an informed judgement. Having the staff of the coordination unit review the work plans before they are presented to the committee will help institutionalize the process. It will also

serve to encourage the components to look to the coordination unit for assistance and support in the future.

The CPSP should be widely circulated in French in the near future. Mission leadership should discuss it with appropriate GOR officials.

There is confusion about the content of the CPSP and how it affects the project. The team urges the Mission to be sensitive to this anxiety and take whatever measures are necessary to discuss the CPSP with all parties involved.

The coordination unit should continue its efforts to train effective component-level accounting staff. The unit staff has organized training for the component's accountants. The unit's accounting staff should organize additional training sessions, as well as a program of follow up guidance. Component accountants must be encouraged to contact the unit's accounting staff with any questions.

To expedite voucher processing and disbursements, all component requests for advances and monthly financial reports should be reviewed by the coordination unit before being forwarded to the USAID project officer. This process should also reduce the involvement of the USAID project officer with accounting details.

If the vicious cycle described above can be broken, it will reduce the level of frustration that prevails among the components and enable key technical personnel in the components to spend more time and effort on implementation and less time on financial reports.

The work plan of the coordination unit should be monitored quarterly by the chairman of the coordination committee.

The coordination unit should be actively involved with monitoring other components. Accordingly, the coordination unit needs to be carefully monitored by the person who is most concerned about the work of that unit. If the coordination unit needs more personnel to accomplish efficiently the tasks that have been outlined above, the national coordinator and his expatriate advisor should make a detailed presentation to the project officer.

The technical committee should meet quarterly.

Meetings of the technical committee will provide an excellent opportunity for host- country technicians and their advisors to exchange information and discuss project implementation. The committee has not been meeting regularly. It is the coordination unit's responsibility to make arrangements for these meetings. In the future, the unit's staff should regularly schedule these meetings and handle all the arrangements required.

The USAID project officer should not be a member of the coordination committee.

The presence of the project officer on the committee has created confusion. When the committee approves a work plan, the project officer's participation in the deliberations of the committee is sometimes interpreted as representing formal USAID agreement to the work plan. Since USAID has a separate role to play in approving annual work plans, USAID employees should not be members of the committee nor participate in its deliberations.

The national coordinator, his expatriate advisor and the president of the coordination committee should meet annually with the leadership of USAID and the ministers involved with project implementation.

The NRMP is a large undertaking that has an important role in Rwanda's development. Annual meetings with leaders of USAID and the GOR should serve to strengthen the commitment of both governments to the project.

2.4. Lessons learned

A comprehensive management information system should be a requirement for future multi-component projects that employ the coordination-unit mechanism. The management information system should include impact monitoring and implementation tracking and should be operative before any project funds are disbursed.

When host-government entities are involved with providing financial reports to USAID, no project money should be disbursed for implementation of technical components until the project officer is satisfied that the host-country personnel who will be involved with preparing financial reports and documents have an adequate understanding of the types of expenses that are allowable as well as USAID financial reporting requirements.

3. Five project components

3.1. Training and research in *marais* management

Rwanda is a small, densely populated country of 26,336 km². More than 90 percent of the country's labor force is engaged in agriculture. Population density in rural areas ranges from 500 to 1000 people per square kilometer. Average farm size is 0.5 to 1 ha.

Marais zones comprise 6 percent of the country, about 160,000 ha. The *marais* zones are the last land resource available to the population. Development of *marais* zones began in the 1970s. A number of large- and small-scale *marais*-development efforts are now underway.

Two critical impediments to the success of *marais* development are described in the project paper and the project grant agreement. The first is an inadequate understanding, both traditionally and theoretically, of *marais* ecology, especially with respect to interrelationships between a given *marais* and activities upstream and downstream from it. The second constraint is the limited ability of the government, the communes and the prefectures to plan and monitor *marais* development so that it is technically and environmentally sound and consistent with the long-term welfare of the community. The objectives of the NRMP's *marais* component are:

a. to increase understanding among government officials and residents of the prefectures and communes concerning ecological, agronomic and socioeconomic aspects of *marais* development and

b. to strengthen the capacity of the government to support environmentally and technically sound *marais* development.

The *marais* component is composed of three elements:

a. in-country training of rural engineering technicians (*technicians du Génie-rural, niveau A2*);

b. research and development of a model *marais*;

c. institutional support to the Division Amenagements Hydro-Agricoles (DAHA) of the Direction Générale du Génie Rural et de la Conservation des Sols.

Amendment number four to the project grant agreement, dated July 8, 1991, provides the component with $1,154,100 broken down as follows:

a) technical assistance, approximately	$ 202,600
b) in-country training	$ 210,300

c) commodities	$ 255,400
d) other costs	$ 485,800

The sum of $76,400 is set aside to cover contingencies and inflation.

Long-term training in the United States was agreed upon between USAID and the GOR in an exchange of letters dated July 1991, just after the signature of the fourth amendment to the project grant agreement.

The financial schedule for the *marais* component, included in the 1992 annual work plan, is provided in Appendix D.

The land-development specialist was requested "to assess the effectiveness of the project in meeting its purpose and objectives, to describe the major constraints encountered by the project, and to make recommendations for medium- to long-term USAID interventions, not only to improve performance and ensure the success of the project, but also to modify the project to fit within the mission's new development strategy, which focuses on the promotion of the private sector."

Evaluation of the *marais* component used the following analytical methods.

a) Training activities. A review of Génie Rural files, visits to the training center at Murambi, Gitarama, discussions with trainees and professors, discussions with MINEPRISEC, discussions with other donors and Génie Rural staff.

b) Research studies in *marais* development. A visit to the Nyamigogo pilot *marais* site and watershed, discussions with local authorities, with the contractor for socioeconomic studies and other donors acting in the field of *marais* development. Visits were also made to various *marais* development projects in the prefectures of Butare, Gitarama and Kigali. Génie Rural files and technical documents produced by the component were reviewed. Discussions were held with Génie Rural staff and personnel of the coordination unit.

c) Activities directed to strengthening DAHA included a review of files and discussions with staff.

Basic documents for evaluation of this component were the following: the project grant agreement; project paper; annual work plans from 1990 to 1993 for the *marais* component; and the annual report for 1990.

The *marais* component is implemented under the leadership of the Ministry of Agriculture, Forests and Livestock. The component's activities started in November 1989 with the appointment of the national coordinator and the arrival of the technical advisor under a USAID

Personal Service Contract. The component's first work plan was approved on January 24, 1990. In March 1992, the director of Génie Rural became the coordinator for the component. The departure of the long-term technical advisor was scheduled for December 1992.

3.1.1. Findings

3.1.1.1. Overall status of the *marais* component and role of the coordination unit

Several obstacles have delayed progress in this component since it commenced in November 1989. These problems were the following: understaffing of Génie Rural and insufficient support from the GOR; insufficient support from the coordination unit and the coordination committee; and as a result, delayed receipt of funds from USAID. These problems have diverted time and effort from technical duties.

The net result is an unsatisfactory and frustrated working relationship between the component, the coordination unit and USAID. The coordination unit and the coordination committee must fulfill their mandate so that key technical personnel can spend more time on implementation. Immediate corrective measures are needed if the *marais* component is to meet its objectives.

3.1.1.2. The NRMP Coordination Unit

Both the national coordinator (the director of Génie Rural and Soil Conservation Directorate) and the project's long-term technical assistant have been diverted from their technical tasks because the coordination unit has not provided needed coordination and monitoring. The coordination unit does not provide adequate support to expedite the paper flow between the component and USAID.

For example: PIL 31 was signed by USAID on August 12, 1992, and by the GOR on September 11. However, the component coordinator was not informed that the PIL had been signed and did not receive a copy of the PIL until late November. As a result, project activities were disrupted because of a lack of funds. The coordination unit was effective in procurement of vehicles and equipment.

The long-term technical assistant estimated that he spent at least 30 percent of his time engaged in nontechnical matters related to these administrative and financial problems.

3.1.1.3. Training

The first element of this component is in-country training of 30 technicians in rural engineering (*techniciens du Génie-rural, niveau A2*).

Despite difficulties encountered at the outset due to MINAGRI's and MINEPRISEC' differences concerning the curriculum, a group of 30 trainees was selected. The group included two women. Training started in September 1991 at the CRFC Murambi Training Center in Gitarama.

A visit to Murambi Center included discussions with trainees and observation of an examination for four of them. Twenty-one out of 30 trainees remain. Of these remaining trainees, 20 are male and one female. Of the nine trainees lost, five had insufficient skills; one resigned for personal reasons; one was fired, accused of theft; one obtained a grant for long term-training in Europe; and one was dismissed for breach of discipline.

Training has fallen behind schedule. The annual work plan for 1990 indicated that courses were to start in June, but they did not get underway until September. The 1990 annual report, dated February 1991, presents reasons for the delay. A new schedule was established. Courses began on September 1, 1991 at the Murambi Training Center. Training will be completed by the end of February 1993, with the completion of the second three-month fieldwork exercise.

Curriculum design and quality is satisfactory. The project grant agreement indicates under section B.1a that "the curricula have been elaborated by DAHA." In reality, the training curriculum draft was issued in May 1990. Génie Rural-DAHA, with strong support from the *marais* technical advisor, initiated discussions with the ministry of education (MINEPRISEC), in order to get its inputs and to guarantee the official insertion of this curriculum in the MINEPRISEC program. Only one year later, in June 1991, the final version of the training program was adopted by MINEPRISEC and MINAGRI in *Programme de formation des techniciens du Génie-rural, niveau A2.*

The training program is comprehensive and multidisciplinary. It includes *marais* development techniques, rural hydraulics, civil engineering, topography, rural works, techniques for soil conservation and environmental protection, administrative and financial management, extension and training activities in rural areas.

A copy of each course was given to each trainee, along with technical handbooks in French. (*Collection Techniques rurales en Afrique, Ministère Français de la Cooperation*, and the *Memento de l'Agronome*).

Courses were given by a team of engineers, professors and trainers. The team included five engineers from MINITRAPE (Ministry of Public Works and Energy), seven engineers from MINAGRI, three professors from MINEPRISEC, one expert from the private sector and an expert advisor to the presidency.

A control system for both quality of courses and timing was established by the technical assistant, and it worked well. Discussions with trainers from MINAGRI and MINEPRISEC found that the courses were appropriate and of adequate quality.

Training will conclude with a final examination in March 1993. The examination will be both oral and written and will also include a presentation of field work. Grading will be by a special committee chaired by a representative from MINEPRISEC. Trainees who obtain a score of at least 50 percent will be awarded official diplomas.

On the basis of the evaluation team's meetings with trainers, including the chairman of the diploma committee and the mathematics professor, it can be said that the training of the first group of 21 technicians (level A2 in rural engineering) is a success.

The Direction du Génie Rural et de la Conservation des Sols (DGRCS) has requested that a second group of 30 technicians be trained as set forth in the project grant agreement, fourth amendment, section B.1.

The consultant asked the director of DGRCS to prepare a memorandum for USAID, explaining where and how the 21 technicians will be placed -- in government services, in projects under MINAGRI and other ministries or in the private sector (see Appendix F).

Based on the evaluation team's discussions with people working in *marais* development, including project managers, donors and private-sector producers, it is clear that the 21 new technicians would not have difficulty finding jobs. The country includes no rural engineering technicians (*techniciens du Génie-rural niveau A2*). At least 10 major donors are engaged in the development of Rwanda's *marais* and require technicians.

3.1.1.4. Research studies and management of a small, model *marais*

As noted above, this activity has been delayed and has encountered difficulties, chiefly due to limited staff in Génie Rural and USAID's reluctance to proceed with the development of the Nyamigogo pilot *marais* without guarantees related to independent legal farmers organizations and to land tenure.

Findings and analyses concerning *marais* development are presented below.

At the time of this evaluation, Génie Rural technical staff working under the supervisor or project technical assistant had mapped an area of 230 ha at a scale of 1:2000. The maps are of average quality with contour lines at intervals of one meter. The maps indicate a low density of leveled spots per hectare. While the maps are adequate for the design of *marais* development plans, they are insufficient for the final design of the hydraulic network's drainage canals. The maps include neither longitudinal profiles of the river bed nor cross sections.

This mapping does not comprise a research activity per se, but it is a basic element required for the design of a Nyamigogo *marais* development plan.

In September 1991, Génie Rural staff, working under supervision of a project technical assistant, conducted a soil study, including studies of soil fertility, agronomy and crop management. The soil study included the entire Nyamigogo *marais* (230 ha). Soil maps are at a scale of 1:10,000.

The soil maps are of the good quality required for the design of the *marais* development plans. They should be considered as a research activity as defined in the project paper and in the project grant agreement.

The project thoroughly addressed hydrology and water management. Hydrological and water-management studies of the Nyamigogo watershed and the *marais* include studies conducted by Cornell University, Dr. Steenhuis, USAID Missions and reports funded under the NRMP through DAI.

Studies completed described cited below.

> August 1990: an overview and analysis of the various research and training activities to be carried out under the *marais* component, with particular emphasis on hydrology and water management.
>
> February 1992: an assessment of sustainable *marais* development, with special emphasis on Nyamigogo hydrological measurements, including water use.
>
> September 1992: "simulation of *marais* hydrology, computer program manual and diskette," in collaboration with Nick van de Giesen, a student researcher.

Services, outputs delivered, guidelines and recommendation provided by Dr. Steenhuis are useful and of good quality. These can be considered as research activities.

Project Technical Assistant R. Sikkens has designed, installed and monitored a measurement network on the Nyamigogo watershed. This network addresses rainfall, water levels and flows. Completion of his final hydroclimatic report is underway. A copy of the draft report showed that it is of good quality and can be considered as research toward a methodology for *marais* development.

Socioeconomic studies have been produced by the Centre de Services aux Coopératives (CSC), a contractor from Gitarama. The socioeconomic study of the Nyamigogo *marais*, March 1990, is of good quality. A field study issued in October 1991 on land distribution in the *marais* in ten prefectures is also useful.

Under a contract dated August 30, 1990, the CSC began work with the Nyamigogo *marais* population later in 1990. This study included household surveys, *sensibilisation*, organizing elections and the creation of farmers *groupements*, as well as a *comite de sensibilisation*. The CSC's second contract ended in June 1992. The last reports issued in 1992 are of lower quality and have not yet been paid for. CSC remains in contact with the population of the Nyamigogo *marais*, who are working without a contract and becoming discouraged.

Over the past two years, the 10,000 people living in the vicinity of the Nyamigogo *marais* have been surveyed by CSC and Génie Rural. According to the sub-prefect at Ruhango, these people were told that development work in the *marais* will start in June 1992. In a meeting with team members, the subprefect indicated that the population has had expectations raised; they are waiting anxiously for something concrete from the USAID/NRMP *marais* component.

Understaffing has meant that very little has been accomplished in terms of economic and marketing studies. However, field data on crops grown in the Nyamigogo *marais* were collected every year. This data includes the following: yields, production and prices.

In February 1992, the Land Tenure Center/University of Wisconsin, submitted an $800,000 proposal for technical assistance in tenure and resource management in the Nyamigogo *marais*. The proposal was not accepted; it was not adapted to the project's needs.

A number of aspects of *marais* research have not been addressed, including the effects of upstream activities on the use of the Nyamigogo *marais* and the impact of *marais* development on downstream users. Site visits and discussions with component personnel revealed that these impacts will be minimal. No research in this domain has been undertaken with the assistance of or in collaboration with the Institut des Sciences Agronomiques du Rwanda (ISAR).

No development plan has been specified for a pilot *marais* in the Nyamigogo valley. The component's technical assistant had insufficient time to prepare a comprehensive development plan for a 50-ha *marais* zone. Nevertheless, much of the basic work needed for the plan has been completed. As noted, these tasks include mapping topography, soil studies, hydrological studies and socioeconomic surveys.

The development plan for the pilot *marais* should include the following:

- design of the drainage network and hydraulic structures;
- field layout and planing;
- distribution of parcels; and
- a cropping plan.

The plan will also quantify the following:

- unpaid work to be done by farmers;
- earthworks by local farmers with pay; and
- works to be done by a contractor, including concrete, masonry, and materials transport.

This work could be undertaken by the project team -- technical assistant, Génie Rural engineer, and two *techniciens du Génie-rural, niveau A2*. It could be accomplished within three months if the project receives strong support from farmers' organizations and local authorities, such as *sous-prefet* and *bourgmestres*. Interviews and visits revealed that local interest and support for the project is strong.

3.1.1.5. Strengthening DAHA and institutional support

The Direction des Amenagements Hydro-Agricoles (DAHA) no longer exists. MINAGRI was reorganized in November 1992. Annex V contains a chart of the new organization of MINAGRI and its staffing. The Direction General has been eliminated; there is now a Directorate of Génie Rural and Soil Conservation (DGRCS) with two divisions.

3.1.1.6. DGRCS support to the NRMP *marais* component

The *marais* component coordinator was appointed in November 1992. This rural engineer worked closely with project technical advisor. However, his support for *marais* activities, including training, decreased in late 1991. He was replaced in March 1992 by the current director of DGRCS. Only the technical advisor is working full time on the *marais* component. The director can devote only a part of his time. Both have spent most of their time on the training activity.

In memoranda to the coordination unit and the MINAGRI minister since February 1992, the project technical advisor has requested additional personnel. MINAGRI should provide more support.

Institutional strengthening and support to date has been useful. It is summarized below.

- The following equipment has been procured:
  - three vehicles;
  - one computer IBM PS2/55 SX + printer + accessories;

- one lap-top ZENITH 386 SX;
- one high-capacity Xerox machine; and
- technical literature for DGRCS' library and office equipment.

- Technical equipment for training technicians in hydrology, topography, soil studies and tests and equipment for the trainees have been procured.
- The DAHA division chief took one short training trip to Burundi and spent two months training in the United States.

Institutional support activities included the following:

- long-term technical assistance -- the LT rural engineer is scheduled to leave in December 1992 (see discussion on long-term technical assistance below);
- maintenance and operating costs for equipment provided;
- payment of salaries for support personnel -- three drivers and one accountant; and
- training DGRCS personnel in the use of computers and in English.

3.1.1.7 Long-term technical assistance to the DGRCs

The provision of a long-term technical assistant is the major form of institutional support for *marais* management. The technical assistant was hired through a direct USAID Personal Service Contract in November 1989 and was scheduled to leave in December 1992. Services were provided on a part-time basis for a total of about 25 person-months over a period of 36 calendar months. The technical assistant's contract stipulated that his home residence is Butare and that part of his duties will be performed there. The technical assistant performed excellent work in spite of constraints and was an asset to the component.

3.1.2. Observations on project goal and purpose

More than 90 percent of the Rwandan people rely on subsistence agriculture. Some 30 percent have less than 0.5 ha, and 70 percent have less than one hectare. Rwanda's economic future will remain largely agricultural, even if nonfarm production continues to increase.

The project goal, long-term agricultural production, is sustained; but in spite of changes in agricultural practices in response to land-use pressures, ongoing exploitation of agricultural land is not sustainable. The final results of the United Nation's Food and Agriculture Organization

(FAO) project, Inventory of *Marais* in Rwanda, indicate that *marais* lands comprise 160,000 ha. About 93,000 ha, almost 60 percent of the total, are under some degree of cultivation. The remaining 69,000 ha are not cultivated.

These lands are the last frontier of Rwanda's arable land area. But to increase yields and cropping intensity, farmers need appropriate techniques for water management, and they need additional inputs of fertilizer and pesticide. Equally, if not more important, they need markets and marketing incentives. At least ten major donors, PVOs and private-sector producers involved in *marais* development concur with this analysis. Moreover, they believe that improved agricultural practices in the *marais* will have a positive effect on farming practices on the hillsides.

The next steps under preparation by the GOR are the following:

- creation of a Cellule Nationale des Marais within MINAGRI/Direction du Génie Rural;
- a national master plan for *marais* development and management with African Development Bank (AFDB) funding; and
- initiation of the following major *marais* development programs:
    - the Mutara region hydro-agricultural project for development of 1800 hectares with the support of six cofinanciers -- Canada, France, AFDB and Kuwait. The project will produce soybeans, rice and vegetables.
    - Nyabarongo development program, supported by the World Bank; and
    - the Bugesera agricultural development program.

Concrete approaches and decisions are being taken toward achieving of sustainable use of the country's wetlands, as indicated in the project's statement of purpose. The NRMP's *marais* component is part of this effort.

3.1.3. The concept of a pilot or model *marais*

The project paper states that the objective is not the development of a small *marais*. Rather, this model *marais* will serve as a laboratory to develop an economically and environmentally sustainable and rational approach to *marais* development throughout Rwanda. The component focus is on methods and procedures that may be used in *marais* projects country wide.

Each *marais* has different physical characteristics, such as topography, size of watershed and area of arable bottom land, slopes, hydrology, run-off rates, soils and groundwater systems.

Populations exploiting the *marais* may also differ economically and socially according to land-tenure arrangements, status and custom and the role of local authorities. These factors affect the dynamism of groups and associations. Some *marais* may be better served and situated with respect to markets and input supplies. The recommended approach to *marais* development is the one that links markets effectively to local realities and responds to producers' needs and capabilities.

There was confusion in some quarters concerning the site-specific nature of *marais* development as it affects replicability. It was argued that because each site was unique, no single system could be devised for all *marais*. For example, a CSC study funded by the project shows that land-tenure arrangements differ over the country's prefectures. Consequently, the results of rural engineering and socioeconomic work at Nyamigogo would not be fully replicable elsewhere.

Component accomplishments at Nyamigogo are site-specific in terms of topography, hydrology, soil study and socioeconomic research. These studies are basic and necessary elements for elaborating any development plan or feasibility study undertaken at any *marais* in Rwanda. The most important product of the training program and work at Nyamigogo is precisely the provision of expertise needed to develop *marais* development plans that are ecologically and economically sound and sustainable.

The output from this component is not a single plan that can be applied anywhere; it is a system or set of procedures and methods that enable Rwandans to design and implement articulated and cost-effective plans for *marais* development.

Research in the Nyamigogo *marais* should thus focus on problem-solving techniques, procedures and methods that can be applied to all instances of small *marais* development. It should result in handbooks for use by field personnel. The handbooks will integrate appropriate approaches and methods for both engineering work and the diagnosis of economic and social factors.

This approach to *marais* development was first shared in a national seminar held in January 1992. The seminar proceedings provide a useful package of research results and lessons learned in *marais* development.

The concept of a pilot or model *marais* may be misleading and operate against the development of a good approach for design, development and management. The logic of the pilot or model is based in an examination of the economic, social and physical realities of a given *marais*. Once these factors are understood, a development plan can be responsive to farmers' needs and capacities, take into account customary land-tenure arrangements, assess markets and incorporate lessons learned from past experiences with farmers' organizations or cooperatives.
The ideal development plan for a given *marais* is the one that works. Local factors may indicate that a development plan starts with drainage of swamp zones. Further stages may be

implemented progressively in response to market incentives. Ideally, a more sophisticated hydraulic scheme will evolve as production is pulled by market demand.

Development of the Nyamigogo project will be a sound and useful activity. Important lessons will be learned and should be shared with other projects in order to develop a set of procedures or processes used in *marais* development. These procedures focus on appropriate market-driven development of production in accord with realities of local economy and social organization.

3.1.5. Sustainability

Economic and financial sustainability and profitability of *marais* development is difficult to assess on the basis of existing data. A recent seminar on *marais* development held in Kigali in January 1992 raised the issue of a lack of data on *marais*-development costs, production budgets for crops and farmer income.

Increased consideration of the role of women is also essential. The majority of agricultural producers are women, and they could benefit from higher production and improved market performance. The team recommends a management information system that will disaggregate statistics by gender. This will provide a basis for monitoring whether the people who are doing the work are actually accruing the benefits from improved production and marketing.

The evaluation team's discussions with project managers and review of relevant documents provided estimates of development costs from 150,0000 to 350,0000 FRW/ha. The cost is probably more for rice projects and large *marais* schemes. Variations in crop yields, the often donor-subsidized costs of inputs -- fertilizers and pesticides -- and market prices make precise calculations difficult. The hazards of such calculations are compounded by a lack of information about market-absorption capacity within the country and about the role of external markets. In sum, more precise estimates of development costs would require a special mission by an agricultural economist.

Marais development is the last window of opportunity for Rwandan agriculture. Agriculture will continue to be the leading sector for employment in the future. If the *marais* component is to be successful, it must provide farmers with cost-effective plans for development. Before production support is initiated, these plans must begin with analyses of markets and market opportunities, as well as assessments of costs and benefits. Focused work is required to identify and expand local markets for food crops and production of export crops. The team's visits to commercial production sites indicated that export crops, such as green beans, can provide favorable returns to producers and exporters. On the basis of training, research and support provided to date, this is an appropriate time to move forward with pragmatic applications.

Environmental sustainability of *marais* development and management should be carefully addressed and factored into calculations of profitability. The environmental integrity of the

marais must be maintained, given their important role in water retention throughout the year. In addition, modifications of *marais* hydrology will have adverse effects on fertility. These effects will have to be compensated by fertilizers. *Marais* development is more than a simple engineering task; it must provide sustainable economic benefits to producers while maintaining an environmentally sound resource base.

3.1.6. Recommendations

3.1.6.1. Management and coordination

The coordination unit and the coordination committee should be requested by MINETO and by USAID to fully exercise their mandate by appointing a permanent national coordinator and undertaking the tasks described below.

USAID should request the contractor to execute fully the responsibilities of coordinating, monitoring and providing support for the implementation of all *marais*-component activities. This task may require DAI's mobilization of short-term technical assistance to redynamize the coordination unit.

Direction du Génie Rural et de la Conservation des Sols should nominate a national engineer and two newly trained technicians to assist the director with implementation.

The 1993 work plan should be ammended to take into account the findings and recommendations of this evaluation report.

3.1.6.2. Training

The coordination unit, MINAGRI, MINEPRISEC and USAID should as soon as possible undertake appropriate measures to train another class of 30 technicians (*Génie-rural, niveau A2*).

The coordination unit should monitor the final phase of the ongoing training of the 21 technicians, the delivery of their diplomas in March 1993 and their subsequent job placement. The unit should also evaluate the effectiveness of the training program through a memorandum to MINAGRI, MINEPRISEC and USAID.

The training curriculum should remain the same. Advertisement for selection of students should be in May, with qualifying exams in July 1993. Training of the second group should start on September 1, 1993.

It should be more convenient and less expensive to do the training within an existing public secondary school in Kigali managed by MINEPRISEC. However, responsibility for training will remain with MINAGRI-Génie Rural.

Before the courses start, trainers will attend a special seminar, *formation pédagogique des chargés de cours de techniciens, niveau A2.*

After the training quality evaluation in March 1993, USAID and MINAGRI/MINEPRISEC should consider support from short-term, highly qualified consultants to deliver special courses for which no local trainer is available. This training may include courses related to marketing, private-sector initiatives and business management.

3.1.6.3. Development of the Nyamigogo *marais*

The Nyamigogo *marais* development should be a priority, even if USAID intends to phase out support for *marais* development at the end of the NRMP in order to support other priorities or sectors.

Although this component is not currently in line with the direction of the new CPSP, the component will support the objectives of the new CPSP to the degree that it produces market growth on the basis of profitable and sustainable production systems. Execution of this component to its conclusion will benefit new activities, such as agro-processing, foreseen in the CPSP.

A second factor that supports development at Nyamigogo is the fact that about 10,000 people were surveyed and heavily visited over the past two years. Frustration will be high if *marais* development does not start soon. Credibility will be lost for USAID and MINAGRI. Furthermore, if work does not begin in the coming months, the utility of research completed to date will be lost, resulting in an unacceptable waste of money.

The target should be raised from 50 ha to at least 150 ha, or about two-thirds of the 230-ha Nyamigogo *marais*. This area should be developed over two years. MINAGRI will require at least one rural engineer and two technicians. The estimated development cost of the 150 ha is $350,000.

3.1.6.4. Technical assistance

A new technical advisor with a background in rural development is needed and should be recruited immediately through the contractor or under a USAID personal serivces contractor (PSC). This individual should ideally be a water-resources engineer with experience in wetlands development and prepared to work in the field. The technical advisor will be based at Ruhango near the *marais* site. Existing office space is available at the agricultural services office in the subprefecture, which is located near the World Bank-financed PSA-IDA project. Home residence may be at Ruhango, Nyabisindu or Gitarama.

3.1.6.5. Génie Rural support for the *marais* component

The MINAGRI/Direction du Génie Rural et de la Conservation des Sols should appoint a rural engineer trained in *marais* development to be based at Ruhango and responsible for implementation. This engineer should work in close collaboration with the technical advisor and two technicians (*Génie-rural, niveau A2*). The technicians will complete training in March 1993. They will be selected from the current class of 21 trainees and will be based in Ruhango, working under the rural engineer above.

The salaries of the engineer and the two technicians will be paid by MINAGRI. The project should pay the costs of per diem and lodging. Quarterly progress reports should be issued by MINAGRI.

3.1.6.6. C.S.C. contract and mandate

MINAGRI should establish a third contract with the CSC to assure the services of at least the sociologist who has worked for the project since September, 1990.

The CSC should maintain a close and permanent relationship with farmers' Comité de Sensibilisation, which represents 11 sectors of the *marais*. The CSC should support this committee in order to address key issues: land distribution, input supply, marketing, water management, maintenance of hydraulic structures and common works. This committee should be progressively transformed into a management committee for the *marais*. This will satisfy USAID's request in PIL No. 29.

The CSC should ensure that farmers participate in the design of the *marais* development plan. Farmers must be involved in key decisions about land distribution and the pace of development.

Emphasis must be placed on development of farmers' organizations and on private initiatives, especially in the areas of marketing and input delivery.

3.1.6.7. The approach to *marais* development

The project team should prepare various development scenarios at the prefeasibility level. These would range from the most simple local-drainage interventions up to a well-designed drainage network with land leveling and hydraulic works to control groundwater.

> These scenarios should be discussed with farmers. A scenario for a progressive, phased development should be established. It should allow farmers' groups to improve their hydroagricultural resources in response to marketing conditions, production realities and land-tenure guarantees.

3.1.6.8. Parcel distribution and land tenure

The problem of land tenure is unlikely to be resolved at a national level in the near future. A top-down, state-level approach to land-tenure problems is unlikely to be satisfactory.

Land-tenure arrangements in the *marais* should be settled at the local level. Farmers' organizations, supported by the CSC, will be much more effective at defining customary use and establishing an equitable plan for exploitation of the *marais* resource. Local authorities concurred that if a distribution plan is agreed upon by farmers, it will be ratified by *bourgmestres* and subprefects for final approval by the prefect.

The seminar on land distribution proposed in the 1993 work plan should focus first and foremost on the local level. The current political situation in the country is not favorable for a national seminar on such a delicate issue. In the future, when conditions for a new land-tenure law arise, a national seminar might be organized in collaboration with the FAO.

3.1.6.9. Environmental assessment

In close collaboration wtih MINETO, the project team should carefully assess the impact of the Nyamigogo *marais* development on areas upstream and downstream from the watershed.

Marais development benefits from the fertility of sediments deposited through hillside erosion. Hydraulic networks, particularly drainage canals, can modify the parameters of the *marais* biosystem, including soils and air humidity, temperature and soil-water relationships. These changes have an impact on the overall *marais* and its related watershed environment. The most obvious impacts are on downstream watershed/*marais* hydrology.

The package of new practices introduced by *marais* development modifies farming systems and farmers' habits. Accordingly, a strong *encadrement* of farmers is needed during the first years of development and management.

The team will study the possibility of developing fish ponds in the *marais*, in collaboration with the fisheries component of the NRMP. Fish ponds should be sited on heavy soils unsuitable for agriculture.

A peat zone in the *marais* should be preserved. Particular attention should be given to *marais* with peat zones. These zones are usually characterized by acid soils. Such areas should not be affected by hydraulic schemes. The Nyamigogo *marais* has a peat zone of approximately 10 ha.

3.1.6.10. Strengthening DGRCS

Long-term technical assistance to DGRCS should be continued. However, as recommended above, the rural development water-resources engineer will be based in the field, close to the *marais* site and the training center at Murambi.

The engineer's duties will include the following:

- design, development and management of the *marais*;
- training of the second group of technicians;
- preparation of a realistic program for *marais* research; and
- support to Génie Rural Kigali on an ad hoc basis.

The budget has sufficient funds to employ this long-term technical assistant to the end of project.

3.1.6.11. Long-term training

Long-term training in the United States in rural engineering and water management up to the master's degree is highly recommended for two national engineers. Trained technical personnel are lacking at a time when pressure is growing to exploit *marais* resources. Given the potential for environmental damage and the precarious economic situation of the rural population, qualified expertise is greatly needed and will continue to be needed in the future. The selection of two candidates must be careful. The departure of selected trainees from their current positions within MINAGRI (or any other institution) should not disrupt ongoing programs.

3.1.6.12. Other support to DGRCS

Continued support for maintenance and operating costs of all equipment and vehicles provided to DGRCS is recommended. This includes salaries for the three drivers and the secretary-accountant for the *marais* component.

Additional equipment is needed for training of the second group of 30 rural technicians.

Local training for Génie Rural agents, accountants, and secretaries should be handled by the coordination unit.

3.1.6.13. The *marais* component and the new USAID strategy

The following recommendations are intended to relate the component's activities to the new USAID/Rwanda CPSP. The CPSP gives priority to increasing real income in the private sector and increasing non-farm production.

The component field team based in Ruhango should identify the appropriate type(s) of institutions needed to assist producers with marketing and supply of fertilizer and pesticide. The economic success and sustainability of *marais* development will hinge largely upon the capacity

of associations of small producers to develop appropriate institutions that support production and optimize links with the market.

Working in close collaboration withs farmers, the project team should assess the best package of cash crops. This package may include soybeans, tomato and vegetables. It should also identify opportunities for local processing, possibly for oil, tomato juice and tomato paste, cereal

3.2. Fish culture in the *marais* component

Previous research identified fish culture as a potentially profitable venture for *marais* development. It was therefore decided to promote an integrated production system of fish culture and cropping, livestock production in *marais* development schemes.

This effort is being implemented by the SPN. Under this component, applied research is to be carried out in the areas described below.

> Integrated fish culture at the commune level, including assistance to farmers, cooperatives and extension agent.
>
> Project funding of one combined MSc/PhD and one MSc candidate in fish culture. The project is also to support the training of 20 extension agents and the in-service training of 75 SPN extension agents.
>
> The project is to provide funds to construct seven communal fish-culture centers integrated fish-culture practices to farmers.
>
> The specific tasks of the mid-term evaluation of this component were to review outputs as follows:
>
> number of productive fish ponds to be increased by 900;
>
> creation in seven *marais* that have enterprises for integrated fish-culture, cropping, and livestock production;
>
> increased production of fish per unit area by 3.5 kg per are per year;
>
> training of one M.Sc./Ph.D. and one M.Sc.;
>
> training of 75 extension agents; augmenting extension staff by 20 new agents;

The report sections that follow will review and describe what has been implemented, analyze and present findings and conclusions, and recommendations.

3.2.1. Review of project outputs

All of the proposed project outputs were implemented. Significant progress was achieved toward meeting the stated outputs and goals.

3.2.1.1. Fish-pond construction

SPN-directed construction of fish ponds in the *marais* is progressing. Of the 900 ponds to be built during the project's five years, about 650--more than 70 percent of the total--have been built. Of this 650, 257 ponds were built in 1991, 246 in 1991 and an estimated 150 in 1992. Data was not available to determine the numbers directly related to project intervention.

3.2.1.2. Fish culture and demonstration facilities

At the national fish stations of Kikembe, Nkungu, Rushashi, Ruhengeri (Project Empoissonement) and Runyinyia, work on infrastructure, ponds and maintenance has been implemented and completed in accordance with 1991 and 1992 work plans. Transfer of the centers at Rushashi and Ndorwa to communes is planned. A lack of apparent interest at Rushashi indicates that the site could be abandoned. Start-up at Bugarama and Gikoro and efforts at Cyimbogo have been delayed because of war. Infrastructure improvements at Birenga, Kibilira have begun.

3.2.1.3. Production increases

Project document and interviews revealed that production increases at the rural level increased from 1.589 kg/ha in 1990 to 1.739 kg/ha in 1991. In 1992, this level of production rose to an estimated 1.965 kg/ha. This rise of 0.37 kg/ha represents a 23.6 percent increase over the last 3 years. The data do not specify to what degree these increases are linked to project interventions.

3.2.1.4. Training

All the proposed training programs have been implemented. The training of a Ph.D. candidate, Mr. Nathaniel Hishamunda, began in March 1991 at Auburn University, Alabama. Training of a M.Sc. candidate, Mrs. Pelagie Nyirahabimana, is also underway at Auburn University.

Of the agents trained to date, a total of 107 were employed at the time of this evaluation in pisciculture development. Sixty-seven worked for MINAGRI, 11 for USAID-related projects and the rest for NGOs.

Retraining of agents is planned throughout the year in four sessions. Training sessions for aquaculturists are carried out at the Kikembe training center. Training of additional extension agents is planned.

3.2.1.5. Research and studies

A number of studies were implemented over the course of the project to date.

3.2.1.5.1. Integration of fish and livestock production

Baseline data collection began in 1990 after the initial construction of integrated pond and livestock production modules. Initial study results indicated the following production possibilities under the prevailing environmental conditions found at Kikembe:

Methodology	Yields kg/ha
Fish/poultry	6,500
Fish/hogs	5,000
Fish/ducks	4,500

Demonstration projects have been implemented at other fish stations under the direction of SPN.

3.2.1.5.2. Rice-fish culture

Dr. William Deutsch conducted a preliminary study under contract to Auburn University and Paul Mpawenimana, interim director of the SPN during the study period. The study concluded that prevailing rice-culture techniques use substances (herbicides/pesticides) toxic to fish. As a result, a dual rice-fish production system is not feasible.

3.2.1.5.3. Carp-rearing program

The carp-rearing program started in 1991. It is apparent from initial studies that not only production but reproduction of the species can be carried out in Rwanda.

3.2.1.5.4. Market feasibility

The SPN, through a DAI contract, has contracted a private group of consultants from Auburn University to conduct a marketing study. The study is to be directed by Curtis M. Jolly, technical assistant for Auburn University, Jean Seth Ngendahimana, Bonaventure Nsabimana and André Ngendabanca.

The study design was completed and approved in March 1992. The final market-evaluation study was to be completed in September; its completion was late due to problems in funding and administration. Data analysis is in progress. The estimated completion date for the report is the end of December 1992.

3.2.2. Findings

3.2.2.1. Fish-pond construction

Most ponds are constructed in accordance with the general specifications given in the SPN manual on fish-culture training.

The evaluation team found that a large number of the ponds it visited were well kept and appeared productive. A significant number of fish ponds were found to be either dry, overgrown with vegetation or covered with algae blooms. The reasons for these problems were as follows:

- poor design leading to draining and maintenance problems and lowered productivity;
- poor management leading to production costs of fish above market value;.
- insufficient backstopping by field extension agents; and
- use of fish culture as means of obtaining land for the commune.

Due to lack of guidance and applied knowledge, fish-pond construction in Rwanda is based more on replication rather than system optimization. Thus, ponds are not adapted to topographic and field conditions. Rather, standard plans are implemented with little reference to the site.

3.2.2.2. Production increases

An analysis of available data from the Rwasabe research station and the SPN facilities indicated that major increases in productivity could be reached by shifting from an integrated livestock system to an organic and inorganic approach to pond fertilization. Yields of 8,000 kg/ha per year and higher are attainable with proper management and the stocking of monosex tilapia fingerlings.

3.2.2.3. Training

Training of the PhD and Masters' degree candidates at Auburn University will greatly assist in development and monitoring of pisciculture in Rwanda.

Extension agents are undertrained. Selected personnel go through a one-month training course in pisciculture. The level of aquaculture-related knowledge and the problem-solving capacity of these agents is limited.

3.2.2.4. Research and studies

3.2.2.4.1. Integrated fish and livestock production

Integration of fish and livestock production has been documented worldwide as an economically viable system. This approach benefits from the presence of penned animals. However, in Rwanda livestock is generally free ranging.

The integrated fish and livestock production method requires substantial capital investment -- livestock production units and livestock purchase, as well as the transfer of technology for rearing penned animals. In addition, fish-culture methodology must be transferred and applied. Production levels from integrated systems are often inferior to outputs from the simpler method of organic/inorganic pond fertilization.

It was apparent from field visits throughout the country that the integrated methodology was not readily accepted because of the relatively high cost and management requirements.

3.2.2.4.2. Rice/fish culture

It is possible, with appropriate changes in management practices in rice culture, that dual culture methods could be introduced with either fish or crustaceans. The impact of current rice-farming practices on the aquatic environment warrant investigation. Downstream impacts from rice-culture operations could well have an adverse impact on aquaculture and other forms of natural production in the *marais*.

3.2.2.4.3 Carp-rearing program

Initial trials with both growout and reproduction of carp species are encouraging. Investigation in the Kigali and Ruhengeri markets indicated that carp, by virtue of its large size, will command a higher price per kilogram than other species, such as tilapia. Inclusion of carp in a dual-culture system with tilapia will increase production and revenue. Carp occur in some of the Rwandan waterways. They could be used for weed abatement in selected *marais* water-distribution systems. This use of carp would reduce labor and management of channels and provide an additional protein source. Nonreproductive hybrids, triploids, could be used in initial studies in order to reduce impacts. Where applicable, use of carp in the fish-restocking program, along with other appropriate species, such as clarias, should be encouraged.

3.2.2.4.4. Marketing study

The study design is well conceived and data collection has been completed. Data analysis and report writing were being finalized at the time of this evaluation.

Existing constraints are most apparent at the rural level. At harvest time, demand is quickly saturated. While demand exists in the larger markets and towns, product availability and quality are the chief constraints.

3.2.3. Conclusions

3.2.3.1. Aquacultural potential

The potential exists for the physical siting of small- and medium-scale aquaculture operations. Aquaculture operations need water and heavy clay soils for constructing pond berns. As a result, they are usually located in areas of marginal value for agricultural production. Proper siting in *marais* development can minimize environmental impacts, increase overall productivity and if sited correctly, can alleviate flooding and irrigation problems.

Areas that offer the greatest chance of success for economically viable development of pond aquaculture are those with abundant water, warmer temperatures, access to markets and the right soil (clay) conditions. These characteristics are found in numerous *marais*.

Potential in the north of the country and at higher elevations is limited to artisanal production because of lower prevailing water temperatures and limited land availability.

Assuming that artisanal production could be increased three times the present level, total annual production would remain at less than 400 tones. A lack of precise information makes it difficult to estimate the commercial production potential for Rwanda. However, based on the total acreage of *marais* located at lower elevations, it is difficult to envision a total development potential in excess of 800 tones annually. A rough estimate of the total potential for the country would not exceed 1300 tones annually. The value of such production is currently estimated at about $1.8 million per year.

3.2.3.2. Economic viability of aquaculture

The economic viability of aquaculture operations in Rwanda are best categorized by size. This can be done with respect to two types: artisanal, farm-based aquaculture and the proposed small- to medium-scale commercial operations.

The profitability of small, farm-based operations must be evaluated in terms of alternative uses for the same site. The viability of the operation therefore lies in the profitability of aquaculture when compared to other agricultural pursuits that might take place in the same area. It should be remembered that ponds are ideally situated in areas not suitable for most types of agriculture. The estimated gross and net income figures for selected activities in *marais* are shown below:

Product	Gross Income FRW[a]	Net Income FRW
Sweet Potatoes	180,000	88,500
Corn	72,000	10,000
Soy Bean	88,000	30,400
Fish [b]	194,400	7,200
Fish[c]	291,600	104,400

[a] Labor 150 per day, inputs and maintenance costs are deducted.
[b] Fish production 1,800 kg/ha/year 40% home consumption and loss, of remaining 60%, 40% sold at 150 FRW,60% at 200 FRW.
[c] Fish production 1,800 kg/ha/year 10% loss, of remaining 90%, 40% sold at 150 FRW,60% at 200 RFW.

Artisanal aquaculture increases protein availability and generates a significant amount of cash for the small farmer. With good management and adequate inputs, this operation can be as economically viable as other crops. What remains to be seen is whether it will be technologically sustainable over time.

The commercial viability of aquaculture in Rwanda can only be assessed hypothetically. No commercially viable small- or medium-scale aquaculture operations were located in Rwanda at the time of this evaluation.

Based on the information from the research centers and work at the commune level, it is apparent that commercially viable operations can be established if the constraints discussed below are removed. (Annex 3 three shows a preliminary analysis of a plausible case study for establishing a small-scale commercial aquaculture operation in Rwanda).

Existing information indicates that aquaculture is marginally viable. If productivity can be increased, viability will increase accordingly. The break-even point is about 2.5 tones per hectare. At this level and with good management, the enterprise could recover capital investment costs by year five.

3.2.3.3. Constraints to aquaculture development

Constraints to aquaculture development that adversely impact small-scale, artisanal and commercial aquaculture are the following: a lack of appropriate technology and a need for its transfer; an absence of an institutional framework; insecure markets; and poor infrastructure and related industries, such as processing and value-added industries.

Constraints to production include a lack of application of proven techniques for fingerling production despite available technology and information on growout methodology, which is readily available. The Rwasave aquaculture station at the university and the SPN centers have the baseline information needed to maximize aquaculture development.

Institutional constraints are the following: the absence of a national aquaculture plan; a low institutional profile of SPN within the Ministry of Agriculture; a high rate of personnel turn-over; a poor understanding of commercial aquaculture within the SPN; and a lack of credit for producers.

Market constraints fall into two categories, urban and rural. Rural markets have very low purchasing power. A barter system might be developed in which fish can be traded for other products. In urban areas, product sales suffer from poor delivery schedules and lack of quality. Even in the larger cities, fish is considered too expensive at the current price of 200-250 FRW per kg.

Infrastructure constraints are principally associated with the following: limited availability of inputs such as feed and organic and inorganic fertilizers; limited supply of monosex fingerlings; and a shortage of ice and reliable product pick-up at the farm sites. Once profitability is recognized by entrepreneurs, development of infrastructure will follow.

Constraints to the development of small-scale artisanal aquaculture are the following: a lack of appropriate technology; limited purchasing power in local markets; problems with access to urban markets; and limited access to appropriate lands.

Constraints to commercial aquaculture are the following: an absence of legal mechanisms to assure title to larger tracts of *marais* land; lack of successful demonstration of commercial aquaculture; and difficulties in obtaining financing because of the above conditions.

3.2.4. Recommendations

3.2.4.1. General recommendations

a. Artisanal aquaculture development is progressing. Technology transfer should be improved so that the technology being transferred coincides with economic realities in the field.

b. The SPN should redirect training to meet the needs and capacities of the artisanal aquaculturist-farmer.

c. Once the transfer of technology has been passed through the extension-agent level, USAID need not continue to fund training programs. Further assistance costs should be absorbed by the individual users.

d. Elimination of commercial constraints should suffice to stimulate commercial aquaculture. The SPN should begin formulation of a plan for aquaculture development should make recommendations to the government for specific needs. If those needs cannot be addressed, commercial aquaculture within country should not be encouraged.

e. The National Aquaculture Plan needs to be completed as soon as possible. Auburn university, participation needs to be reevaluated and the completion date moved forward.

f. USAID financing of further aquaculture development should be minimized until a comprehensive aquaculture development plan is produced.

g. The plan must take into account findings of the marketing study and the evaluation team.

h. The SPN interim director should develop a strong presence within MINAGRI. This director should provide concrete recommendations at the division level for aquaculture development.

i. The role of the private sector in marketing and distribution, processing, and sales needs to be developed. If benefits are achieved, the private sector should become involved.

j. The formation of cooperatives in the marais will help in the development of both artisanal and commercial enterprises. Access to credit can be increased by forming cooperatives. Development banks may be convinced to support small aquaculture-related loans.

k. Land-tenure constraints can be resolved locally at the commune and prefecture levels.

3.2.4.2. Specific recommendations

a. Training of additional agents should be suspended until a comprehensive and realistic aquaculture development plan is approved and the need for more agents is demonstrated.

b. The overdue market-feasibility study critical to making about decisions the directions and potential benefits from the component. This study should have been a high priority for

SPN and should have preceded some of the other research activities. The market study should be completed and used to formulate the aquaculture-development plan as soon as possible. The coordination unit and the contractor should demand timely execution of contracts and monitor their progress on a quarterly basis.

c. It is possible in some areas to reduce construction costs by increasing the size of the ponds. Pond construction and productivity (ease of management) are closely interrelated; site specifics must be considered, including construction costs and plausible yields prior to implementation.

d. Given the number of ponds already existing, it is doubtful that more or improved demonstration facilities are required. A phase-out of demonstration facilities should be planned by year four of project implementation.

e. The Kigembe site should be divided into a training facility, while retaining some ponds for demonstration purposes. The rest of the ponds and access to the system should be leased or sold to interested parties for commercial development.

f. In order to obtain reasonable yields, certain technological and economic criteria must be met. Principal technological criteria are described below.

- Production of monosex tilapia should be facilitated, either by species cross (*T. nilotica* X *T. aurea*), feeding of hormone-treated feeds for sex reversal, or hand sexing.

- Ponds should be stocked with tilapia fingerlings at 4-6 units per m^2, depending on the site.

- Pond management should employ organic and inorganic fertilization methods.

- Feeding during final months of growout should be encouraged.

- Pond productivity and environmental parameters indicate that dual culture of tilapia and carp or clarias is feasible at numerous sites.

- In colder areas, stocking densities should be increased to produce a higher volume of smaller fish.

- Systematic and accurate record-keeping on feed and fertilizer inputs, growth rates, temperatures, productivity (seiche-disk readings) and dissolved oxygen must be kept.

- Pond management on individual sites must be based on site-specific parameters.

g. The SPN should reevaluate methods and approach. The SPN should abandon duplication of applied research and carry out its mandate toward sustainable and economically viable aquaculture training and development.

h. The SPN needs more contact with field agents and needs to monitor data collection and undertake analyses. The SPN need to establish a viable database and an analytical system.

i. Until the PhD and Masterss degree candidates return from their training at Auburn University, an experienced, full-time commercial aquaculture specialist must be attached to the project. The coordination unit should contract such a person in order to give timely assessments and direction. This type of on-site assistance will be much more cost effective and beneficial than a series of periodic missions.

j. The role of this specialist would be to identify specific development opportunities, improve and assist aquaculture development and to help stimulate private-sector participation in marketing, distribution, growout, fingerling production, preservation, conditioning and processing of value-added products.

k. This aquaculture specialist, with SPN assistance, could identify special mission needs. These specific interventions could than be carried out by Auburn University or other capable entities after approval by the coordination unit and USAID on an as-needed basis through Indefinite Quantity Contracts (IQC).

l. Upon approval of the aquaculture development plan, at least four supervising agents should be recruited and trained in order to monitor field personnel on a continuing basis. These agents could be drawn from the field agent pool. These agents should be retrained by SPN and should be given comprehensive training at the Rwasave aquaculture-research facility for additional practical experience.

m. Each agent would be charged with evaluating and assisting field extension agents. In this area, it might be advisable to involve Peace Corps volunteers and local counterparts in order to reduce costs.

n. The training program and training manual need to be updated in order to take into account the lessons learned during the last three years.

p. A system needs to be devised to transfer to beneficiaries -- the Rwandan government and end users -- training and employment costs, such as salaries and related expenses.

q. The SPN and the demonstration centers should reorient their goals toward dissemination of technology appropriate for Rwanda. This effort would support development of a strong rural-aquaculture industry using a combination of organic composting and inorganic fertilization to boost productivity. The integrated-culture method may be retained as an alternative system.

r. Artisanal, farm-based aquaculture should be encouraged to the degree that it is sustainable and self-sufficient.

s. Entrepreneurial interest should motivate development of commercial aquaculture with the support of cooperatives in the *marais*. The above analysis indicates that reasonable levels of profitability and return on investment can be attained.

t. To stimulate the interest of the private sector in aquaculture development, industries of appropriate scale will have to be developed as follows:

- pond-site purchase and pick-up by wholesalers and major retailers;
- establishment of competent wholesaler-distribution centers in major towns for aquaculture and fisheries products;
- support for small retailers to sell at local markets;
- small-retailer training in quality control;
- development of value-added products, such as smoked, salted or otherwise cured products, frozen filets, precut brochettes for sale to small restaurants to stimulate development of the rest of the industry.

u. Private-sector involvement should be stimulated in terms of purchasing, distribution and processing. Areas of special emphasis are as follows:

- establishment of centrally located regional purchase and preservation facilities, such as cooperative or private-sector salting and smoking stations;
- development of organized pick-up and delivery routes for preserved and fresh fish for delivery to markets in Butare, Ruhengeri, and Kigali;
- in larger towns, development of private-sector wholesalers, wholesale-retailers and retailers for product sale to restaurants and individuals; and

- at the rural level, cooperatives to organize product harvest, pickup and distribution.

3.3. Soil conservation and agroforestry (COSAF)

Africare was chosen to implement the Conservation des Sols et Agroforestry (COSAF) component of the NRMP. Africare and USAID signed a cooperative agreement on December 18, 1990. The life of project (LOP) for this component is three years, November 1990 - November 1993. The amount of the agreement is $1,633,218, of which $978,400 -- 60 percent -- has already been spent.

COSAF is to promote and extend agroforestry technologies that will allow farmers to cultivate hillsides while maintaining or increasing soil fertility and agricultural production. The COSAF scope of work also included recommendations on how to accomplish the following: reduce damage caused by torrential runoff in the lava zone; quantify soil erosion losses; provide assistance in development of communal forestry plans (CFP); and monitor soil erosion and fertility. COSAF operates in five communes of the Ruhengeri Prefecture.

Ruhengeri Prefecture is the most densely populated area of Rwanda. The majority of the population is rural and depends on agriculture for its livelihood. This dependence places severe pressure on the land. Agricultural production can no longer keep up with the demands of an expanding population. Farming practices in the project area have become increasingly damaging to soil conservation and to erosion control.

These damaging farming practices are widespread and have had these consequences: fallowing to restore soil fertility has been greatly reduced; marginally productive areas and fragile lands have been converted to fields; production and use of animal manure has decreased; and GOR long-term soil-conservation practices have ceased.

In order to assist the COSAF component in achieving its objectives, USAID contributed financing to the Agroforestry Research Network for Africa for the Bimodal Highlands (AFRENA), a project sponsored by International Council for Research in Agroforestry (ICRAF). ICRAF/AFRENA's role in the COSAF component includes the following efforts: studies of problems of land-use systems; identification of potential technologies; research-station and on-farm research on behalf of COSAF; provision of technical backstopping; and providing to COSAF vast experience in Rwanda and other developing countries.

Also under the COSAF component, USAID also awarded a grant to CARE International for the reforestation of 400 ha in the Gituza Commune.

This section begins with a general set of findings, comments and recommendations for the COSAF component as a whole. Subsequent sub-subsections review the component's elements as specified in its mandate: soil conservation and erosion control, agroforestry, monitoring and evaluation and training. Institutional issues are also reviewed. The concluding subsection reviews reforestation efforts at Gituza undertaken by CARE.

3.3.1. Findings

The soil-conservation and agroforestry component has the largest share of the NRMP budget; but its outputs do not reflect this high proportion of project funds. Reasons for this component's relatively low performance are the following:

a lack of monitoring and evaluation, focused targets and quantifiable outputs;

promotion of expensive or relatively expensive technology, such as radical terraces and exotic plant species (some plant seeds cost more than $50/kg and have to be imported by AFRENA from Australia or Asia);

promotion of irrelevant training, specifically unnecessary and costly field trips by local authorities;

travel time required to field sites as a result of the geographic breadth of the project throughout the prefecture; and

promotion of irrelevant, academic research (AFRENA, in its effort to find the best plant species adaptable to Rwanda, neglected to promote already-proven species among farmers.

3.3.1.1. Measures for soil conservation and erosion control on degraded or fragile lands

As stated earlier, soil degradation and erosion in Ruhengeri Prefecture are approaching alarming proportions. The USAID and the GOR, through the NRMP, are taking steps to redress this trend. To successfully implement methods for soil conservation and erosion control, COSAF has taken three types of actions: runoff control, soil-fertility improvement, and soil protection.

3.3.1.2. Runoff control

COSAF, in its extension effort, focused on specific actions to reduce the amount of rainfall runoff on hillsides. These actions are described below.

- Antierosion lines:
  - the reduction of distance between existing AELs from 20 m to 10 m and a reduction of spaces between plants from 40 cm to 20 cm
  - mixing of grass species with agroforestry species in the antierosion lines
  - replanting grass species destroyed by livestock, and
  - management of these grass species

- Erosion inhibiting hillside ditches and their maintenance.
- Inclined talus and growth of grass on the talus surface.
- Use of rocks and grass strips as AELs.

To obtain the grass species needed near the sites, COSAF delineated a 0.2-ha area in each sector -- an area set aside for seed production and seed multiplication of *setaria, pennisetum* and *tripsacum*.

3.3.1.3. Soil-fertility improvement

COSAF extended methods for improving soil fertility. These methods involved the application or mixing in the soil the following:

(a) organic matter, (b) animal manure and (c) green manure;
On some sites, COSAF helped to establish composting pits as a source of organic matter.

3.3.1.4. Soil protection

COSAF has decided that radical terraces should be established in the Butaro, Cyeru and Nyamugali communes. One-hectare sites in each of the communes were being set up for demonstration. In order to spread this technique throughout the commune, these sites were further subdivided into four sectors of 0.25 ha each. Three terracers were contracted from the CPA/Kissaro to train local farmers in the three communes. Each terracer-contractor was allocated a budget for 800 person-days to complete this job using 60 farmer trainees. The contractor can use all 800 person days but must complete the work in no more than two months. The contractor must agree to train 15 farmers per sector and move from sector to sector to supervise the work in all four sectors. In addition, contracts were signed with farmers who would supply the land; other interested farmers around the sector were encouraged to visit. The contractor is paid 80,000 FRW per hectare. Ideally, 15 laborers per site would be hired and trained, but in reality the terracer may decide to hire fewer trainees in order for them to obtain higher renumeration.

In the future, farmers interested in radical terraces must hire the terracers on their own. According to COSAF, if the idea of radical terraces is not accepted, this method will not be promoted elsewhere.

Most of the runoff-control techniques implemented were fully accepted by farmers. Technology for improvement of soil fertility was also being practiced on the sites visited. Radical terraces are expensive, and farmer acceptance of this method in the absence of a subsidy or other financial incentive is doubtful.

3.3.1.5. Recommendations

a. COSAF activities in Ruhengeri should be restricted to the war-free communes of Mukingo, Nkuli and Nyamugali. In these communes, grass-seed production and multiplication nurseries should be maintained.

b. Work underway on the construction of radical terraces should be completed.

c. Construction on new sites should be discouraged, especially because they reduce cropping areas and may exacerbate soil erosion.

d. Soil mulching with the grass produced and crop rotation should be encouraged.

e. Use of lime in nurseries should be discouraged until production has been privatized. Lime use should then be left to the discretion of the nursery producer.

f. Fertilizer use should be avoided on project nurseries. It raises input costs and misleads farmers into believing that tree growth rates and development will be the same in their own fields.

g. Inclined talus should be encouraged on existing progressive terraces; it uses less labor, can increase farm size and does not disturb the land as much as other interventions.

h. Hillside erosion ditches should be discouraged; they cause more damage than good.

i. Damaging cultural practices, such as ploughing up and down slopes should be discouraged. Lateral cultivation techniques should be encouraged.

Aerosion elimination lines were being implemented on the sites visited. In most cases, tree plants were small and neglected. The design of existing antierosion elimination lines was not well conceived. Consequently, spaces between vegetative bands on the contours have to be reduced, and additional antierosion elimination lines have to be put in between existing ones. This work is done at a cost to the GOR, the project and to the farmer, who loses valuable land. Often domestic animals browse on the antierosion elimination lines after harvest. antierosion elimination lines made of rocks in volcanic areas appear to have more success, probably because they do not require much labor afterwards and livestock can freely graze on the pennisetum species and crop residues.

More research is required on the effects of antierosion elimination lines on soil fertility and erosion. In any event, it was determined that by the end of 1987, an estimated 84 to 98 percent of soils in the communes of Nyamugali, Nkuli, Cyeru, Butaro and Mukingo had already been

provided with antierosion elimination lines (Nyamulinda, RRAM). Soil protection appeared adequate in these areas.

Proper techniques for installing inclined talus (sloped walls between terraces) can increase size. However, farmers resist the idea. In Nyabisindu (Butare) for example, a German agroforestry project had little success with talus. After 13 years, only 20 percent of the inhabitants of the six project communes had adopted it. The main benefit stressed by COSAF is increased fodder for livestock. The idea of promoting agroforestry species for fodder does not work because farmers generally own few livestock, and these can browse on fallow land. The appeal of talus sown with grass on progressive terraces is not fodder but increased land area.

Radical terraces look impressive to the layman. When soil depth, slope and other factors are correctly taken into account and the terraces are created on appropriate land, they can reduce erosion. DAI consultants, commenting on a soil map prepared by a Belgian technical-assistance group, found that "a large part of Ruhengeri Prefecture is unsuitable for radical terraces (R. Gaddis, 1992). This evaluation team found good examples of radical terraces in Ntyaro Commune (Butare), in Mushongi, Nyamugali Commune and in Kibali Commune (Buyumba). On these sites, land slope was not too steep -- 15 to 30 percent, and the soil depth was good.

A major drawback with radical terraces is their cost and the uncertainty of their impact on the soil. Farmers are willing to volunteer their lands for radical terracing because its cost is subsidized at 80,000 FRW/ha for labor. The cost could become considerably higher if construction material and food and lodging were included. The terraces are expensive for the average Rwandan, who normally makes 20,000 to 60,000 FRW/year, has from 0.2 - 1.0 ha of land and feeds a family of five or more people (Wilcock, D.,1986 and LaFramboise, D. 1992).

DAI's economic analysis of radical terraces determined the following: "based on the value of wood products only (fuelwood and poles), forestry plantations are not likely to be economically or financially feasible" (Ron Gaddis, 1992).

If the only added value is the increased yield in fodder for livestock, the farmer may not accept radical terraces for the simple reason that he or she may not own any livestock or because of the farmer's herd is too small to make the effort valuable. A national agriculture survey by MINAGRI in 1989 revealed that in Ruhengeri, 23 percent of the farmers own 1 to 2 cows, 59 percent own 2 to 3 goats, 45 percent own 2 to 3 sheep, and 6 percent own 1 to 2 pigs. Overall, a small proportion of farmers own few farm animals.

Another reason for not adopting radical terraces is the low value of grass or trees species. It should also be added that radical terraces do not significantly increase crop yields. On the contrary, radical terraces result in a 20 to 40 percent reduction in cultivated area, depending on the slope (Roose E., et al.).

The use of lime and fertilizers on project nurseries should not be subsidized by the project. Use of these fertilizers should be left to the discretion of the nursery owners once privatized. So far, farmers obtain these chemicals for free or at a minimal charge from the GOR or other countries financed projects. This cost to the farmers does not reflect the true market value. In the absence of this subsidy, they may discover that additional input cost is not justifiable.

Moreover, farmers generally prefer to use fertilizers on cash crops rather than on trees that provide no immediate economic benefit. Most farmers in Rwanda are engaged in subsistence farming; 63 percent of crops produced in Rwanda are consumed on the farm (Loveridge, 1992). More research is needed on the proper and safe use of fertilizers and lime. Improper use of lime on ultisols and oxisols, for example, can reduce water percolation and plant growth by inhibiting the uptake of phosphorus and micronutrients. Where rainfall is moderate and soil leaching is minimal, lime is not needed (Hudson, 1981).

Another problem related to fertilizers is the lack of a reliable distribution system in the private sector. A large proportion of fertilizers used in Rwanda is subsidized or free of charge from donor organizations. As a footnote, it should be noted that some pesticides and fertilizers are listed in the AID Handbook (#13) as restricted goods; procurement and use of these fertilizers requires a written authorization from USAID.

Use of plant material for mulching is needed to reduce erosion and to conserve soil structure. Another valuable soil-conservation technique is crop rotation to break up the process of pest or disease, which may develop under monoculture. Different plants have different nutrient requirements; crop rotation makes good use of all the available soil nutrients.

Crop mixing is another viable alternative for soil conservation. Mukingo Commune provides several good examples of crop mixing of corn and beans and mixing of sorghum and beans. Corn and sorghum were used as live tutors -- climbing poles -- for the beans. Fodder is produced from the beans after harvest. This technique comes from the farmers.

Hillside erosion ditches reduce the cultivable land surface and cause land slides. Stagnant water in the ditches also breeds mosquitoes.

Farmers hoe their fields on sloping terrain, from the bottom of the slope to the top. This practice contributes to erosion by moving soil further and further down the slope. The farmers should hoe their sloping fields along the contour lines. COSAF should encourage this latter practice.

3.3.2. Recommendations

a. COSAF should continue its extension activities in Ruhengeri in three of the original five communes until November 1993. After this date, an evaluation is recommended. This

assessment of performance should bear in mind the recommendations of this evaluation before any extension is made.

b. Tree nurseries in these communes should be reduced to a few, proven agroforestry, fruit tree and grass species.

c. These nurseries should be fully privatized in the true sense, not passed on to contract producers as soon as possible.

d. Production of other agroforestry species should be left to the care of MINAGRI or the communes themselves.

e. Activities in communes situated in war zones should be phased out.

f. Production of other agroforestry species should be left to MINAGRI or to the communes.

h. More time and effort should be devoted to the extension of techniques for soil conservation and agroforestry. This effort should be focused on degraded and fragile areas in intensive development sites.

i. GOR should encourage farmers to adopt these techniques by providing incentives such as tax concessions or easy access to credit.

3.3.3. Agroforestry

Agroforestry is critical to soil conservation and erosion control. COSAF was invited to participate in four major agroforestry activities: landslide stabilization; improvement of soil fertility and structure; control of degraded and fragile soil; and development of communal forestry plans.

3.3.3.1. Landslide stabilization

Among techniques promoted by COSAF are agroforestry tree planting in and between fields, along contour lines and along paths to the fields.

3.3.3.2. Improvement of soil fertility and soil structure improvement

Use of organic manure from leguminous trees was encouraged. Species such as fruit trees and trees used for fuelwood and poles were also promoted.

3.3.3.3. Control of degraded and fragile soils

COSAF has promoted the establishment of one tree nursery per sector. The sector nursery will produce 25000 trees of various species for agroforestry, 5000 for forestry and 2500 fruit trees twice a year. Ten to 20 ha per sector were designated as intensive development sites. The 25000 agroforestry trees and the 2500 fruit trees were to be planted on these sites; the 5000 forestry trees were for collective plantations on communal or private lands. In addition, one nursery was created per each commune of 5000 agroforestry species, 20000 forestry species and 5000 fruit trees.

3.3.3.4. Communal forestry plans (CFP)

COSAF will develop one CFP per commune with the help of a local consultant. The CFP is intended to provide an inventory of available forestry resources, identify degraded areas for policy implementation, identify areas for reforestation and establish plans for reforestation and management of communal forests. The planned completion of two CFPs in 1992 was not realized. A CFP for Nyamugali commune was published in August 1992.

3.3.3.5. Findings and conclusions

Although soil erosion and soil degradation are bad in the Ruhengeri prefectures the 5 prefectures visited out of a total 16, did not show critical degradation problems. In the majority of the sites visited, soil erosion in fields, gully erosion, and soil fertility were not major problems. The land condition noted at these sites may be the result of one of the determinant site-selection criteria, namely the farmer's willingness to volunteer his land for soil-conservation techniques. In such a case, this sampling might not reflect the original soil conditions of the farmer's land.

Landslides were seen in many places, however, especially along roadsides, outside the fields and after heavy rain.

Agroforestry species extended by the project were viewed with caution. Farmers preferred to stick with proven species of Calliandra, Grevillea, Leucaena and Markhamia. Fruit tree species were appreciated.

Nursery privatization was in fact contract farming rather than privatization. Exotic tree seeds were imported from Asia or Australia for up to $50/kg and were multiplied by AFRENA/ICRAF and then provided to AFRICARE for distribution in the nurseries.

COSAF signs a contract with farmers who will produce the required number of trees for 50,000 FRW (1.5 FRW/plant) for the season. These trees are then given to the farmers for free. Nursery privatization may not work due to a lack of farmer interest in the species grown.

The communal forestry plan completed at the time of this evaluation (Nyamugali) made a good assessment of the forestry situation in Rwanda; it identified zones of tree deficit and provided plans for future reforestation. Its shortcomings were, however, the quasi-exclusion of private and government land at the benefit of communal lands. The plan should deal more with forest management. Overall, the CFP is considered adequate and should be fine tuned and used as a model.

3.3.3.6. Recommendations

a. Fruit trees and leguminous agroforestry species of Calliandra, Grevillea, Leucaena and Markhamia should be encouraged in the intensive development sites.

b. Use of grass species should also be encouraged on all project sites.

c. GOR should provide incentives to promote rapid adaptation of agroforestry techniques.

d. Planting of other tree species should be reduced.

e. The component should focus on the most degraded areas, such as those along road sides to prevent land slides.

f. Implementation should be left to the communes; COSAF may provide technical assistance and guidance.

g. The actual process of privatizing plant nurseries, not just the contractual arrangements, should be accelerated and completed as soon as possible.

h. New species to be introduced should come from various parts of the country.

i. The community forestry plans for Mukingo and Nkuli should be completed.

The introduction of new species should be encouraged because it gives farmers a wider choice vis-à-vis their needs and soil characteristics. Farmers tend to be reticent about trees that compete with other, more pressing short-term needs.

Antierosion elimination lines of Sesbania and Calliandra were uncared for and farmers tended to resist their introduction. Trees, especially on communal lands, had been destroyed by refugees but were growing back at a good rate. They often develop more branches, and because their root system is already established, they are useful for soil-erosion control.

Field visits showed that gully erosion on fields is minimal. Landslides, particularly after heavy rainfalls, are prevalent along roadsides. In Gaseka sector (Nyamugali Commune) farmers have

planted Pennisetum species on their own initiative to retain soil. Pennisetum, which is already being promoted by MNINAGRI, should be encouraged. It grows quickly, produces good fodder, stakes and roofing material while improving soil fertility (Cunard, 1992).

To increase the chances of successful nursery privatization, emphasis should be placed on the four tree species mentioned above and on fruit trees. Analysis of baseline information (La-Framboise, 1992) indicates that farmers prefer Calliandra, Grevillea, Leucaena and Markhamia. Local interest in fruit trees is evident from their rapid turnover in nurseries. Privatization of tree nurseries comprised species of these genera will have better chances of success. Privatization of exotic tree nurseries will likely be difficult. Farmers shy away from exotic species in favor of fruit trees and proven species.

Tree species were heavily subsidized by the project. From the seed import to the multiplication phase, the farmer does not realize the true cost of the plants. When nurseries are privatized, the farmers costs will increase substantially. It was not surprising that after a year of privatization of the Gituza CARE project, the biggest client was found to be the project itself.

COSAF should consult with CARE on proper methods for nursery privatization. GOR could provide incentives to farmers in the form of tax benefits or easier access to credit from local banks to help them start their own nurseries or purchase plants from private nurseries.

A great deal of effort went into the establishment of the Nyamugali CFP. However, little has been said about the management of trees once they are established. The CFP refers to the supply of tree species on communal, private, and government land but does not take into account agroforestry species planted by COSAF's agroforestry component. The entire CFP should serve as a guideline for the commune, not just the trees in the communal land. The CFP should have been completed prior to undertaking any tree-planting activities in the commune.

The CFP also advocates establishment of a communal forestry fund to underwrite future reforestation projects, forest-management activities and promotion of wood-based small enterprises. The money will supposedly come from sale of forests products and from NGOs. This element of the plan needs more fine tuning. Who will manage the funds? What will the contribution be from the GOR, from the commune and from private land owners into these funds? And on what basis will the contributions be made? In any case, this aspect of the CFP is beyond COSAF's involvement and should stay that way.

3.3.4. Monitoring and evaluation

Monitoring and evaluation was not specifically included in the first COSAF work plan. Topics relating to monitoring were, however, scattered throughout the plan. Having realized the need and/or having being asked to organize all activities in a concise manner, this section was

subsequently included in the 1992 work plan. COSAF intended to implement monitoring and evaluation in the following ways:

review past erosion problems to identify lessons learned and propose appropriate technology to provide future solutions;

conduct on-farm research in agroforestry and soil conservation;

use ICRAF/AFRENA to identify agroforestry species, forestry species and graminoids most suitable the COSAF purposes; and

establish communal research and demonstration centers in Nkuli and Mukingo. Past projects, such as Ruhengeri Resource Analysis and Management (RRAM) and Farming Systems Research Project (FSRP) have centers in other communities. Therefore, there is no need to establish these centers in all five communes.

Under monitoring and evaluation for the 1992 work plan, COSAF added baseline-data gathering, evaluation of agroforestry species in the field by the chiefs of sections at least once per season, evaluation of tree-management techniques and tree utilization by farmers once per year. The work plan also called for submission, according to needs of monthly, yearly or/and quarterly reports to USAID, AFRICARE, the coordination unit and MINAGRI.

3.3.4.1 Findings and conclusions

ICRAF/AFRENA collaboration with the project has been adequate. This collaboration has, however, gone about as far as it can go

Communal research and demonstration centers are plentiful; farmers' fields can serve the same purpose.

On-farm research in agroforestry and soil conservation is minimal.

The level of monitoring is inadequate. Due to other obligations to the MINAGRI, the commune agronomist was unable to devote his full attention to the project. The coordination unit did not follow up the project in the field. And due to the long travel distance, the coordination cell in Ruhengeri was not able to get out in the field regularly. Evaluation was lacking, and key indicators were missing in the baseline survey.

3.3.4.2. Recommendations

a. USAID investment in ICRAF/AFRENA as reflected in PIL 26 should stay at the current level. COSAF should direct all its research needs through ISAR.

b. Monitoring and evaluation should involve agricultural agents (MONAGRIs), chiefs of sections, communal agronomists and the coordination unit. Measurable target outputs should be defined, and progress towards achieving targets should be evaluated at the end of each quarter. At regular intervals, the project should assess the level of nitrogen build-up, soil-erosion rates, tree planting and survival rates and adoption of promoted technologies.

c. The NRMP coordination unit should help COSAF define indicators and implement a monitoring system for the project. Coordination-unit staff should make regular field visits to assess progress so that deviations can be corrected in a timely way.

d. COSAF should pursue on-farm research on agroforestry and soil conservation through the ISAR. Research topics should focus on farmers' needs and preoccupations.

The ICRAF/AFRENA collaboration with COSAF has been satisfactory. Research themes were directly related to COSAF's needs. ICRAF/AFRENA will research problems identified by COSAF. In this regard, it has done its job. This finding was confirmed by the COSAF coordination unit, by MINAGRI and by the NRMP coordination unit.

More research is needed to determine the effect of tree species on soil erosion and soil fertility, as well as the impact of these factors on income and rates of acceptance. This information is necessary for useful economic analysis of project interventions. ISAR is well equipped to help in this endeavor.

Demonstration activities are effectively exploited at the farmer level. For new technology, other project activities can be used for this purpose. Moreover, the GOR does not see the benefits of establishing demonstration centers.

Even though the baseline survey contains useful information, key indicators are missing. Some critical indicators not available are these: yields for major crops in the communes; types of erosion problems faced by the farmer; and types of agroforestry and soil conservation-techniques in use. Nor was data available on the survival rate of trees planted. A percentage of farmers using fertilizers and pesticides was estimated, but no mention was made of their sources of supply, whether they were private, governmental or projects.

3.3.5. Training

To attain the prescribed training outputs, COSAF has developed a five-level training program aimed at everyone involved in the project. These participants include the following.

3.3.5.1. Farmers

In-country training will involve theoretical and practical training on themes of agroforestry and soil conservation. Field trips have been organized to research centers and other project areas.

3.3.5.2. Local authorities

Modalities, themes and training sites for local authorities have yet to be defined and identified.

3.3.5.3. *Monagris*

Five days of training each season will be given to *monagris*. Seasonal themes will depend on what is being marketed at the time.

3.3.5.4. Communal agronomists

Two to three days per season have been set aside for extension training, work organization and communication. Training on specific topics such as soil conservation, nursery management, and radical terraces will depend on seasonal themes.

3.3.5.5. Coordination team

Field trips in Rwanda and neighboring countries have been planned. Two MINAGRI agents will undergo long-term training overseas, resulting in two master's degrees in soil conservation and agroforestry.

COSAF is using experience from past projects as well as new project's (FSRP, PAP, CPA, CARE, ICRAF/AFRENA) and government organizations (ONAPA, INADES) to achieve this ambitious training program. Training activities involving these organizations have included site visits for demonstration purposes, meetings, and dissemination of information.

3.3.5.6. Findings and conclusions

Training thus far has had little or no effect on the project. Farmer and extension-agent training has been minimal. Communal-agronomists' training was adequate. Long-term training had not yet been undertaken.

3.3.5.7. Recommendations

a. Training efforts at the farmer level should be increased. Section chiefs and MONAGRIS agents should also be given more training. Training for local authorities and the coordination team should be reduced. A general meeting at the beginning of the season

should familiarize authorities with COSAF activities, direction, and season objectives. This meeting will also serve as a forum to exchange ideas and address potential problems.

b. Long-term training should start as soon as possible. Two master's programs in soil conservation and agricultural economics are most appropriate. Every effort should be made to have the trainees join the COSAF coordination team.

Training is a vital part of any extension program. COSAF's initiative to provide theoretical and practical training to farmers has been good, and more should be done in this direction. Since the success of the project depends on how farmers understand and adopt new concepts, emphasis should be placed on farmers' needs and preoccupations. Training of the communes' technical-service capability is essential for the continuation of project after COSAF.

The utility of training for local authorities is questionable. This training was added in the 1992 work plan. Procedures, themes and training sites have not been defined. According to the 1992 work plan, these parameters "will be defined in the near future." The contribution to the project of this training is not clear.

Training of communal agronomists and MONAGRIs should focus on project objectives. Long-term training in soil conservation and agricultural economics is badly needed. In the COSAF coordination unit, training should focus on the people most closely connected to farmers. The section chiefs are good candidates in this regard.

The Rwandan experience with agroforestry activities since the 1960s has put a great deal of agroforestry expertise in place. More qualified personnel are needed in soil conservation and agricultural economics. An agricultural economist is needed to evaluate all these activities, their relevance, their economic feasibility and impacts on beneficiaries. If the project is financing studies, returning trainees should understand that they must be willing to work in the project upon their return.

3.3.6. Institutional issues

COSAF has not been adequately integrated into the local system. Use and allocation of communal agronomists' time is planned at the operational-unit level in biweekly levels. Activities for the whole unit are planned with other agronomists in the region. All activities for the next two weeks are prioritized and assigned to each communal agronomist. This process often gives COSAF's activities a low priority. The biweekly meetings do not always take place, and when they do, all parties may not attend. COSAF does not have a direct voice in this planning. In fact, the commune agronomists are also advisors to the bourgemestes. Their duties include, among other things, enforcing government agricultural guidelines (fining farmers for

non-compliance) and tax collection. Essentially, MONAGRIS and commune agronomists have their own agendas and are more responsible to the commune than to COSAF or to the farmers.

MINAGRI has not acted in an enthusiastic way toward COSAF. MINAGRI has not appointed a monitoring and evaluation division chief to the project yet. The training division chief was only hired in July 1992. Thirty-four extension agents were assigned to the project. COSAF had to train an additional 21 extension agents to make up the 55 agents required. The GOR moves technical staff assigned to the project in and out without warning. These actions reflect or suggest MINAGRI's low esteem for the project and its lack of interest in the project's activities.

USAID focuses too much on details. USAID performance has been characterized by overmanagement. The coordination unit should take care of day-to-day activities. Changes in the cooperative agreement have, for example, been made unilaterally by the ADO. All parties, including the GOR, should be notified.

3.3.6.1. Recommendations

a. GOR should make every effort to integrate COSAF into its activities. COSAF should have a higher priority. Chiefs of section should be of a higher calibre.

b. Communal agronomists attached to the project should be asked to devote more than 50 percent of their time to the project.

c. The USAID ADO should refer all day-to-day matters to the NRMP coordination unit.

d. Changes in the cooperative agreement that affect communal research and demonstration centers, on-farm research in agroforestry and soil conservation, and fertilizer and lime use should be made at the highest level possible so that everyone concerned can be at the same level of understanding.

3.3.7. The role of women in COSAF

No special effort has been made to assess or address women's roles, interests or constraints in each of the project phases. Women, however, are major participants in and beneficiaries of the project.

3.3.7.1. Recommendations

a. A special effort should be made to include women in long-term and short-term training programs.

b. The extension-agent team should reflect the importance of women in agriculture and the number of female beneficiaries in the project area.

Women play an important role in Ruhengeri agriculture. However, women are at a disadvantage since the current land-tenure system does not allow women to own land. In the absence of data indicating the number of female participants in the project, it is difficult to address their interests and make recommendations. Surveys refer to farmers in general, without gender distinction.

Careful consideration and analysis of costs and benefits by gender will be very important in the management information system to be developed. The role of women in sustaining this component is related to their role in agriculture since component activities will be difficult to sustain financially under the realignment of Mission goals. A generalized improvement of the agricultural economy may produce incentives to reinvest in the land. Should this occur, women will plan a key role in accomplishing this reinvestment even without land ownership.

3.3.8. Gituza reforestation effort

The reforestation project at Gituza began in 1985 with reforestation, agroforestry and soil conservation. CARE International was awarded a grant of $66,000 last year for reforestation of an area that burned in 1990, and bought pine species from successfully privatized nurseries in the region.

In October 1991, tree planting began on steep slopes, in micro-catchments and throughout an area of 44.3 ha. Trees were planted at a rate of 833 trees per ha at a ratio of 3 m horizontally to 4m vertically. A target of 60 ha is set for this year. The trees looked good and had reached a height of 20 cm. The trees were doing well considering the slow growth rate of pine trees, the lack of moisture and the shallow soil depth on hillsides. CARE was contracted to plant 200 ha over four year. The project appeared to be making satisfactory progress.

The apparent agreement from USAID for CARE's use of fertilizer has been a controversial subject with COSAF. CARE sites are less populated, have less contamination of ground water by water infiltration because of the shallow-soil/dry-site combination and, more importantly, use fertilizer for reforestation. COSAF would not have objected to the use in AFRICARE projects of fertilizer by farmers who bought their plants from the nurseries.

3.3.9. CARE's method of nursery privatization

CARE has traditionally sold farmers' inputs, such as bags and seeds. Private nurseries grew the tres and sold them to individuals according to supply and demand. The species grown depended on the area. CARE planned to privatize the system by selling the bags and seeds to local store owners and providing for future supply. At that point, CARE would withdraw from the process.

3.3.9.1 Findings and conclusions

Reforestation activities have been satisfactory and have been funded appropriately.

3.3.9.2 Recommendations

a. CARE International should maintain its current course of activities until withdrawal is appropriate.

CARE's reforestation efforts are appropriate. Trees planted on steep slopes appear to be weeded and in good health. Low rainfall in the area has necessitated creation of microcatchments for planting. This technique accumulates rain runoff for plant growth.

3.3.10. Project sector development and project sustainability

In consideration of USAID's new country program strategy plan, COSAF should concentrate on the recommendations of this evaluation. Private nurseries should be established to provide seed trees and grass species needed for soil conservation. Farmers should be encouraged to form associations and cooperatives to establish nurseries that produce and market tree. Farmers should be encouraged to visit COSAF's offices and communicate concerns rather than waiting until COSAF's personnel reaches the field.

The long-term sustainability of the project depends on successful privatization of the project's input sources and the provision of qualified GOR training personnel. After the completion of AFRICARE, Rwandans will run the project. GOR should make every effort to keep long-term trainees in the project. GOR should provide incentives, such as tax reduction and access to credit, that encourage farmers to use promoted technologies. These techniques should be simple and economical.

3.4. Natural-forest management

The afro-montane forests of the Parc National des Volcans (PNV) and the Nyungwe Forest Reserve (NFR) represent the last vestiges of a once-greater Rwandan natural forest. The dramatic regression of this forest is primarily the result of an extension of traditional agricultural practices; and this extension was caused by Rwanda's rapidly expanding population.

The area of the Virunga Forest in the PNV decreased by nearly 50 percent between 1958 and 1973. This reduction was largely the result of an unsuccessful attempt at industrial cultivation and production of pyrethrum. Subsequent agricultural colonization of this failed project in northwestern Rwanda further reduced the forest's range. The Nyungwe Forest in southwestern Rwanda was reduced by 15 percent over a 21-year period beginning in 1958. Encroachment in Nyungwe resulted from expanding local populations applying pressure on forest fringe areas.

National park status for the Virunga Forest in the PNV ultimately provided minimal protection and slowed the encroachment process. Throughout the 1970s, Dr. Dian Fossey sensitized the world to the tolerant and gentle lifestyle of the Virunga Forest's severely endangered mountain gorillas. In 1979, development of a world-class ecotourism program, featuring the gorillas in the PNV, brought increased international attention and publicity to Rwanda's fragile afro-montane environments. The PNV has benefitted from increased international interest and scrutiny. Augmented revenue from park and gorilla-viewing receipts rose until political instability began in October 1990.

These earnings easily justify continued protection of the national park. Throughout PNV history, the Karisoke Research Center (KRC), founded by the late Dr. Fossey, played a crucial and expanding role in providing baseline and applied scientific information on mountain gorilla behavior and ecology. The KRC, in conjunction with the Dian Fossey Gorilla Fund (DFGF), has recently assumed a key position relative to increased gorilla and PNV natural-forest protection.

Until the end of the last decade, the Nyungwe Forest remained a mystery to not only much of the world, but to most of Rwanda. Research begun in 1985 with funding by Wildlife Conservation International (WCI), convinced GOR and other conservation organizations of Nyungwe's ecological diversity, its multiple uses, and ecotourism potential. The Nyungwe Forest Conservation Project (PCFN) was created in 1987 by WCI. Using the conservation model established in the PNV, PCFN has been successful at establishing ecotourism, research studies, and conservation-education programs throughout the Nyungwe Forest and neighboring communal areas. An affiliate program of PCFN, the Frugivore Project has evolved to study specific forest and faunal relationships and overall forest dynamics.

The following sections of this report evaluate the project management of Karisoke Research Center (KRC), the Nyungwe Forest Conservation Project (PCFN), and the Frugivore Project as it relates to their agreement with USAID Rwanda and the Rwanda Natural Resource Management Project (NRMP). In accomplishing this purpose, the evaluation team completed the following steps:

1. evaluated the effectiveness of on-going biological, physical, and socio-economic research relating to afro-montane forests and their applicability to agricultural production in the lowlands;

2. examined educational efforts undertaken to promote multiple-use management and conservation of natural forests;

3. toured construction sites of an interpretive center and other project-related facilities and evaluate their progress;

4. determined the progress made relating to involving Rwandan candidates in conservation and park management MSc programs; and

5. evaluated in-country training programs of Rwandan counterparts and park personnel.

The methodology used to accomplish the scope of work included the following:

- personal interviews with people associated with KRC, PCFN, the Fugivore Project, the Rwandan Office of National Parks and Tourism (ORTPN), the Ministry of Environment and Tourism (MINETO), and related conservation and management projects;

- site visits to Parc National des Volcans, the KRC,the Nyungwe Forest Reserve, PCFN, and the Frugivore Project; and

- a comprehensive literature review of associated project papers, project and government agreements, and related scientific manuscripts.

3.4.1. Findings

The content of the agreement between USAID and the Natural Forest sub-component organizations can succinctly be divided into three general categories: construction, research, and conservation education. The two sub-components, PCFN and KRC, are evaluated individually within the context of these three general categories. The Frugivore Project, an affiliate of PCFN, was evaluated within the context of the PCFN Research category.

A general finding is the need for careful consideration and analysis of costs and benefits by gender. This information forms an important element in the management information system to be developed. Although there are women professionals among expatriate community, local women currently have a peripheral role in the natural forest management component.

3.4.1.1. Nyungwe Forest Conservation Project

3.4.1.1.1. PCFN Construction

The construction element of PCFN is divided into two phases. One is nearing completion; the second scheduled to begin in 1993. The first phase is being completed at two separate sites and involves design and construction of a welcome-interpretive center within the forest reserve, and design and construction of a PCFN office building and housing duplex for PCFN staff members at a site immediately outside the forest.

While visiting Nyungwe, the team found the building shells of the welcome-interpretive center nearing completion. This facility consists of a reception and canteen building, the museum and interpretive center, and an office and laboratory building. The buildings are attractive and practical and offer a pleasant introduction to the PCFN ecotourism experience. The museum lacks a design plan and interpretive program for exhibits and displays. Representatives from WCS and the New York Zoological Society visited the center several months ago tp consult with the previous PCFN director. The intent of the visit was to assist with overall exhibit and program design. The project has not received a response from WCS. The new co-directors have not been involved in the design process. Additionally, money has not been budgeted to to complete proposed exhibitry and displays once decisions regarding design are made.

The aesthetics of the PCFN office building and housing duplex provided the team with an entirely different impression. Located outside the forest, the buildings are luxurious in style and funtionally questionable. For example, each housing unit contains two kitchens, one African and one European. Of equal concern to the co-directors is the lack of economically reasonable planning to electrify the houses and provide the office with a telephone system.

3.4.1.1.2. PCFN Research Program

The PCFN research program is directed by Dr. Samuel Kanyamibwa, a well-qualified Rwandan scientist. Until recently, Dr. Kanyamibwa worked full-time with PCFN, but he currently divides his time between a professorship at the University of Butare and PCFN. Close association with the university provided an opportunity to incorporate Rwandan students into the PCFN research program. University students, in turn, have trained local research assistants to carry out day to day sampling and data collection work in the field. One of the students recruited from the university has been selected to pursue a master of science degree sponsored by PCFN at a

university in the United States. The project has not selected a specific program or an appropriate university nor developed a time schedule for matriculation.

Researchers with PCFN are conducting a variety of research studies concentrating on developing baseline information on forest ecology and the impact of indigenous use of the forest. Specific biological studies include an on-going inventory of birds and mammals related directly to altitude and seasonal differences, primate and bird affiliatory relationships, and another involving identification of introduced plants to the forest. Human impact studies include the monitoring of human circulation in the forest as it relates to agricultural use, poaching, and the local gold-mining industry. Cattle circulation within the reserve is monitored by PCFN. Additionally, landslides within the forest are regularly examined. The team was impressed by the scope and depth of PCFN research and, in particular, by research applicability to future decisions in forest management and multiple-use areas.

The Frugivore Project, a distinct research entity within PCFN, concentrates its efforts on animal-plant-ecosystem interactions. Specifically, the project is examining select fruit eaters and seed dispersal. Information resulting from the study will be applied to resolving how the overall forest reserve might be exploited at sustainable levels. Again, the consultant was extremely impressed not only with the depth of research being done, but also with regards to the inclusion of Rwandan assistants at varying degrees of scientific levels within the program. Many of these assistants have developed skills that will translate into jobs within PCFN, and potentially with ORTPN.

3.4.1.1.3. PCFN Conservation Education

The conservation education program is presently coordinated by a second year Peace Corps Volunteer (PCV). The volunteer's Rwandan counterpart left PCFN unexpectedly several months ago and a replacement has not yet been hired. The overall program has tried several different approaches since its inception, and still appears to be seeking a purposeful direction.

Educational presentations have been done at primary and secondary schools. Teacher workshops and community rallies have been organized. The content of presentations to date has been largely biological and ecological in nature, and has not focused on people issues and multiple use possibilities. Nonetheless, community interest in the PCFN has grown around the forest and the potential for further community involvement and the establishment of functional cooperatives based on local artisanal work using forest products is high.

Another second year PCV has been training guides, trackers, and trail maintenance laborers to support the ecotourism element of the PCFN program. Impressive trail systems have been created from which habituated groups of black and white colobus, blue monkeys, and grey-cheeked mangabeys can easily be observed. Guides offer not only general and scientific

information on the monkeys, but are qualified to answer questions regarding forest ecology. As political stability returns to Rwanda, Nyungwe is well prepared to offer an additional exceptional ecotourism possibility to international travellers seeking to view the PNV's mountain gorillas.

3.4.1.2. Karisoke Research Center (KRC)

3.4.1.2.1. KRC Construction

The USAID agreement with KRC provides funding to rehabilitate and expand the 12-year-old research camp located at 10,000 feet in the PNV forests. The consultant's visit to KRC found construction nearly finished with minimal work left to complete. Researcher and camp personnel have been reconstructed, additional lodging built, and a much needed camp kitchen, dining, meeting, and work space area constructed. Progress on this element of the USAID/KRC agreement has created a more reasonable situation for KRC staff.

Gas or diesel generators power much of the facility. Plans within the agreement provide for additional use solar power. Arrangements have been made with an in-country consultant to assess KRC needs. Based on needs and a situation assessment, solar panels should be installed sometime in 1993. The last phase of KRC construction will equip the facility with a high-frequency radio system to provide better communication channels to and from this isolated site.

3.4.1.2.2. KRC Research

KRC has historically conducted behavioral and ecological research on the Virunga's mountain gorillas. Its international reputation has attracted primatologists from all over the world. Recently, however, KRC has adopted a much broader afro-montane ecological approach. The agreement with USAID focuses on application of this approach to a better understanding of forest ecology. The intent is that PNV and ORTPN administrators, working jointly with KRC, will use these studies to make sound park-management decisions. In additon, the study of human factors and needs immediately outside the park should be an important consideration within KRC's scope of research and should be incorporated into the overall interactive process.

In fairness to KRC, the research center has been located in a war zone for the past two years and has been evacuated several times. The fighting has led to problems maintaining consistency in certain aspects of programming. Even though it has advertised abroad, KRC has had difficulty attracting research students to work in the forest and center.

The bulk of research at KRC still predominantly concerns gorilla behavior and ecology. An important bamboo study began two years ago, but was interrupted because of the war and has not been reinitiated. A Rwandan university student has been working part-time doing small-mammal surveys within the park, but resides and works only on an irregular basis at KRC. This part-time residency appears to be the case for other Rwandan students who have worked and are

working at KRC. Malachite sunbird and tree hyrax studies are proposed and are scheduled to begin sometime in 1993. It is difficult to state, at this point, whether these proposed research studies are to be conducted in an applied or a purely academic manner.

The agreement between USAID and KRC does not require KRC to submit an annual work plan. Therefore, USAID and the coordination committee have not been able to determine in advance the kind of research proposals that KRC is considering nor have they monitored the orientation of work being done. The establishment of a research program acceptable to KRC, USAID, and the coordination committee, under the terms of the agreement, has been extremely difficult to attain.

3.4.1.2.3 KRC Conservation Education

Dr. Louis Nzeyimana was hired by KRC in October 1992 to initiate the conservation education program. The program has already achieved moderate success and has developed important contacts for the education program as well as for the research program. Thus far, the program's direction has focused on secondary and university students and has involved individuals in PNV and KRC field trips. The program has allowed students to visit previously impossible destinations and has provided not only expatriate, but also Rwandan role models with whom they could interact.

These accomplishments are commendable. Attracting Rwandans to conservation and field research activities has traditionally been difficult; keeping them involved professionally has created further problems. The program may provide a basis for resolving this dilemma in the future. Further efforts should be made in this direction and will ultimately benefit KRC by providing the institution with a pool of Rwandans for researchers and research assistants.

University seminars are being scheduled to disseminate information on KRC research projects. Additionally, teacher seminars are being organized to promote a better understanding of not only gorillas, but also forest ecology and the value of the park and its internal resources.

Another aspect of KRC education and training involves selection of an M.Sc. candidate to be trained in the USA. Jean Boscoe Nizeye, former assistant conservator of the PNV, was nominated by KRC and is presently completing his second year at Colorado State University. He is enrolled in a master's program in parks management. His second year of study is being funded by the NRMP, and he is expected to complete his thesis on "Visitor Management in Protected Areas" in 1993.

One final observation concerns Dr. Louis Nzeyimana, as conservation education officer in the KRC administrative and professional scheme. Dr. Nzeyimana represents the first Rwandan to be selected for such a position in KRC's 20-year history. His is the only expatriate-Rwandan

counterpart relationship at the center. Dr. Nzeyimana's appointment is an extremely important first step and should establish a trend to be followed.

3.4.2. Recommendations

3.4.2.1. Nyungwe Forest Conservation Project

3.4.2.1.1. PCFN Construction

The building shells of the PCFN welcome and interpretive center are nearing completion without a design plan to appropriately equip them. Additionally, financing does not exist within the budget to complete a proposed plan. USAID, in conjunction with PCFN and the NRMP coordination unit, should discuss the level of funding needed to complete this phase of the project and if available, additional monies should be committed. The PCFN should be required to submit a precise exhibit plan and interpretive program to USAID and the coordination committee.

The coordination committee, the USAID architect, and PCFN co-directors should carefully examine the proposed plans of phase two of the staff housing section of the construction element. A redesign should be considered to not only reduce costs, but also bring the buildings on line with other housing structures in the region. The use of other building materials and a design based on explicit need should, indeed, be considered.

Given the government time schedule for bringing electricity to the housing/office building site and the unreasonable costs associated with doing so now, purchase of a 3.5 to 5.0 KVa diesel generator should be considered. This is economically feasible within the budget and can be expeditiously accomplished. Additionally, it is imperative that the PCFN office have telephone capability at reasonable cost. A practical solution should be sought.

3.4.2.1.2. PCFN Research

The new project codirectors should work closely with Samuel Kanyamibwa, research advisor, to broaden the existing program and stimulate additional applied research possibilities. PCFN, in collaboration with the NRMP coordination unit and the Coordination Committee, should discuss and agree upon potential areas of research. Close contact with other NGOs and PVOs working within the Nyungwe Forest should be maintained to avoid research duplication and allow for prudent expenditure of limited funds. Furthermore, collaboration between organizations will promote a truly concerted conservation effort throughout the Nyungwe region.

3.4.2.1.3. PCFN Conservation Education

PCFN should quickly advertise and seek to hire a qualified Rwandan to fill the vacant education officer position. This person should not only be familiar with education methodology, but should also possess expert human relations skills and an interest in promoting regional cooperatives. Extension work relating to multiple-use of forest materials like bamboo for baskets, olive wood for jewelry, and forest honey should be examined. The PCFN tourism program presently relies heavily on a resident visitor audience, but this could change quickly when reasonable political stability returns to the country. PCFN, through its education component, should be prepared to assist in marketing local products when the international market returns.

If PCFN determines a need for additional PCV support for this program, the project should consider requesting a third year volunteer. Reasonable language abilities are an absolute must in this program and will assist in establishing a distinct direction for the overall program.

3.4.2.2. Karisoke Research Center

3.4.2.2.1. KRC Construction

The NRMP coordination unit should offer the necessary assistance to KRC to complete the construction element of their program. This includes equipping the camp facility with solar panel units and installing high-frequency radio equipment.

3.6.2.2.2. KRC Research

KRC should be required to submit annual work plans and annual reports as do other NRMP component organizations. The NRMP coordination unit and the Coordination Committee should use these reports to determine the importance and the applicability of proposed research that is to be funded by NRMP. Those research programs funded by NRMP should be designed to not only promote a further understanding of the PNV afromontane forest, but should also apply directly to better management of this fragile ecosystem. KRC should work more closely with PNV headquarters and ORTPN to determine priority topics.

KRC should move quickly to incorporate full-time Rwandan researchers into the system, assist with field training, and monitoring their progress. KRC might wish to seek advice from PCFN to determine why and how they have been successful at recruiting Rwandans into both research and administrative systems.

3.4.2.2.3. KRC conservation education

The new conservation officer should develop close alliances with the University of Butare and the University at Ruhengeri to assist in recruiting Rwandan students for research grants and

programs. Using seminars and workshops, he should strive towards further dissemination of information from KRC research to the Rwandan citizenry.

New conservation education should rely heavily on teacher training and development of strong teacher support systems; i.e. teacher guides, textbooks, teacher workshops, and subsequent teacher monitoring.

Generally, the NRMP coordination unit and the CC should consult with KRC regarding the potential for creating Rwandan counter-part posts for appropriate camp administrative and research oriented positions. In the interim, the conservation officer should be involved not only in outreach programming from the base office in Ruhengeri, but also in the KRC camp administrative and research decision-making process.

3.4.3. Recommentations

Rwanda's natural forests and national parks have played an increasingly important role in its economy over the past decade. Rwanda's internationally recognized gorilla ecotourism program has attracted visitors from all over the world. Tourism, a non-entity in 1979, became the second most important foreign-currency earner in 1989. Political instability since 1990 has dampened the upward trend. When stability returns to Rwanda, the country must once again accommodate an interested international market. A sound ecotourism program will contribute significantly to economic recovery.

3.4.3.1. Parc National des Volcans

During a visit to the Parc National des Volcans, the team found it deeply disturbing that specific management decisions regarding the PNV are being undertaken with apparent disregard for both forest ecology and the mountain gorilla population. The following examples can be cited:

The eastern portion of the PNV has been severely dissected by long-term military activity between Mt. Sabinyo and Mt. Muhavura. Gorilla groups ranging in this area have been cut off from the rest of the Virunga mountain-gorilla population. Additionally, a 100 m-wide swathe has been cut on the western slopes of Sabinyo through the population's highest density. The war has determined many of these activities and decisions regarding this could not simply be made on the basis of park management.

However, the construction of a road on Mt. Karasimbi from the PNV park boundary through potentially prime gorilla habitat to the mountain's summit for equipment and service of a radio and television tower cannot be rationalized by war. Visiting the site, the team discovered a road being constructed with no detectable engineering plan. A bulldozer had cut indiscriminate swathes through the bamboo and hagenia/hypericum zones attempting to make its way to the top

by whatever means possible. En route, 20 to 30 m cuts had been made, in some cases over 3 m deep, that removed all topsoil. A vehicle cannot maneuver on this road or carry tons of equipment to the 14,000 foot summit. Severe erosion is already in evidence. Even more disheartening, the road has created direct public access to the forest, and consequently, not only bamboo, but also large tree cutting and lumbering in the hagenia and hypericum zones has begun.

These observations were made within two days of receiving word that evidence of gorilla trail on the northeastern slopes of Karisimbi, the first in over 25 years, had been found. The trail was only 1,500 meters away from, but well above, the construction site. Given the present degree of disturbance elsewhere in the PNV, these slopes are extremely important to present and future mountain gorilla populations and may determine the species survival. Rwanda's ecotourism program, in turn, depends on this survival. The NRMP and GOR must ensure the complete and continued protection of the PNV and its endangered inhabitants.

3.4.3.2. Recommendations

USAID, the Coordination Committee, KRC, the International Gorilla Conservation Program (IGCP),and the Volcano Veterinary Center (VVC) should apply all possible pressure to ORTPN, MINETO, and GOR to halt all road construction before further irreparable damage to the forest and gorilla habitat is done. If the process is not immediately halted, action on an international scale should be taken. The PNV, via mutual accord between the GOR and the International Union For the Conservation of Nature, was declared a World Biosphere Reserve in the mid-1970s. The PNV is subject to international legal protection and preservation.

3.4.3.2. PCFN and KRC: Project extension and additional funding

The importance of a viable ecotourism program to Rwanda's future is clear. Future success will be articulated in terms of management decisions based on current research and education programs. Present PCFN and KRC budgets are modest within the overall scope of the NRMP. These budgets limit the breadth of present and future research and education work. Additionally, long-term technical assistance and overall project planning beyond the NRMP are essential, but severely limited because of untcertain funding.

3.4.3.3.1. Recommendations

USAID and the coordination unit should carefully consider the possibility of increased funding for PCFN and KRC based on the organizations' research, staffing, and program operational needs. Additional funding may be available within the present NRMP package as a result of changes made in other NRMP components based on other recommendations. The feasibility of USAID involvement, after the life of the NRMP, should also be considered.

3.4.3.4. Akagera National Park

In addition to trips to the PNV and the Nyungwe Forest, three team members made visit to the Akagera National Park. The results of their visit follow.

Compared to other East African and Central African protected areas, Akagera is one of the region's premiere savannah parks. Previous to 1990, Akagera offered not only phenomenal wildlife diversity, but also a striking array of habitat areas within one region. Wildlife was abundant and easy to observe. Team members observed with dismay, that on this visit the same natural area had very little remaining wildlife. Species diversity had severely dwindled and herd sizes were greatly diminished. Wildlife was conspicuously vehicle- and people-shy and impossible to approach. While there, the team members encountered fish and crocodile poachers blatantly at large displaying their catches and attempting to sell crocodile hides.

Follow-up with park rangers and former park authorities indicated that poaching was rampant throughout the park. Some estimates indicated that 75 to 80 percent of wildlife had already been destroyed. No authority or control exists in the park at present, and if the trend continues, another of Rwanda's excellent ecotourism possibilities will quickly disappear.

3.4.3.4.1. Recommendations

USAID, within the scope of the NRMP, should closely scrutinize the Akagera situation and consider offering immediate assistance. This could initially take the form of guard salary support and ultimately develop into wildlife surveys and park infrastructure assessments to determine what is necessary for its re-establishment. Salvaging the park will secure not only one of the world's most beautiful savannah zones, but will strengthen Rwanda's ecotourism.

In conclusion, Rwanda has formidable potential for ecotourism development. The mountain gorillas of the PNV, easily accessible lower altitude afro-montane forests of Nyungwe, and the rolling savannahs of Akagera offer a wildlife package found nowhere else in Africa. Rwanda's natural forests and parks are an important national resource which contribute significantly to the nation. Protected and preserved, these wild ecosystems will continue to be used to benefit the country and its economy. USAID can play a major part in this strategy that follows the agency's shift toward privatization. By broadening the scope of the NRMP, USAID can play an important role in revitalizing Rwanda's economic future.

3.5. Assistance in environmental planning and formulation of environmental policy

A document review, field visits, and interviews were used to evaluate this component. Seventeen people were interviewed, three of whom were executive officers in the environmental NGO community. A review of relevant planning and organizational documents and inter-office correspondence was undertaken. Field visits were made to the south east, the region around Butare, and to the north east, the Ruhengeri and Lake Ruhondo region. Another circuit was made through the potato farms and pyrethrum plantations around the base of Volcano National Park. A new road under construction on the slopes of Mount Karisimbi was followed to its end point and a survey was made noting environmental impacts. Bob Winterbottom, provided significant insight and thought relevant to this evaluation.

Evaluation of this component focused principally on the assistance provided by the Technical Advisor to MINETO in environmental planning and the formulation of environmental policy.

Environmental policy and planning are new areas of governance in Rwanda and trained personnel are few. The organizational structure and setting of the Ministry of Environment and Tourism (MINETO) has evolved quickly. The organization that is now MINETO has moved through three organizational settings in a period of a little more than two years. Planning for a Rwandan organization for environmental affairs began in the Ministry of Health and Social affairs in 1985. In 1989, it was moved to the Ministry of Planning (MINIPLAN). As planning and programs developed, the National Environment Service (SNE) was created. In 1991, SNE was moved to the Ministry of Agriculture, Ministry of Agriculture, Livestock and Environment (MINAGRI) as one of five ministerial branches. In a few months, another organizational change was announced. In April 1992, SNE was transformed into the Ministry of Environment and Tourism, (MINETO). The last two moves took place in a period of months; three draft organizational forms were developed. (The latest official organigram is given in Appendix 4).

MINETO is a small organization which faces a plethora of potential responsibilities. Currently responsibilities for the environment are spread across many ministries: MINIPLAN, MINAGRI, MINISANTE, MINITRAPE, MINTRANSCO, MINAFFET, MINSUPRES, MININTER and MINIPRISEC. Theoretically, MINETO is charged with providing leadership and direction to other ministries that have environmental responsibilities. However, the ministry has yet to establish a plan for coordination of environmental aspects among the them and define those areas for which it will assume primary responsibility. On the operational level, the minister and senior management expressed a strong interest in the developing capacity for impact assessment and environmental protection. MINETO is working on policy development, and has taken preliminary steps to initiate inter-ministerial cooperation for the establishment of shared processes and procedures.

MINETO is also involved with the private sector through the Environment Department and Division of Heritage and Tourism. When draft legislation is passed, the ministry will be involved with EIA reviews, monitoring, and permitting regulations in the private sector.

Concern for the environment is growing. The World Bank, other international financial institutions, bilateral donor agencies, and NGOs intend to undertake environmental programs in Rwanda. There have been a significant number of missions and the creation of new donor forums, such as the Club of Dublin. While these activities have distracted MINETO while it is struggling with the pressures of institution building, they also represent an underutilized source of ideas and stimulation for national initiatives.

The creation of a National Council for the Environment (CNE) has been under discussion for some time. The Minister has been actively engaged in these discussions. The role envisaged is to establish national policies for the environment and natural resource management by coordinating and consolidating policy in all ministries having an environmental function. This will ensure concerted action at all levels.

3.5.1. Findings

A Senior Advisor was supplied to the GOR through the Natural Resources Management Project (NRMP) to aid in the development of an Environmental Policy and Action Plan. He began working with MINIPLAN in February, 1991. His tasks were:

- To provide technical assistance to MINIPLAN for the follow-up and implementation of the Environmental Strategy and Environmental Action Plan.

- To assist in the organization of an administration unit in MINIPLAN and the identification of institutional mechanisms that need to be put in place in order for MINIPLAN to carry out the environmental mandate.

- To supply technical and scientific support to MINIPLAN for review of ongoing and proposed development activities with respect to their possible environmental impacts on environmental problems in Rwanda.

- To support technical departments in developing the capabilities to assess the environmental implications of in-house programs. He also supports coordination of programs and activities of the various government agencies involved in land use planning, natural resource management, and environmental conservation and protection.

Though it is difficult to assert that these tasks will be complete by the termination of his current contract in February 1993, much has been accomplished in each area of responsibility.

The Government of Rwanda's environmental policy has been developed, promulgated and institutionalized. The GOR has established and staffed the Ministry of Environment and Tourism. It has also approved, published, and distributed the National Strategy for Environment and the Environmental Action Plan (SNER/PAE). A number of local bilateral donors guided the plans preparation, after which it was presented in June 1991 at the Donors' Round Table in Kigali.

Five public information meetings were held over the past year. These traced the importance of environmental management and sustainable development to Rwanda's economic and social well-being. Two events focused on women and the environment.

MINETO is headed by a minister with a small office. Operational direction is provided by a director general supported by small divisions of finance, research, and inspection. MINETO is divided into two directorates: environment and tourism/heritage.

The Environment Directorate has three divisions: (1) Education and Information, (2) Studies and Planning, including environmental impact assessment, and (3) Environmental Protection and Conservation of Natural Resources. The total staff numbers twenty-seven; only nine are full-time GOR employees.

The Tourism Directorate has two divisions: (1) Tourism/Heritage and, (2) Tourism Promotion. Tourism and natural heritage are economically important to Rwanda. The promotion of ecotourism interests in the parks and reserves of Rwanda is a well proven source of foreign currency.

The GOR established the Ministry of Environment and Tourism in late April, though staffing was not completed for another three months. Parliamentary approval of the formal description of the organizational components and organigram were given in August 1992. Eighteen of the 27 staff members of the Environment Division are contract personnel. The staff in the rest of the organization is largely permanent civil servants. New staff, recruited through the Minister's office, are also civil servants. This situation evolved because Environment Division staff was originally recruited on contract by MINIPLAN to prepare the SNER/PAE. They were transferred to MINAGRI on the same contractual basis and moved again when MINETO was organized. This has resulted in job insecurity.

MINETO does not yet possess the legal authority to execute its mandate. The ministry still lacks clear distinctions between key staff and administrative divisions and confronts responsibilities that it cannot hope to fulfill with the current staff and budget. A draft law being

prepared will provide direct control over many areas of development and construction through the EIA process. This law, when promulgated, will strengthen the authority to some degree. However, MINETO is still far from establishing credibility or recognition among other ministries that currently involve in environmental issues.

This situation hinders the contractor's advisor for environmental affairs. Within MINETO, the advisor reports to the Director of the Environment Directorate rather than to a governmental policy board. The advisor does not have a Rwandan counterpart and is largely occupied with day to day operations. His contract clearly specifies that his role is to provide technical advice and guidance on environmental matters at an executive policy level.

Discussions with staff and observations indicate that the level of environmental knowledge and related technical expertise in the ministry is generally low. The level of knowledge of general management procedures such as planning, goal setting and evaluation is also low. In both cases a major contributing factor has been the tendency to make staff assigments with little prior technical training or experience.

There is, for example, little institutional knowledge of the procedures, practices, and processes of environmental impact assessment within the Environment Directorate's Division of Environmental Studies and Planning. Additionally, there is little institutional knowledge of environmental protection within the Division of Environmental Protection and Conservation of Natural Resources.

The Division of Education and Environmental Information appears to have sufficient capacity to get general programs launched. Programs of curriculum development for primary and secondary schools are under way as are programs designed to increase public awareness.

3.5.2. Conclusions

The Ministry of Environment and Tourism has been established. It is a fledging institution, short on expertise and other resources. As it stands now, it is far from being able to execute a mandate for environmental oversight. The ministry does not have adequate staff to coordinate environmental and natural resource policies between governmental agencies. There are less than 10 senior-level staff, including the Minister's office. MINETO must devote a great deal of time and energy to institutional development.

The National Environmental Strategy and the Environmental Action Plan have been adopted as GOR policy.

Ministry staff require additional training in environmental and organizational management.

The advisor for environmental affairs has not been placed in an appropriate position and does not report at a policy formulation level. The advisor has no Rwandan counterpart.

Activities planned for upcoming years are not clearly prioritized in the 1993 work plan. Though considerable effort has apparently gone into focussing the workplan, several actions are as yet clearly more important and deserve greater emphasis.

A wide number of ministries and agencies play a role in managing Rwanda's environmental affairs. These include nine ministries, six agencies including the National University of Rwanda, and the Rwandan Institute for Science and Technology.

Trained personnel are in short supply; less than one-tenth of one percent of the student population enter university-level training programs.

A National Council for the Environment (CNE) can support MINETO by providing a means to set national priorities and policies for environment and natural resources. The Council can additionally coordinate and consolidate policy through all ministries and sectors. It can serve as a bridging device while MINETO develops its institutional foundation.

3.5.3. Recommendations

Progress in consolidating environmental policy and planning in Rwanda may be attained by establishing a National Environmental Council (CNE). The council would be composed of senior personnel from MINETO, MINIPLAN, MINAGRI, MINISANTE, MINITRAPE, MINTRANSCO, MINAFFET MINSUPRES,MININTER and MINIPRISEC. The council would report directly to the prime minister and would be chaired by the Minister of Environment supported by his director general. A secretariat would reinforce the Council. The role of the CNE would be to assure agreement and focused effort on environmental priorities through all environmental sectors of Ministries, the National University, the private sector, and NGOs.

Ideally, the council would:

- coordinate national level environmental policy through MINETO;
- finalize plans for the Donor Round table;
- set national environmental program priorities:
- monitor the achievement of programs such as the Natural Resources Management Plan, and the SNER/PAE;

- plan human resources development to serve the Environment sector.

The council could also initiate the development of special programs for MINETO such as the consolidation of bio-inventories into one information system.

Initially, the council would act to reduce pressure on MINETO, allowing it to concentrate on priority tasks for institution building. As MINETO develops, the work of the Council can gradually be shifted to the ministry. It is expected that the role envisaged for the Council could be shifted progressively to MINETO over five years and the council's secretariat reduced accordingly.

The most viable link between MINETO and the council would be through the Office of the Director General. This office would work with the minister and staff to prepare MINETO's agenda and supply the technical advice and analyses required. The office would be expanded to accommodate a technical services element.

A highly qualified environmental advisor would be required for the new technical services unit. The advisor would work directly with the director general and with Rwandan counterparts. This group would operate in small problem-solving teams to address specific problems and CNE agenda items. This would assure transfer of valuable technical skills.

The mandate of the Advisor for Environmental Affairs should be renewed and revised to support the technical services unit.

Addition of the technical services unit to the Director General's office should be made even if development of the National Environmental Council is delayed.

The advisor's new assignment to the Director General would include:

- provision of technical assistance required to establish the functions of the technical unit;

- furnish planning assistance required to enable the minister of MINETO and the GOR to establish the National Environmental Council;

- provide support to MINETO to arrange in-house training in EIA, environmental protection, management methods, and procedures;

- give technical, scientific, and management support to MINETO and the GOR in establishing a biodiversity program building on existing bio-inventories;

- provide input for drafting appropriate legislation for EIA processes and procedures; and

- coordinate activities concerning environmental aspects of NRMP component activities with the office of the Director General;

3.5.4. Training needs

Training support is critical to this comonent. Recruitment of two short-term technical assistants is recommended. These technical assistants will provide counterpart training at a professional working level within MINETO. They will also provide in-country training to a larger audience of professionals from other ministries with an environmental role. It is recommended that in-country training be used. This will insure that larger numbers of professionals are trained faster assuring a better technical transfer. This is also more cost-effective.

An expert in environmental impact assessment will work with a small team of three or four Rwandan counterparts from the Environmental Planning and Studies Division. The TA will have two tasks: First, establish a procedure and process for EIA in Rwanda. This will be guided by the draft law; ammendments can be made where appropriate. Second, the TA will train GOR staff in the skills required to properly execute the EIA process in the field.

This activity can be organized in two stages:

1. The technical advisor will organize the counterpart team and lead in the design of an EIA procedure and process. The process would conform with and ameliorate the draft environmental law. After completion of this four- to six-week process, the TA will introduce the concept of draft generic EIA guidelines. These would include instructions for the research element of the EIA process by project type. Road construction, hydrologic projects, and multiple-use proposals for National Parks are obvious priorities.

At the end of 4 months, a EIA procedures will have been produced. Guidelines will also have been developed for two or three of the project types listed above. At this point, the TA could leave for a period allowing the Rwandan team to continue to work on guidelines.

2. The technical advisor would return three months later to work with the team on a short term basis solving problems and reviewing work completed. The outputs from this exercise, EIA procedures and guidelines and the lessons learned, would then be used to prepare a one-week training course. The course will present on-site training in EIA practices and procedures for additional MINETO staff and personnel from other Ministries.

The principal product are EIA procedures for Rwanda, guidelines for carrying out EIA studies in the field for all major project types, five technicians trained in EIA, and up to sixty people introduced to EIA.

The use of a second short term advisor, skilled in environmental protection procedures, is recommended. This technical advisor will be recruited to provide training in the development of environmental protection norms. The technical advisor would work under the supervision of the director of environment with four to six Rwandan counterparts. Three will be recruited from the Environmental Protection and Resource Conservation Division. Other team members will be recruited from other ministries.

This training will also be organized in two stages:

1. The tecnical advisor will work with the team to establish a process for collating, reviewing, and amending environmental quality regulations administered by the ministries represented on the team. The technical advisor will set up a system to access expert advice and comments by the ministries involved. Results will be forwarded to ministries legal divisions for action.

After four months, a procedure for collating, reviewing, and amending environmental protection norms will have been established. Four to six technicians will have been introduced to the process. A body of revised norms will also have been produced.

2. The technical advisor will ultimately return to work with the team for up to four weeks to review work completed by the team. The products of this exercise, revised environmental protection norms and lessons learned, can then be used to prepare a training course which will cover environmental protection and the skills required to plan and carry out enforcement activities and inspections. The course would be presented to MINETO staff as well as to personnel from other ministries.

The products of this technical assistance will be revised environmental protection norms; institutionalized knowledge for writing and revising environmental assessment norms, and five trained specialists. Up to 60 people can be trained in a one-week course which explains how to plan and carry out environmental protection inspections and related activities.

Costs for the two training programs for this component are estimated as follows:

Two technical advisors for 150 working days each. Cost per day, including expenses is $600.

Salaries and expenses $600 X 300 days	$ 180,000

Air fare 4 round trips 4 X $ 5,000	20,000
Total estimated cost	$ 200,000

3.5.5. Biodiversity: consolidation of existing biological inventories into one national information system.

Biological inventories have economic potential. A single, successful product may have important returns in foreign currency. Apart from faunal populations which are central to parks and tourism, Rwanda's flora may contain plant materials for pharmaceuticals, health products, cosmetics, and biological insect control.

It is recommended that MIETO coordinate with research projects, such as those at the Karisoke Research Center and the Nyungwe Forest Conservation Project, in order to commence building a national inventory of biodiversity.

3.5.6. Recommendations

The project should encourage the development of a national environmental council which can identify and consolidate intra-ministerial and a wide range of sectoral responsibilities at the appropriate administrative level. Once a national system has been defined and consolidated, functions may be transferred to MINETO.

The long-term advisor should be retained and his terms of reference revised. He should be situated in an appropriate structural position in the Director General's office at MINETO.

Training is the first priority for MINETO. Training in environmental impact assessment, environmental protection, and management is recommended.

4. Mid term evaluation recommendations

4.1. The coordinating unit

a. The lead minister should ensure the immediate appointment of a permanent national coordinator.

b. The lead minister should instruct the coordination committee to exercise its mandate for coordination and management of the project.

c. The coordination committee should insist that the coordination unit conduct its day-to-day responsibilities for coordinating and monitoring.

d. The coordination committee must meet at least quarterly to fulfill its responsibilities. Accordingly, the lead minister should ensure that the committee president has adequate time to conduct his duties with the coordination committee.

e. The coordination committee should visit at least one work site for each component to gain first-hand knowledge of each component's work and must allot adequate time to review the annual work plans for the five components.

4.1.1. Establishment of a management information system (MIS)

a. USAID should request the contractor to give priority attention to implementation of a project-wide management information system (MIS). This system should include the following tasks outlined in the project grant agreement:

- "monitoring the progress of the project towards the achievement of its goals;"
- "ensuring that the activities of the various implementing agencies (e.g., PVOs, communes, MINAGRI, centrally-funded TA,) under the separate components of the project are coordinated;" and
- "setting objectives and coordinating data collection for measurement of project impact."

b. At a minimum, the national coordinator or the expatriate advisor should visit each component every quarter to compare actual accomplishments with the annual work plan.

c. Establishment of an MIS will require

- consultations with component managers to assure cooperation in the MIS;
- short-term expertise in system design to assist the coordination unit;
- short-term field or component-level technical assistance to establish a commonly understood set of indicators for each project's integration into the MIS;
- an assessment of the coordination unit's and the components' requirements for technical assistance and commodities related to the MIS.

d. USAID should request the contractor to dispatch a two-member technical-assistance team. The team should include a specialist in management-information systems to assist the coordination unit with computer programs and an evaluation specialist to establish objective, verifiable indicators of progress and impacts.

e. Within three months, GOR and the Mission should expect the MIS be designed and substantially implemented within three months. The GOR and USAID should expect that the MIS will be operational and used for project monitoring and impact evaluation within six months.

f. If the three- and six-month MIS goals are not met, the team recommends that the lead ministry and USAID amend the project-grant agreement to contract with a private firm to maintain financial records, prepare financial reports, and monitor the project and its implementation.

g. The MIS should include impact monitoring and implementation tracking and should be operative before any project funds are disbursed.

h. The coordinating unit should receive copies of all correspondence and memoranda between the project components and USAID.

i. The USAID project officer must make sure that the coordination unit is completely informed and encourage the components to take routine questions to the coordination unit rather than to the project officer.

j. The coordination unit must play a central role in coordinating and ensuring that components are on schedule.

k. The national coordinator and the expatriate advisor should consult with all components and the USAID project officer to determine whether the schedule and conditions pertaining to disbursement outlined in PILs 27, 28, 29 and 30 were followed.

l. The coordination unit should send out a realistic disbursment calendar to all components, to the lead ministry and to the USAID project officer. The CU staff should remind components of deadline dates and ensure that the dates are respected.

m. USAID/Rwanda should expeditiously process work plans, requests for advance and final reports.

n. The coordination unit should inform the components that requests for advances can be prepared before the PIL for the year's budget is approved. Advance requests should be ready as soon as the PIL is approved.

n. The coordination unit staff should review the annual work plans of each component before submission to the coordination committee to use best the coordination committee's meeting time.

o. The Dian Fossey Gorilla Fund's work plan is not currently being submitted to the coordination committee for review. The DFGF plan for 1993 should be immediately submitted for review by the coordination unit and then forwarded to the committee.

p. The CPSP should be widely circulated in French in the near future. Mission leadership should discuss it with appropriate GOR officials.

q. The coordination unit should continue to train effective component-level accounting staff. The unit's accounting staff should organize additional training sessions and a program of follow up guidance.

r. All component requests for advances and monthly financial reports should be reviewed by the coordination unit before being forwarded to the USAID project officer.

s. The work plan of the coordination unit should be monitored quarterly by the chairman of the coordination committee.

t. The coordination unit should be actively involved with monitoring other components. If the coordination unit needs more personnel, the national coordinator and his expatriate advisor should make a detailed presentation to the project officer.

u. The technical committee should meet quarterly.

v. The USAID project officer should not be a member of the coordination committee since USAID has a separate role to play in approving annual work plans.

w. The national coordinator, his expatriate advisor and the president of the coordination committee should meet annually with the leadership of USAID and the ministers involved with project implementation.

4.2. The *marais* component

a. The coordination unit and the coordination committee must fulfill their mandate so that key technical personnel can spend more time on implementation. The project needs immediate corrective measures, if the *marais* component is to meet its objectives.

b. The development plan for the pilot *marais* should include the following:

- design of the drainage network and hydraulic structures;
- field layout and planning;
- parcels' distribution; and
- a cropping plan.

c. The plan should quantify the following:

- unpaid work to be done by farmers;
- earthworks by local farmers with pay; and
- works to be done by a contractor, including concrete, masonry, and materials transport.

d. USAID should request the contractor to execute responsibilities for coordinating, monitoring and providing support for the implementation of all *marais* component activities.

e. Direction du Génie-rural et de la Conservation des Sols should nominate a national engineer and two newly trained technicians to assist the director with implementation.

f. The project should amend the 1993 work plan to incorporate the findings and recommendations of this evaluation report.

4.2.1. Training in the *marais* component

a. As soon as possible, the coordination unit, MINAGRI, MINEPRISEC and USAID should train a second class of thirty technicians (*techniciens du Génie-rural, niveau A2.*)

b. The coordination unit should monitor the final phase of training of the current twenty-one technicians, the delivery of diplomas in March 1993, their placement in jobs and evaluate the effectiveness of the training program through a memorandum to MINAGRI, MINEPRISEC and USAID.

c. The training curriculum should remain the same.

d. The project should advertise for students in May, 1993, with qualifying exams in July, 1993. Training of the second group should start on September 1, 1993.

e. The component should train the students within an existing public secondary school in Kigali managed by MINEPRISEC. The responsibility for training should remain with MINAGRI-Génie Rural.

f. Before the courses start, all trainers should attend a special seminar: "formation pédagogique des chargés de cours de techniciens GR.A2".

g. After the training quality evaluation in March 1993, USAID and MINAGRI/MINEPRISEC should consider support from short-term highly qualified consultants to deliver special courses that lack a local trainer.

4.2.2. Development of the Nyamigogo *marais*

a. The Nyamigogo *marais* development should be a priority, even if USAID intends to phase out support for *marais* development at the end of the NRM project in order to focus support on other priorities or sectors.

b. The target should be raised over two years from 50 ha to at least 150 ha.

4.2.3. Technical assistance

a. The contractor or USAID PSC should recruit a new technical advisor with a background in rural development. This individual should be a water resources engineer with experience in wetlands development and prepared to work in the field.

4.2.4. Génie Rural support for the *marais* component

a. The MINAGRI/Direction du Génie Rural et de la Conservation des Sols should appoint:

- a rural engineer trained in *marais* development to be based at Ruhango.
- two technicians (*Génie-rural, niveau A2*), who will complete training in March, 1993 and work under the engineer above;

4.2.5. C.S.C. contract and mandate

a. MINAGRI should establish a third contract with the CSC to assure the services of at least the sociologist who has worked for the project since September, 1990.

b. The CSC should maintain a close and permanent relationship with farmers' Comité de Sensibilisation that represents eleven sectors of *marais*. This committee should be progressively transformed into a management committee for *marais*.

c. The CSC should ensure farmer participation in the design of the *marais* development plan.

d. Emphasis must be placed on the development of farmers' organizations and on private initiatives, especially in the areas of marketing and input delivery.

4.2.6. The approach to *marais* development

a. The project team should prepare various development scenarios at the pre-feasibility level.

b. A scenario for a progressive, phased development should be established and should allow farmers groups to improve their hydro-agricultural resources in response to marketing conditions, production realities, and land tenure guarantees.

4.2.7. Parcel distribution and land tenure

a. The team strongly recommends that land tenure arrangements in the *marais* be settled at the local level.

b. The seminar on land distribution proposed in the 1993 work plan should focus primarily on the local level.

4.2.8. Environmental assessment

a. The project team should carefully assess the impact of the Nyamigogo *marais* development on areas up- and down-stream from the watershed in close collaboration with MINETO.

b. A strong *encadrement* of farmers is needed during the first years of development and management.

c. The project should site fish ponds on heavy soils that are unsuitable for agriculture.

d. The project should preserve a peat zone in the *marais* and give particular attention to *marais* with peat zones characterized by acid soils.

4.2.9. Strengthening DGRCS

a. The project should continue long-term technical assistance to Génie-rural.

4.2.10. Long-term training

a. The team recommends long-term training two national engineers in the United States up to the Master's degree level in rural engineering and water management. The selection of trainees from current positions within MINAGRI or any other institution should not disrupt on-going programs.

4.2.11. Other support to Génie Rural

a. The team recommends continued support for maintenance and operating costs of all equipment and vehicles provided to DCGS

b. The coordiantion unit should handle local training for Génie-rural agents, accountants, and secrétaries.

4.2.12. The *marais* component and the new USAID strategy

The following recommendations are intended to relate the component's activities to the new USAID Rwanda CPSP.

a. The component field team, based in Ruhango, should be requested to identify the appropriate types of institutions needed to assist producers with marketing and input supply.

b. The project team should assess the best package of cash crops in close collaboration with farmers and should identify opportunities for local processing, such as oil, tomato juice and tomato paste and cereal flour.

c. The project team should involve local NGOs and US-based PVOs, specializing in rural credit, cooperative development and rural institutions, and marketing. The project should consider the involvement of these organizations in *marais* development.

d. Local entrepreneurs should undertake construction of a warehouse and other common elements of the *marais* hydraulic network, including earthworks, masonry, and concrete works.

4.3. *Marais* aquaculture

a. The project team should improve the transfer of technology to coincide with economic realities in the field.

b. The SPN should redirect training to meet the needs and capacities of the artesanal aquaculturist-farmer.

c. Once the transfer of technology has been passed through the extension agent level, USAID should not continue funding training programs. Individual users should absorb further assistance costs.

d. Elimination of comercial constraints should suffice to stimulate commercial aquaculture. The SPN should begin formulation of the *Aquaculture Development Plan* and make recommendations to the government for specific needs. If those needs can not be addressed, commercial aquaculture in country should not be encouraged.

e. The *National Aquaculture Plan* needs to be completed. Auburn University's participation needs to be re-evaluated and the completion date moved forward.

f. USAID should minimize financing of further aquaculture development until a comprehensive aquaculture-development plan is produced.

g. An aquaculture-development plan must take into account findings of the marketing study and the evaluation team.

h. The SPN interim director should develop a strong presence within MINAGRI and should provide concrete recommendations at the division level for aquaculture development.

i. The role of the private sector in marketing, distribution, processing, and sales should be developed. If benefits are achieved, the private sector should be involved.

j. Development banks should be encouraged to support small aquaculture related loans.

k. The project team should suspend additional training until a comprehensive and realistic aquaculture development plan is approved and their need is demonstrated.

l. The project team must complete the market feasibilty study and use it to formulate the aquaculture development plan.

m. The CU and contractor should demand timely execution of contracts and monitor their progress on a quarterly basis.

n. The project team should reduce construction costs by increasing the size of the ponds.

o. The project team should phase out demonstration facilities by the fourth year of project implementation.

p. The project team should divide the Kigembe site into a training facility, while retaining some ponds for demonstration purposes. The team should lease or sell the rest of the ponds to interested parties for commercial development.

q. In order to obtain reasonable yields, certain technological and economic criteria must be met. The principal technological criteria are as follows:

- production of *Monosex tilapia* either by species cross (*T. nilotic* x *T. aurea*), feeding of hormone-treated feeds for sex reversal, or hand sexing;

- ponds should be stocked with tilapia fingerlings at 4 to 6 units per m2, depending on site;

- pond management should employ organic and inorganic fertilization methods;

- feeding during final months of growout should be encouraged.

- pond productivity and environmental parameters indicate that dual culture of Tilapia and carp or clarias is feasible at numerous sites;

- in colder areas, stocking densities should be increased to produce a higher volume of smaller fish;

- systematic and accurate record-keeping on feed and fertilizer intputs, growth rates, temperatures, productivity (seiche disk readings), and dissolved oxygen must be kept;

- pond management on individual sites must be based on site-specific parameters; and

- the SPN should re-evaluate methods and approach, abandon applied- research duplication, and carry out sustainable and economically viable aquaculture training and development.

r. The SPN needs more contact with field agents, to monitor data collection and undertake analyses. The SPN must establish a viable database and an analytical system.

s. The project must have an experienced, full time aquaculturist until the Ph.D. and Masters candidates return from their training at Auburn University. The CU should contract with such a person for timely assessments and direction.

t. The project team must, upon approval of the *Aquaculture Development Plan*, recruit at least four supervising agents to monitor field personnel on a continuing basis. SPN should retrain these agents and give them comprehensive training at the Rwasave aquaculture research facility for additional practical experience.

u. The project team should involve Peace Corps volunteers and local counterparts in order to reduce costs.

v. The project team should update the training program and training manual to take into account the lessons learned during the last three years.

w. The team should devise a system that transfers training and employment costs, such as salaries and related expenses, to beneficiaries (GOR and end users.)

x. The SPN and the demonstration centers should dessiminate technology appropriate for Rwanda. The integrated-culture method may be retained as an alternative system.

y. The project team should encourage artesanal farm-based aquaculture to the extent that it is sustainable and self-suficient.

z. Commercial aquaculture should develop with the support of cooperatives in the *marais* through entrepreneurial interest.

aa. In order to develop the interest of the private sector in aquaculture development, the following appropriate industries of scale must be developed:

- pond-site purchase and pick-up by wholesalers and major retailers;
- competent wholesaler-distribution centers in major towns for aquaculture and fisheries products;
- small retailers for sale at local markets, some of which are already in place but need to be trained in quality control; and
- value-added products, such as smoking, salting and curing, frozen filets and pre-cut brochettes for small restaurants, to stimulate the rest of the industry.

bb. The project team must stimulate private sector involvement in purchase, distribution and processing by emphasizing the following areas:

- centrally located and regional purchase and preservation facilities, such as private-sector salting and smoking stations;
- organized pick-up and delivery routes for preserved and fresh fish to markets in Butare, Ruhengeri, and Kigali;
- private sector wholesalers, wholesale-retailers and retailers to sell to restaurants and individuals; and
- at the rural level, product harvest, pickup and distribution.

4.4. Soil conservation and agroforestry component

a. COSAF should continue its extension activities in Ruhengeri but on a reduced scale.

b. The project team should phase out activities in communes situated in war zones.

c. The project team should reduce tree nurseries to proven agroforestry, fruit and grass species.

d. The project team should leave production of other agroforestry species to MINAGRI or the communes.

e. The project team should devote more time and effort to the extension of soil-conservation and agroforestry techniques. This effort should be focused on degraded and fragile areas of intensive-development sites.

f. COSAF should restrict activities in Ruhengeri to the war-free communes of Mukingo, Nkuli and Nyamugali and should maintain, in these communes, grass seed production and multiplication nurseries.

g. The project team should complete work underway on the construction of radical terraces and should discourage construction on new sites, because they reduce cropping areas and may exacerbate soil erosion.

h. The project team should encourage soil mulching with the grass produced and crop rotation.

i. The project team should discourage use of lime in nurseries until production has been privatized and, then, leave lime use to the discretion of the nursery producer.

j. The project team should avoid fertilizer use on project nurseries because fertilizer use raises input costs and misleads farmers into believing that tree growth rates and development will be the same in their own fields.

k. The project team should encourage inclined talus on existing progressive terraces because the practice uses less labor, can increase farm size and does not disturb the land as much as other interventions.

l. The project team should discourage hillside erosion ditches, because the ditches cause more damage than good.

m. The project team should discourage bad cultural practices, such as plowing up and down slopes and should encourage lateral cultivation techniques.

n. USAID investment in ICRAF/AFRENA as reflected in PIL 26 should stay at the current level.

o. COSAF should direct all its research needs through ISAR.

p. Monitoring and evaluation should involve agricultural agents (MONAGRIs), chiefs of sections, communal agronomists and the CU.

q. The project team should define measurable target outputs and evaluate progress towards achieving targets at the end of each quarter.

r. At regular intervals, the project should assess the level of nitrogen build-up, soil erosion rates, tree planting and survival rates and adoption of promoted technologies.

s. The NRMP CU should help COSAF define indicators and implement a monitoring system for the project. CU staff should make regular field visits to assess progress so that deviations can be corrected in a timely manner.

t. COSAF should pursue on-farm research on agroforestry and soil conservation through the ISAR. Research topics should focus on farmers's needs and preoccupations.

u. The project should increase training efforts at the farmer level and should give more training to section chiefs and MONAGRIS agents.

v. The project should reduce training for local authorities and the coordination team.

w. Long-term training should start and should include two master's programs in soil conservation and agricultural economics. The trainees should join the COSAF coordination team.

x. GOR should integrate COSAF into its activities, give the agency a higher priority and provide more skilled and experienced section chiefs.

y. The project team should ask communal agronomists to devote more than 50 percent of their time to the project.

z. The USAID ADO should refer all day-to-day matters to the NRMP Coordination Unit.

aa. Senior officials should make any changes in the cooperative agreement (CRDC) so that everyone concerned will be at the same level of understanding.

bb. The project must make a special effort to include women in long- and short-term training programs. The extension-agent team should reflect the importance of women in agriculture and the number of female beneficiaries in the project area.

cc. CARE International should maintain its current course of activities.

dd. COSAF should continue extension activities in Ruhengeri until November, 1993. The team recommends an evaluation after this date before any extension is made.

4.5. Parks and natural-forest management component

4.5.1. Nyungwe Forest Conservation Project

4.5.1.1. PCFN construction

a. USAID, in conjunction with PCFN and the NRMP coordination unit, should determine the level of funding needed to complete this phase of the project and, if sufficient funds are available, should commit additional monies.

b. The project should require PCFN to submit a precise exhibit plan and interpretive program to USAID and the CC.

c. The coordination committee, the USAID architect, and PCFN co-directors should examine the proposed construction plans of phase two of the staff-housing section; consider a redesign to reduce costs; consider using other building materials and a design based on explicit need; and bring the buildings into line with other houses in the region.

d. The project should consider purchase of a 3.5 to 5.0 KVa diesel generator.

e. The PCFN office must have telephone capability at reasonable cost.

4.5.1.2. PCFN research

a. The new project co-directors should work closely with Mr. Samuel Kanyamibwa, research advisor, to broaden the existing program and stimulate additional applied research possibilities.

b. PCFN, in collaboration with the NRMP coordination unit and the coordination committee, should discuss and agree upon potential areas of research.

c. The project should maintain close contact with other NGOs and PVOs working within the Nyungwe Forest, and avoid research duplication to ensure prudent expenditure of limited funds.

4.5.1.3. PCFN conservation education

a. PCFN should advertise and hire a qualified Rwandan to fill the vacant education-officer position.

b. PCFN, through its education component, should be prepared to assist in marketing local products when the international-market returns.

c. If PCFN determines a need for additional PCV support for this program, the project should consider requesting a third year volunteer.

4.5.2. Karisoke Research Center

4.5.2.1. KRC construction

a. The NRMP coordination unit should offer assistance to KRC to complete construction, including equipping the camp facility with solar-panel units and installing high-frequency radio equipment.

4.5.2.2. KRC research

a. The project should require KRC to submit annual work plans and annual reports as other NRMP component organizations do.

b. The NRMP coordination unit and the Coordination Committee should use these reports to determine the importance and the applicability of proposed research.

c. Those research programs funded by NRMP should not only promote a further understanding of the PNV afromontane forest, but should be applied directly to better management of this fragile ecosystem.

d. KRC should work more closely with PNV headquarters and ORTPN to determine priority topics.

e. KRC should move quickly to incorporate full-time Rwandan researchers into the system, assist them with field training and monitor their progress.

f. KRC might wish to seek advice from PCFN about recruitment of Rwandans into research and administrative systems.

4.5.2.3. KRC conservation education

a. The new conservation officer should develop close alliances with the University of Butare and the University at Ruhengeri to recruit Rwandan students for research grants and programs.

b. Using seminars and workshops, the conservation officer should strive toward dissemination of information from KRC research to the Rwandan citizenry.

c. The consultant should believe strongly that new conservation-education programming should rely heavily on teacher training and development of strong teacher-support systems; i.e. teacher guides, textbooks for classroom use, teacher workshops, and subsequent teacher monitoring.

d. The NRMP coordination unit and the CC should consult with KRC regarding the potential for creating Rwandan counter-part posts for appropriate camp-administrative and research-oriented positions.

e. In the interim, the conservation officer should be involved not only in outreach programming from the base office in Ruhengeri, but also in the KRC camp administrative and research decision-making process.

4.5.3. The parks and natural-forestry component in general

a. USAID and the coordination committee should consider increasing funding to PCFN and KRC, based on the organizations' research, staffing, and operational needs.

b. USAID involvement, after the life of the NRMP, should be considered.

c. The consulting team strongly recommends that USAID, within the scope of the NRMP, scrutinize the Akagera situation and consider offering immediate assistance.

4.6. Environmental Planning and Policy Component

a. Progress in consolidating environmental policy and planning in Rwanda may be attained by establishing a National Environmental Council (CNE) coposed of senior personnel from MINETO, MINIPLAN, MINAGRI, MINISANTE, MINITRAPE, MINTRANSCO, MINAFFET, MINSUPRES, MININTER, and MINIPRISEC.

b. The CNE should do the following:

- coordinate national level environmental policy through MINETO;

- finalize plans for the Donor Round table;
- set national environmental program priorities;
- monitor the achievement of programs such as the Natural Resources Management Plan, and the SNER/PAE; and
- plan human-resources development to serve the environment sector.

c. The most viable link between MINETO and the Council would be through the Office of the Director General. The office should be expanded to accommodate a technical-services element.

d. The consulting team recommends that the mandate of the Advisor for Environmental Affairs be renewed and revised to support the technical-services unit.

e. The project team should add the technical-services unit to the Director General's office even if development of the National Environmental Council is delayed.

f. The advisor's new assignment to the Director General should include the following:

- technical assistance to establish the technical unit;
- planning assistance to enable MINETO and GOR to establish the National Environmental Council;
- support MINETO's in-house training in EIA, environmental-protection, management methods, and procedures;
- give technical, scientific, and management support to MINETO and the GOR for a biodiversity program that builds existing bio-inventories;
- help draft legislation for EIA processes and procedures; and
- coordinate environmental aspects of NRMP components with the Office of the Director General.

g. The project should encourage the development of a national-environmental council that can identify and consolidate intra-ministerial and sectoral responsibilities.

h. Once the project has defined and consolidated a national system, functions should be transferred to MINETO.

i. The project should retain a long-term advisor and revise the position's terms of reference.

j. The advisor should assume an appropriate structural position in the Director General's office at MINETO.

k. The consulting team recommends training in environmental-impact assessment, environmental protection and management for MINETO agents.

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Appendices
Mid-term evaluation
Rwanda Natural Resources Management Project

Appendix 1
Scope of work

Appendices

Appendix 1: Scope of Work for the Mid-Term Evaluation of the Natural Resources Management Project.

A. Purpose:

The purpose of this scope of work is to describe the level of effort required for 7 consultants to undertake a mid-term evaluation of the Natural Resources Management Project (No. 696-0129). The consultants will be asked to assess the effectiveness of the project in meeting its purpose and objectives, to describe the major constraints encountered by the project, and to make recommendations for medium- to long-term USAID interventions, not only to improve performance and ensure the success of the project, but also to modify the project to fit within the Mission's new development strategy which focusses on the promotion of the private sector.

B. Background:

The Natural Resources Management Project (NRMP), as amended, is a 5 year and 6 month effort, with an A.I.D. contribution of $13,545,000. The Project Agreement was signed on June 7, 1989, and the Project Activity Completion Date is December 31, 1995. The stated goal of the project is "sustained long-term agricultural production." The project purpose is fourfold: "(1) reduced erosion on Rwanda's hillsides; (2) sustainable use of the country's wetlands; (3) protection of its natural forests; and (4) greater coordination by the GOR of activities affecting the natural resource base."

The project currently involves two Rwandan technical ministries, the Ministry of Environment and Tourism, and the Ministry of Agriculture, Livestock, and Forests. Technical assistance is being provided by Development Alternatives Inc. (DAI) with subcontracts to Cornell and Auburn Universities. DAI has posted two long-term technical advisors: a Project Coordinator (4-year assignment) and an Environmental Planner (2-year assignment). Day-to-day coordination and management of the project is the responsibility of a Coordination Unit (Cellule de Coordination) composed of a Rwandan National Coordinator and the DAI Project Coordinator.

The project has five basic components. These are: (1) training and research in marais management; (2) integrated fish culture in the marais; (3) agroforestry and soil conservation; (4) natural forest management; and (5) assistance in environmental planning and in the formulation of environmental policy. Each of these components has its goal, objectives, and outputs, which must contribute to achieving the overall project purpose and goal.

C. Project Outputs:

Projects outputs were specified as follows, according to project component:

1. **Training and research in marais management**

1.1 Thirty technicians trained in marais management and working in the field on marais related activities.

1.2 Three applied research studies in marais development and aquaculture (economic and marketing; soil fertility, erosion, water management and aquaculture policy; and social economic issues).

1.3 One 50 ha. model marais managed on a sustainable basis, incorporating lessons learned from research undertaken by the project. Production is to increase by 20 percent.

1.4 Division Amenagement Hydro-Agricole (DAHA) strengthened.

2. **Integrated fish culture in the marais**

2.1 Number of productive fish ponds increased by 900.

2.2 Creation of integrated fish-culture and crop-livestock production enterprises in 7 marais areas.

2.3 Increased production of pond fish per unit area by 3.5 kg/are/year.

2.4 Training for one MS/PhD and one MS degree in fish culture.

2.5 Increased capacity within the National Fish Culture Service for extension and adoption of integrated fish culture-crop-animal techniques. Train 75 extension agents. Increase extension staff with 20 new agents.

3. **Agroforestry and soil conservation**

3.1 Implementation of appropriate soil conservation and erosion control measures on degraded or fragile lands targetted at 500 ha. Inventory of erosion problems. Five commune forestry plans established.

3.2 Increased extension of proven soil conservation and erosion control measures. Fifty trained extension agents actively extending techniques.

3.3 Communal research and demonstration centers established.

3.4 Fifty sector nurseries strengthened.

3.5 Two MS degrees in soil conservation.

3.6 Applied on-farm research in agroforestry and soil conservation.

4. **Natural forest management**

4.1 Six research studies completed on the physical, biological, and socio-economical environment of the afromontane forests, and linkages with agricultural production in the lowlands.

4.2 Education efforts undertaken to promote the multiple use management and conservation of remaining natural forests.

4.3 Interpretive centers and related facilities constructed.

4.4 Two MS degrees in conservation and park management.

4.5 In-country training for Rwandan counterparts and park guides.

5. **Assistance in environmental planning and in formulation of environmental policy**

5.1 The GOR plays positive role in coordinating environmental policy.

5.2 Environmental action plan developed and being implemented.

5.3 National fish culture strategy developed.

5.4 Marais development strategy approved.

5.5 National seminars, workshops, and coordinating meetings held involving a wide range of Rwandans involved in environmental issues.

Overall Project Management

In order to assist in overall project management, A.I.D. is financing one technical advisor who shares responsibility with the Rwandan Project Coordinator for the overall supervision of the project, including establishment of objectives and monitoring of progress for all five project components.

D. Specific Tasks

1. The evaluation team will evaluate the administrative and scientific performance of the NRMP contractors and of the GOR implementing agencies in terms of input delivery and the attainment of project outputs (comparing actual achievement with planned levels). At the same time, it will assess whether the output targets are realistic and will lead to the attainment of the project's stated purpose and goal. The team will make recommendations for better backstopping, management and improvement of project performance. In particular, the performance to date, and future function of the support given to overall project management through the project Coordination Unit should be examined.

2. The evaluation team will assess whether the objectives of the project components, the goal and purpose of the project as a whole, and the general approach of the original project design remain valid, and whether the assumptions in the original design (both implicit and explicit) are realistic. The team will recommend changes to the project's design and implementation documents (e.g., Project Paper, Project Agreement, and Cooperative Agreements, Grants and Project Implementation Letters) that may be needed to improve project performance and to focus activities in accordance with USAID's new development strategy described in the CPSP. The team will recommend verifiable indicators of the achievement and completion of project outputs, purpose and goal. Such recommendations will take into account the level of resources remaining under the project.

3. The evaluation team will examine the institutional relationships between the various agencies involved in the NRMP, the relative distribution of resources among the agencies, and the relative performance of these agencies in terms of attainment of project outputs. Specific attention should be paid to the ICRAF/AFRENA work with Africare's Soil Conservation and

Agroforestry activity.

4. The evaluation team will assess the relevance of studies and analyses completed under the project to policy questions facing Rwanda, and assess their impact on policy formulation. The team should consider specifically the work completed by the Environmental Planning Component.

5. The evaluation team will assess the sustainability of project activities and evaluate the GOR capacity for long term support of these activities, especially in the light of their existing inability to meet the requirement for 25 % Host Country Contribution. Where possible the team should make recommendations for actions necessary to ensure the long-term sustainability of project activities.

6. Based on the current CPSP, the team will make recommendations as to what can be done to address the extension and privatization questions in all components of the project within the current project budget and timeframe. In particular, the team should advise how the Fish Culture, Marais Management, and Soil Conservation and Agroforestry Components might continue their production activities with more emphasis put on privatization, and whether that is realistic or feasible. The team should consider how an orderly phase-out of these activities could be managed if a move to privatization is not feasible and should indicate a timeframe for any phase-out of activities.

7. Although the project is scheduled to continue until December 31, 1995, the expatriate Environmental Planner is scheduled to depart in February, 1993, and the Coordinator in June, 1994. The evaluation should assess the need for additional TA and recommend measures necessary to ensure project continuation after withdrawal of technical assistance.

8. The evaluation team will assess the relevance and quality of work aimed at involving the populations living around the Nyungwe and Karisoke Forests in conservation and forest management practices.

9. The evaluation team will assess the overall impact of the project on the Ministry of Environment and Tourism and on the Ministry of Agriculture, the local administration, and the economy of the communes in which the project is operating. The team will determine whether the project has been adequately integrated into the local administration, and will comment on what level of integration is appropriate and how it should be structured.

10. The evaluation team will assess the relevance of both long and short-term training completed, underway or planned under the project. The team will also study the problems which arise because positions vacated by participants on departure for training are not kept open for them on their return and make recommendations for immediate resolution of such problems.

11. Gender Considerations

The evaluation team will assess whether or not the project has implemented activities targeted at women and make recommendations as to how the project could benefit more women in the project area. Particular attention should be paid to the following issues:

- Design, Appraisal and Implementation

How were the interests and roles of women (compared to men) taken into account in each of the design, appraisal and implementation stages of the project? In what ways did women (compared to men) participate in these processes?

- Effects and Impacts

What were the effects, positive or negative, of the project concerning women's (compared to men's) access to income, education and training, and with respect to workloads, role in household and community and health conditions? How were the interests and role of women (compared to men) taken into account in the evaluation? Were significant factors concerning women overlooked at the appraisal stage?

- Data Availability

Were gender specific data available for each of the project stages?

A. Design
B. Appraisal/approval
C. Implementation
D. Monitoring
E. Evaluation

- Sustainability

How did women's integration in AID activities affect the sustainability of project outcomes? Were outcomes more sustained (or less sustained) when women were taken into account in AID activities? Are the results achieved by the project equally sustainable between men and women beneficiaries?

E. Methodology and procedures

The Team Leader is to develop a detailed work plan for the evaluation. S/he will assign specific tasks to each of the team members, including him/herself. This work plan is to be completed, and submitted to USAID ADO for approval, by midday on the third day after the Team Leader's arrival in Kigali. USAID will return the work plan by COB on that third day.

To conduct the evaluation the team will:

1. Review all relevant project documentation and the CPSP. This review should start upon arrival of the team in Kigali.

2. Interview relevant personnel at USAID/Rwanda, Ministry of Environment and Tourism, Ministry of Agriculture, Africare, Wildlife Conservation International, Digit Fund, and at project sites. Contact local authorities (prefecture, communes, farmers (both male and female) and local community leaders.

3. Make field visits to the NRMP project sites and study research and extension activities.

4. The consultants will work a six-day week and will collaborate closely with the staff of USAID and GOR. Office space will be provided by the project. Field visits will be arranged by the evaluation team with help from the project Coordination Unit. The team will be self-contained and will not require any support from USAID.

F. Evaluation Team Composition

The evaluation team will be composed of 7 individuals:

1. A Team Leader/Socio-Economist

Qualifications: PhD in sociology with extensive course work in economics. Must be fully competent in statistics and research methodologies. Five years' experience in evaluation of development projects in Africa is required, together with ten years' work experience with the formulation of policy aimed at encouragement of sustainable production systems in Africa. The Team Leader should have demonstrated ability to lead a multi-disciplinary evaluation team and complete the required report within the specified time-frame, as well as an ability to work harmoniously with others and to deal with personnel conflicts.

2. A Land Development Specialist

Qualifications: PhD in Land Use Planning, or related subject. Ten years' experience of working on land development and land tenure issues with small farmers in Africa. Specific experience with agricultural land development and engineering aspects of water management is required.

3. A Fish Culture Specialist

Qualifications: PhD in Aquaculture. Ten years' experience, of which five years should have been in Africa, with small-scale, private sector fish production and marketing, as well as experience in aquaculture research work.

4. An Environmental Scientist

Qualifications: PhD in environmental sciences. Ten years of experience in environmental research. Specific experience in environmental policy and planning, or of monitoring of the implementation of environmental policies by official bodies, is required.

5. A Soil Conservation Scientist

Qualifications: PhD in soil conservation. Ten years of experience with small farm production systems in Africa and with development of farming systems aimed at maintenance of soil fertility and reduction of soil erosion. Specific experience in high rainfall, upland areas of Africa is desirable.

6. A Parks Management Specialist

Qualifications: PhD in ecology and post graduate course work in Parks Management and Tourism. Ten years' experience of natural forest management and ecology, together with five years' experience of management of tourist facilities in ecologically sensitive areas.

7. A Management Specialist

Qualifications: MSc in management. Ten years of experience in the establishment and evaluation of government agencies and private sector internal management systems for the control of resources, implementation, monitoring and evaluation of activities. Specific experience in African agricultural development projects very desirable.

The individuals selected will have English competence at FSI level S5/R5 and French at a minimum FSI S3/R3 and should be familiar with private sector economy and policy formulation, preferably with experience in design, implementing, and/or evaluating similar types of projects. All team members should be familiar with microcomputers as tools for data collection and report writing and should have demonstrated ability to write clearly and concisely. The actual distribution of tasks between the team members will be the responsibility of, and coordinated by, the team leader.

G. Timing

Four weeks will be allotted to carry out this evaluation. The Team Leader will provide 26 work days of input in Rwanda, the Management Specialist will provide 14 work days in Rwanda, and the remainder of the team 24 work days in Rwanda, for the evaluation. The assignment will commence o/a November 2, 1992 and end o/a November 28, 1992 (December 1, 1992 for the Team Leader). The timetable and budget assumes two working days of travel to and from Rwanda.

H. Reports and Deliverables

The Team Leader will give weekly oral briefings to USAID ADO and PDO on the status of advancement of the evaluation work plan.

The following reports are required under the contract, in the quantities specified:

Reports	Copies	Due Date
First draft of the evaluation report in English and in French	5	On work-day 19 of the evaluation
Final version of the evaluation report (bound) in English and French	10	On work-day 26 of the evaluation

A meeting to review the draft report of the evaluation will be held by representatives of USAID and GOR on work-day 21 of the evaluation. Comments on the draft report will be provided to the evaluation team following this meeting.

The team will take the comments made by USAID and GOR representatives into account in preparation of the final version of the report which is to be submitted in hard copy (in English and in French) on work-day 26 of the evaluation, before the Team Leader leaves Rwanda. In addition to text copies as specified above, the final version of the report in English and in French should be provided on diskette in Wordperfect 5.1 format.

The required format for the evaluation report is as follows:

- Executive summary
- Table of contents
- Acronyms
- Body of report
- People contacted
- Bibliography
- Appendices

I. Miscellaneous

- Health Room Facilities: Use of these facilities is on a cost reimbursable basis only. The US-based consultants will have to travel with SOS medical insurance and a medical certificate stating that they are able to work in Rwanda. Copies of both SOS insurance and medical certificate are to be submitted to the Health Room and Executive Officer (EXO) upon arrival in Kigali. Use of Health Room facilities will be denied unless the medical and insurance (SOS) certificates are on file.

- Exchange accommodation: USAID-funded expatriate consultants are allowed to cash at the American Embassy personal checks drawn on a U.S. bank.

- International Travel: Business Class is authorized only in lieu of overnight stop en-route. Visas and pre-departure medical vaccinations and other travel arrangements are the responsibility of the consultants.

- Computers: The team is required to provide IBM compatible computers for their work. USAID printers can be made available.

- Pouch: The team is not authorized Pouch use.

Appendix 2
List of contacts

Appendix 2
List of contacts

Ahimana, Célestin	MINAGRI
Bahigiki, Emmanuel	previous secretary general, MINIPLAN
Bicamumpaka, Martin	former national coordinator NRMP
Bizimungu Télésphore	D.G. MINIPLAN
Bourgemestre of Cyeru	
Bunane, Charles	Chef de Service at ORTPN
CCCE	
Clay, Peter	assistant director - Karisoke Research Center
COSAF / Ruhengeri	
DeLucco, Paul	Africare director
Director of Planning	MINIPLAN
Direction Régionale	MINAGRI at Ruhengeri Wetlands Component
FAC	
FAO	
Fimble, Cheryl	codirector PCFN
Fimble, Robert	codirector PCFN
Fuller, Kurt	ADO
Gahirwa, Karemera	attaché - Planning - MINETO
Gasana, James	former Minister of Agriculture
Goufau, Alain	Fao expert in charge of national inventory of wetlands
Grève, Albert	World Bank, Environment Department.
Habimana, Elisapha	attaché Conservation of Natural Resources, MINETO
Habiyambere, Thadée	director general of Forest Service
Habyarimana, Oreste	executive secretary, ARDI
Habyarimana, Cyridion	program head, UNDP
Hakizamungu, Ignace	former secretary general MINAGRI
Hémo, Claude	World Bank, Environment Department
Hicks, June	Peace Corps volunteer - PCFN
Hicks, Steve	Peace Corps volunteer - PCFN
Johnston, Alan	director, Peace Corps
Kabagambe, Jean-Bosco	director SPN Kigembe
Kagabo, Léonard	MININTER
Kagenza, Donat-Léon	ORTPN conservator - Nyungwe Forest
Kanyamibwa, Samuel	research advisor - PCFN
Karamaga, Charles	Research and Statistics, SPN
Karasira, Claver	trainer SPN
Karemera, Protais	chief, Environmental Studies and Planning MINETO
Karpers, José	coordinator, IGCP
Kayijamahe, Athanase	director of Rural Engineering and Soil Conservation, MINAGRI
Kazungu, Charles	researcher PCFN
Kristensen,Kurt	master of science candidate - Frugivore Project
La Framboise, David	Technical Advisor Africare - COSAF

Makuba, Aaron	Advisor MINAGRI
Masabo Nyangezi, Juvénal	President du Comité de Coordination et Directeur du Tourisme MINETO
McNeilage, Alastair	Ph.D candidate KRC
Monfort, Alain	DAI Ecotourism Consultant
Mbanziriza, Etienne	Research - PCFN
Munyaligoga, Viateur	Researcher PCFN
Mujawayezu, Claudia	Acting director / Directeur Environment MINETO
Mukakarera, Colette	ISAR
Mpawenimana, Paul	Director, Fish stocking and fish rearing project SPN, Ruhengeri
Nelson, Gary	AID Director
Ndagijimana, Léonard	Chief, Environmental Protection, MINETO
Ngendahimana, Jean Seth	Fish Marketing study
Niang, Amadou	ICRAF
Nkundineza, Jean-Daniel	NRMP National Coordinator
Nkusi, Juvénal	Coordinator, Environment and Development, ARAMET
Nshimiyimana, Alphonse	Committee Member / D.G. Animal Production / MINAGRI
Ntaganda, Félicien	S/Préfet Chargé des Affaires Economiques, Préfecture, Ruhengeri
Nyamacumu, Athanase	ORTPN representative
Nyangezi, Etienne	ORTPN
Nzeyimana, Pie	Ministère des Affaires Etrangères
Nzeyimana, Louis	conservation education coordinator for DFGF
Personnel ARAMET	environmmental PVO
Personnel of COCOAB	environmental PVO
Personnel Kalisoke	
Renzaho, Juvénal	consultant and former national coordinator of COSAF
Richards, Mel	Volcano Veterinary Center
Robinson, Dawn	Volcano Veterinary Center
Ruhumuliza Gaspard	Ministry of Tourism and Environment
Rukangira, Ernest	director of National Environmental Service
Rukeramihigo, Protais	coordinator of COSAF
Rushemeza, Révérien	director of rural engineering
Ruzigamanzi, Antoine	assistant project manager
Rwagasore, Isaïe	division chief, conservation, MINETO
Rwamakuba, André	director of regional health, MINISANTE
Samyn, Jean-Marie	advisor to Minister of Forests
Shaban	ORTPN representative - PCFN
Shyirambere, Canisius	park warden, PNV.
Sikkens, Roelof	advisor to Marais Component
Smucker, Glenn	NRMP advisor (DAI)
Steklis, Dieter	director Karisoke Research Center
Sun, Chin	PhD candidate - Frugivore Project
Tardiff, C.	counsellor, Canadian International Development Agency
Twagirayezu, Jean-Marie	engineer, Rural Engineering
Twagirumukiza, Emmanuel	A/Ag.Dev.Officer USAID
Uwiringiyimana, Juvénal	Director Rwanda office of Tourism and National Parks ORTPN

Uwumusaraba, Jean	Director (acting) Fisheries, Aquacultures, and Apiculture
Verheust, Lieven	SPIR
Veverica, Karen	
Weber, W.	WCS - Director (African Region)
Williamson, Elisabeth	departing director PCFN
Winterbottom, Robert	technical assistant MINETO

Appendix 3
Baseline economic analysis
Small-scale commercial and artesanal operations

Appendix 3

Base line economic analysis of small scale commercial and artesanal Tilapia aquaculture operations in Rwanda.

For the purpose of the exercise we have assumed the following criteria:

Small scale commercial

- Deeded Land can be Purchased
- Adequate water availability and soils
- Farm size 10 acres
- Mono sex Tilapia fingerlings available
- Local Interest by Knowledgeable Entrepreneur, profits are his income.
- Availability of secured short and long term loans at 14%, long term loan pay back over 7 years 2 year grace period for 50% of Capital Investment Needs.
- Construction costs 2,750 U.S. per ha or 385,000 FRW
- Labour at 125 FRW per day
- Fingerling costs 5.5 FRW each, stocking at 6,000/acre yields 2.4 tons/acre per cycle
- Water exchange by gravity
- Stand-by aeration used only 630 hours a year
- Fish sold at pond side for average 180 FRW per kg.

Artesanal/Farm Operation

- Labor rates of 125 FRW only used to calculate construction costs.
- ** Fish production 1.8 kg/ha/year 40% home consumption and loss, of remaining 60%, 40% sold at 150 FRW,60% at 200 RFW.
- *** Fish production 1.8 kg/ha/year 10% loss, of remaining 90%, 40% sold at 150 FRW,60% at 200 RFW.
- Labor for maintenance and management not calculated as it was assumed that if not involved in fish culture farmer was involved in other non renumerated field.

FINANCIAL ANALYSIS SMALL SCALE COMMERCIAL

Capital Investment Needs	**U.S. Dollars**
A. Land Purchase (500 per acre)	5,000.00
B. Development Costs (2,616 per acre)	26,160.00
C. Equipment (3 aerators,nets,lab., one pick-up used,holding tanks)	21,340.00
Sub-total Capital	52,500.00

Sales

A. Tilapia (2.4T X10X2X1.28 U.S.)	61,440.00

Production Costs Per Year (2 cycles)

A. Fingerlings	4,715.00
B. Manure/Fertilizer/Feed	15,840.00
C. Labour	5,085.00
D. Energy and Fuel	3,400.00
E. Office support, Accounting	1,200.00
E. Miscellaneous	2,500.00
Sub-total Production Costs	**32,740.00**
Gross Profit	**28,700.00**

CASH FLOW FINANCIAL ANALYSIS

ITEM DESCRIPTION	**YEAR (U.S. Dollars X 1000)**						
	1	**2**	**3**	**4**	**5**	**6**	**7-10**
Gross Profit	28	28	28	28	28	28	112
Capital/Int L.T.	-	-	10.3	10.3	10.3	10.3	10.3
Capital/Int S.T.	3.4	3.4	3.4				
Net Cummulative Profit Prior Taxes	**28**	**52**	**66**	**81**	**98**	**116**	**218**

ARTESANAL OPERATION

The estimated cash value of inputs for a one ha artisanal operation are as follows:

IMPUT	**DESCRIPTION**	**COST U.S. Dollars**
Capital		
Pond	Labor (125 RWF/Day)	
	3 M3 per man/day	2,550.00
	Inlet/Outlet	200.00
		2,750.00

Production Costs		
Fingerlings (50/50 Purchase/Produced) (2 cycles/year)		931.00
Feed/Fertilizer		334.00
Miscellaneous (Equipment)		72.00
		1,337.00
Sales		
Fish **	(194,400 FRW)	1,388.57
Fish ***	(291,600 FRW)	2,082.85
NET INCOME PRIOR TAXES		
**		51.57
***		745.85

The benefits of the first hypothesis are that a substancial amount of animal protein is made available at the rural level.

SENSITIVITY ANALYSIS

SMALL SCALE AQUACULTURE OPERATION
(U.S. DOLLARS)

ITEM DESCRIPTION	INCREASE 10%	INCREASE 20%	DECREASE 10%	DECREASE 20%	RESULT GYPA *
Fish Production	X				5,144.00
(FP)		X			9,288.00
				X	**-12,288.00****
Production Costs	X				- 2,645.00
(PC)				X	2,645.00
Combined (FP and PC)	PC			FP	**-14,933.00*****
	FP			F	7,789.00

* GROSS YEARLY PROFIT ADJUSTMENT PRIOR CAPITAL AND INTEREST REPAYMENT AND TAXES.

** BREAK-EVEN POINT
*** NOT SOLVENT FINANCIAL ASSISTANCE NEEDED AFTER 3RD YEAR.
** Break Even Point

Appendix 4
Fish culture in the *marais*

Opportunities Identified for placing the 21 trained technicians.

Memorandum to USAID Kigali
From : Révérien RUSHEMEZA, Directeur du Génie Rural et de la Conservation des Sols

and Jean LeBloas, Consulant, Evaluation team
Identified opportunities for placing the 21 trained technicians "Génie Rural A2"

1. Background :

1.1 At the present time at last, a dozen of major donors and PVO's are involved in marais development projects. The country issued a Development strategy for marais in 1987, but don't have any well trained technicians in the field of rural and water management. One of the GDR's objectives is to have one technician du Génie Rural per commune, which means 150 technicians.

1.2 During the national seminar organized on January 20-24, 1992 in Kigali, all participants, including most of the managers and technicians (nationals as well as ewpatriates) involved in marais development, were unanimous to deplore the lack of qualified technicians in rural engineering and water management, for design, development and management of marais. (Réf. seminar proceedings, FAO document).

1.3 The NRM project/marais component will complete the training of 21 "Techniciens Génie Rural niveau A2" in March 1993. The purpose of this memo is identify a set of job opportunities for these 21 technicians in ongoing project or in the private sector.

2. Job opportunities for technicians

Génie Rural A2

Projects, PVO's and other opportunities

1. P.S.A. (intervient dans six préfectures : Cyangugu, Kibuye Gisenyi, Kibungo, Kigali et Gitarama)
   N.B. (Projet Service Agricole) = P.S.A.
2. P.D.A.G (Projet pour le Développement Agricole de Gikongoro)
3. D.G.B (Développement Global de Butare)
4. P.R.B (Projet Rizicole de Butare)
5. D.A.N.K (Développement Agricole Nshili/Kivu)
6. C.Z.N (Projet Crête Zaïre-Nil)
7. Projets Rizicoles (Rwamagana, Bugarama etc..)

8. SOPRORIZ (Société de la Production du Riz)
   Kabuye, Mukunguri
9. P.A.D.E.C (Programme d'Appui au Développement
   Economique) (intervient dans trois préfectures :
   Cyangugu, Gisenyi et Byumba)
10. P.K.M (Projet Kagitumba Muvumba)
11. Plan Directeur du Mutara
12. CYGAND (Cyabingo, Gatonde Ndusu)
13. Projet Kibungo II
14. Kigali Nord
15. Kigali Est
16. P.S.T.P. HIMO (selon leur programme): ILO funding
17. O.C.I.R. Thé
18. Au niveau de la Direction du Génie Rural et la
    Conservation des Eaux et des Sols. DGRCS
19. Dans le secteur privé : travaux publics, routes et
    pistes
    rurals, etc...

Appendix 2.G.

Staffing: Direction du Génie Rural et de la Conservation des Sols

* Directeur: Révérien RUSHEMEZA
* Ingénieurs (niveau A0)
  - Projet PARN marais: Jean-Marie Vianney TWAGIRAYEZU
  - projets divers: François HATEGEKIMANA
  - projet FAO inventaires des marais: Aaron MAKUBA
  - Projet FAO inventaires des marais: Emmanuel RUDASUMBWA
* Techniciens (niveau A1)
  - Projet FAO inventaires des marais: Salvator NTARYABASIGAYE
* Techniciens (niveau A2): Aucun (none)
* Comptable
  Projet PARN marais: Mme Immaculée
* Secrétaires
* Chauffeurs (2 actuellement) payés par le projet Divers.

Appendix 2.H. Long term training in the US for 2 national engineers (Master's degrees in rural engineering)

This training was agreed upon in an exchange of letters in July 1991 between USAID and the GOR, just after the signature of the fourth amendment to the Grant Agreement.

A) Identified applicant : Emmanuel RUDASUMBWA

MINAGRI Agricultural Engineer (level A0), trained by the UNDP/FAO "Inventaire des Marais" project in the field of computerized data bases settlement.

* He is the unique Ag/Rural development engineer well trained in the use of computer
* He is the best national counterpart of the UNDP/FAO inventory of marais project team which will be in charge of the elaboration of a "Master Plan for marfais development in Rwanda", to be funded by the African Dev.Bank and UNDP.
* He has been proposed as the head of the "Cellule Nationale des Marais", which core will be the team in charge of the preparation of the marais master plan.
* Based on the above statements, it is recommended by this mid-term evaluation that :

a) Prior to his departure for long term training in the US, Mr. Emmanuel RUDASUMBWA ensure the good starting of the master plan study and the creation of the "Cellule Nationale des Marais". These tasks may require at least the entire year 1993.
b) The option of considering another applicant should be considered.

B) * Second identified applicant : Eugène RUTAGENGWA, agronomist trained at Butare University. Has a job now within the "Kigali Nord Project" financed by the French.

RECOMMENDATION

Long-term training in the US up to the Masters degree in rural engineering, for two nationals : it is recommended that the GOR/MINAGRI submit the names of at least 3 or 4 applicants with a CV and a note explaining how their current position within MINAGRI (or elsewhere) will be fullfilled during their training in the US. The final selection of two will be done jointly by USAID, the Coordination Unit and MINAGRI, based on a set of criteria including education level and current position in the Rwanda Administration.

Appendix 2.I Marais Development: cost of studies (November 1992)

Topography (Source FAO)	
* map scale 1/2,000	
10 to 15 spots per hectare	12,000 to 15,000 FRW/ha
contour lines interval 0.50	(équiv: 80 to 90 $/ha
* map scale 1/1,000	15,000 to 18,000 Frw/ha
	(équiv: 90 to 130 $/ha)
Soil Study (source FAO)	
In sit reconnaissance, sampling, lab tests, soil map at a scale of 1/5,000	2,100 to 3,000 Frw/ha
	(équiv: 80 to 100 $/ha

Note : The above unit costs are for implementation by national technicians. They did not include the cost of expatriate technical assistance. A recent UNDP/ILO project indicates an average cost for studies of $ 150/ha (withour T.A.).

Examples of Marais Development costs

1.	Projet Développement Agricole de GIKONGORO (40 ha) FAO,Karen Franken, Janv.1992).... Includes earth works, hydraulic structurek (in wood, concrete,masonry, and gabions)	223,000 Frw/ha
2.	Projet Rizicole de Butare (1987-90) financed by CCCE	
	a) Dev.of Nyabugogo perimeter	350,000 Frw/ha
	b) Downstream large perimeter	250 to 300,000 Frw/ha
	c) Improvement of 3 marais (Cyili, Mirayi, and..)	250 to 300,000 Frw/ha
	d) Works to create small hydraulic structures in the Akanyaru marais	100,000 FRw/ha
	All the above costs include dev.works and topography.	
3.	Byumba marais financed by the Netherlands	300,000 Frw/ha
4.	Development of a "minimized" hydraulic structure for a small size marais (source : FAO)	100 to 150,000 Frw/ha
5.	Rwasave Butare marais : cost of new marais source Loiret-Butare, funding EEC	300,000 Frw/ha
6.	UNDP/ILO project (marais Rugende and Rumirabahashyi)	315,000 Frw/ha

Maintenance of hydraulic structure in a developed marais per year : 15 to 20,000 FRW/hectare (sources PDAG,PDGB,PRB)

Appendix 2.J.

Farmer income for various crops in Marais conditions and under irrigation + drainage conditions in Rwanda (1992)

Production costs include inputs (seeds only in marais conditions; seeds; fertilizers and pesticides in irrig.+ drainage conditions), and labour with one work day = 150 FRW (about one $) "Marais conditions" means that a minimum drainage is provided. In FRW, $ 1 = FRW 140; for one hectare. Without "redevances (fees)

CROPS	MARAIS CONDITIONS									
(1992 market price FRW/Kg)						Production Gross costs			Field	Value farm gate
						Net Income				
						Labour	Input			
						per ha				
SWEET POTATO (12)	36,000	96,000	8	96,000	51,000	54,000	37,000	15	180,000	88,500
GREEN BEANS* (30)	28,500	3,300	0.8	26,000	21,500	31,100	14,700	1.5	45,000	0
(35)	30,000		1.5	0	10,900	0	23,700	3.5	122,500	76,700
SOYBEAN (40)	33,000	9,500	2.5	60,000	36,000	33,900	20,750	2.2	88,000	30,400
CORN (18)	31,500	12,000	2.2	45,000	78,500	41,250	23,450	4.0	72,000	10,000
SORGHUM (25)	46,500	12,600	8	55,000		44,250	92,000	3.5	87,500	19,800
TOMATO (12)	30,000	13,500	10	96,000		64,500	36,500	20	240,000	83,500
CARBAGE (12)		11,500		120,000		45,000		20	240,000	158,500

Source : UNDP/ILO project / marais Rugende and Rumirabahashyi

* Green beans income: At the Rwasave marais project, managed by Loiret-Butare, the green beans exported to Fran provide the following income farmers (source : project agronomist, November 1992) Farm gate price: 35 Frw/Kg (Lo prices range from 30 to 35 Frw/Kg). All inputs are privided to farmer, their cost being substracted from inc

value one parcel average 0,045 ha. Average net income for one parcel : 6,000 FRW. This income per farmer corresponds to about 133,000 FRW/ha, which is far above the UNDP/ILO figures for green beans. Actually, theaverage yield for green beans at Rwasave perimeter managed by Loiret-Butare is 3.5 tons/hectare. With this Yield the income per hectare for,one crop green beans is 76,700 FRW/ha.

CROPS YIELDS, PRICES AND INCOME IN BUTARE PREFECTURE (IN MARAIS)

CROPS	CROP CYCLE	YIELD T/HA	MARKET PRICE FRW/HA	GROSS VALUE FARM GATE FRW/HA	INPUTS COSTS FRW/HA	NET INCOME/ PARCEL OF 3.5 A FRW	NET INCOME/ PARCEL/ MONTH FRW	% NET INCOME PER CROP RATIO
OCAL BEANS	3	0.8-1	30-50	35,000	5,275	1,075	358	28.40%
OYBEAN	4	1	40-50	45,000	5,400	1,386	347	22.03%
ORGHUM	4	2	15-20	35,000	9,900	879	220	17.95%
WEET POTATO	5	7-10	10-15	106,250	19,000	3,054	661	16.43%
ABLAGE	3	15	15	225,000	6,660	7,642	2,547	32.35%
OTATO	3.5	10-15	15-20	218,750	77,650	4,939	1,411	18.40%
GREEN BEANS	2.5		35	122,500		4,288	1,715	40.00%

Source : Projet "Developpement Global de Butare"
Service Agricole de la Prefecture

Comments on this table :
* Cablage provides the highest net income, in the current market situation. However a substancial production increase would have an immediate effect on market price.
* Green beans has the highest income ratio
Net income/parcel/month

Gross value/parcel

Appendix 2.K

Note on: "Projet Inventaire des Marais au Rwanda"

Le principal objectif du projet PNUD/FAO/MINAGRI/RWA/89/006 "Inventaire des marais du Rwanda" a ete l'elaboration et la mise en place d'une banque informatisee de donnees sur les bassins versants et les marais de l'ensemble du pays. Cette banque de données , actuellement opérationelle, est constituée de trois bases de données princpales sur : les bassins versant du pays, les tronçons de marais du réseau hydrographique supérieur et les tronçons de marais des réseaux hydrographiques inférieurs. Les multiples données (géographie, climat, hydrologie, agro-écologie, pédologie, superficies, toponymie, etc..) de la banque sont rassemblées sous forme de fiches techniques types. Chacun des bassins versants inventoriés (au total près de 350) et chacun des tronçons de marais (au total près de 300 pour les tronçons du réseau supérieur et près de 3000 pour ceux des réseaux inférieurs) dispose donc de sa fiche technique. Dans le cadre de l'interrogation et l'exploitation de cette banque de données, et plus particulièrement de la présentation des résultats, le projet FA/RWA/89/006 "Inventaire des marais du Rwanda" a notamment préconisé la représentation graphique. Dans la mesure de ses moyens, le projet a installé et testé un logiciel S.I.G. (Système d'informations Géographiques), et des essais de digitalisation et de représentation graphique des données sur le marais sous forme de cartes thématiques ont déjà été effectuués. Toutefois, le développement de l'outil S.I.G. dans le cadre particulier de l'exploitation de la banque de données des marais du Rwanda est toujours en cours. Les cartes présentées ci-après sont données à titre d'exemple provisoire car elles ne sont que le résultat

d'essais effectués sur des données n'ayant pas toutes fait l'objet d'une vérification finale ou d'une actualisation récente. De même, les tronçons de marais du réseau supérieur ne figurent pas sur ces cartes pour la simple raison que leur digitalisation n'est pas encore terminée.

Appendix 2.M

Donors,PVOs, Projects in the field of marais

. Amenagement hydro-agricole de la region du MUTARA

Financement acquis : 450.000.000 FRF = 90 millions Dollars US

Cofinanciers :	France caisse centrale	80 million FRF
	Canada ACDI	130
	Fonds Koetien	58
	FAD	40
	RWANDA	85
	Autres	57
	Total	450

Objet : Amenagement de 1.810 ha, en irrigation riz, soja.
En phase de demarrage, etant donne la situation politique.

2. Projet rizicole de Butare

Financement : Caisse Centrale (CFD)
* 1ere Phase : 37 MFF (7.4 million dollars), acheve
  - reprise des perimetres rizicoles chinois, perimetres nouveaux
  - 720 ha acheves
  - Rendement moyen global : 5.6 t/paddy sur 2 campagnes
  - degage des resultats beneficiaires a cause de la gestion rigoureuse.
* 2eme Phase : en cours de demarrage
  - extension des perimetres rizicoles. Presence permanente d'un assistant technique

3. Projet DGB Butare : (Developpement Global de Butare)
   Financement : FED
   1ere phase s'acheve le 31.12.92
   2eme phase sera negociee en juin 93.
   Composante marais :
   * 40 ha geres par Loiret-Butare (1.600 attributaires)
   * 150 tonnes haricots verts/an expedies en France.
   * 35 ha amenages par DGB va aussi etre bientot encadre par Loiret-Butare.

4. Projet d'amenagement hydroagricole de la Nyabarongo

   Etude de factibilite achevee; financement Banque Mondiale. 10.000 ha de marais potentiellement irrigables.

Financement : FAC, Caisse Centrale.

5. Amenagement de la vallee de RUSUMO prefecture (Kibungo)
Financement prevu : Caisse Centrale.

6. Projet PSA-IDA, Financement Banque Mondiale. 1ere phase achevee: 15 M dollars, 5 ans, sur 5 prefectures.
2eme phase en cours concerne toutes les prefectures, sauf Gikongoro (ou il y a deja un projet PNUD-FIDA-FAO).
2 marais amenages dans les prefectures de Gitarama.

7. Projet allemand RUHENGERI. Developpement agricole, en cours.

8. Projet Francais (FAC) - Kigali Nord
- Kigali Est
- Byumba

9. Projet GIKONGORO (PDAG)
Financement FAO-UNDP-FNUE-FIDA

10. Belgique: Intervention dans prefecture de Kibungo (PDRK) sur une dizaine de sites de marais

11. PNUD-BIT: Amenagement des marais de RUGENDE et de Rumirabahashyi.

Appendix N

Un exemple d'aménagement de marais privé de 40 ha à Masaka

1. Périmètre visité par J.LeBloas le 20 Novembre 1992. Masaka, sur la rivière Mulindi, petit affluent de la Nyabarongo, 20 km Est de Kigali.

2. Propriétaire et réalisateur de l'aménagement : Michel RUBAYIZA, Ingénieur agronome rwandais,Chef du projet Unité Opérationnelle de Masaka. Il a obtenu en 1986 une concession d'aménagement et d'exploitation du marais pour une durée de 30 ans ("contrat de bail"). L'Etat reste propriétaire du terrain qui, avant aménagement était un marécage de papyrus inculte.

3. Démarrage des travaux d'aménagement en 1986. Réalisés en 1 an, grâce à des prêts bancaires rwandais. Infrastructure hydro-agricole comprend :
   - 1 fossé de protection en R.G., de 1.600 m environ;
   - 1 collecteur central drain principal de 1500 m
   - 1 canal d'irrigation en RD amenant les eaux amont jusque derrière la digue de protection aval. L canal = 2.400 m S = 9 m^2 v = 21.600 m3 terrains
   - 1 digue de protection aval séparant le périmètre du marais à papyrus. V. digue plus ou mois 10.000 m3 de terrassement.
   - 1 station de pompage aval pour l'exhaure des eaux de drainage et d'infiltration sous la digue aval.

   Le volume total des terrassements effectués en un an est de l'ordre de 35.000 m3.

4. Cultures pratiquées : légumes : choux, haricots, patate douce, tabac une parcelle expérimentale de 0,5 ha environ.
5. Système d'irrigation : par gravité, à la raie (billons) Mr. Rubayiza vient d'acquérir, avec une aide du FAC, un système mobile d'irrigation par aspersion, pouvant couvrir les 2/3 de son périmètre de 40 ha. Le pompage se fera dans le collecteur central ou le canal adducteur en RD, ou des canaux secondaires.

Appendix 3

Base line economic analysis of small scale commercial and artesanal Tilapia aquaculture operations in Rwanda.

For the purpose of the exercise we have assumed the following criteria:

Small scale commercial

- Deeded Land can be Purchased
- Adequate water availability and soils
- Farm size 10 acres
- Mono sex Tilapia fingerlings available
- Local Interest by Knowledgeable Entrepreneur, profits are his income.
- Availability of secured short and long term loans at 14%, long term loan pay back over 7 years 2 year grace period for 50% of Capital Investment Needs.
- Construction costs 2,750 U.S. per ha or 385,000 FRW
- Labour at 125 FRW per day
- Fingerling costs 5.5 FRW each, stocking at 6,000/acre yields 2.4 tons/acre per cycle
- Water exchange by gravity
- Stand-by aeration used only 630 hours a year
- Fish sold at pond side for average 180 FRW per kg.

Artesanal/Farm Operation

- Labor rates of 125 FRW only used to calculate construction costs.
- ** Fish production 1.8 kg/ha/year 40% home consumption and loss, of remaining 60%, 40% sold at 150 FRW,60% at 200 RFW.
- *** Fish production 1.8 kg/ha/year 10% loss, of remaining 90%, 40% sold at 150 FRW,60% at 200 RFW.
- Labor for maintenance and management not calculated as it was assumed that if not involved in fish culture farmer was involved in other non renumerated field.

FINANCIAL ANALYSIS SMALL SCALE COMMERCIAL

Capital Investment Needs	**U.S. Dollars**
A. Land Purchase (500 per acre)	5,000.00
B. Development Costs (2,616 per acre)	26,160.00
C. Equipment (3 aerators,nets,lab., one pick-up used,holding tanks)	21,340.00
Sub-total Capital	52,500.00

Sales

A. Tilapia (2.4T X10X2X1.28 U.S.)	61,440.00

Production Costs Per Year (2 cycles)

A. Fingerlings	4,715.00
B. Manure/Fertilizer/Feed	15,840.00
C. Labour	5,085.00
D. Energy and Fuel	3,400.00
E. Office support, Accounting	1,200.00
E. Miscellaneous	2,500.00
Sub-total Production Costs	**32,740.00**
Gross Profit	**28,700.00**

CASH FLOW FINANCIAL ANALYSIS

ITEM DESCRIPTION	**YEAR (U.S. Dollars X 1000)**						
	1	**2**	**3**	**4**	**5**	**6**	**7-10**
Gross Profit	28	28	28	28	28	28	112
Capital/Int L.T.	-	-	10.3	10.3	10.3	10.3	10.3
Capital/Int S.T.	3.4	3.4	3.4				
Net Cummulative Profit Prior Taxes	**28**	**52**	**66**	**81**	**98**	**116**	**218**

ARTESANAL OPERATION

The estimated cash value of inputs for a one ha artisanal operation are as follows:

IMPUT	**DESCRIPTION**	**COST U.S. Dollars**
Capital		
Pond	Labor (125 RWF/Day)	
	3 M3 per man/day	2,550.00
	Inlet/Outlet	200.00
		2,750.00

Production Costs		
Fingerlings	(50/50 Purchase/Produced) (2 cycles/year)	931.00
Feed/Fertilizer		334.00
Miscellaneous	(Equipment)	72.00
		1,337.00
Sales		
Fish **	(194,400 FRW)	1,388.57
Fish ***	(291,600 FRW)	2,082.85
NET INCOME PRIOR TAXES		
**		51.57
***		745.85

The benefits of the first hypothesis are that a substancial amount of animal protein is made available at the rural level.

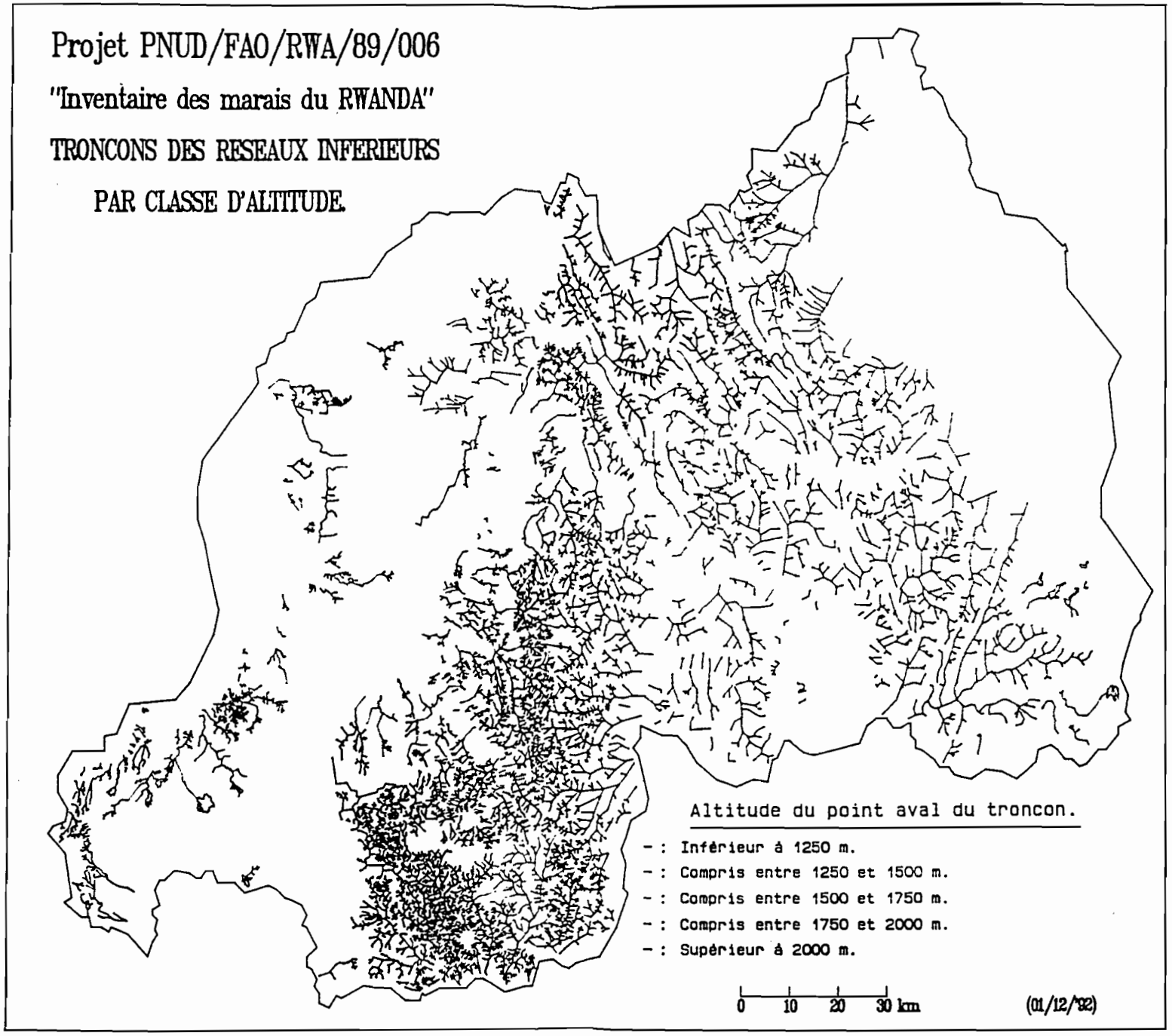
SENSITIVITY ANALYSIS

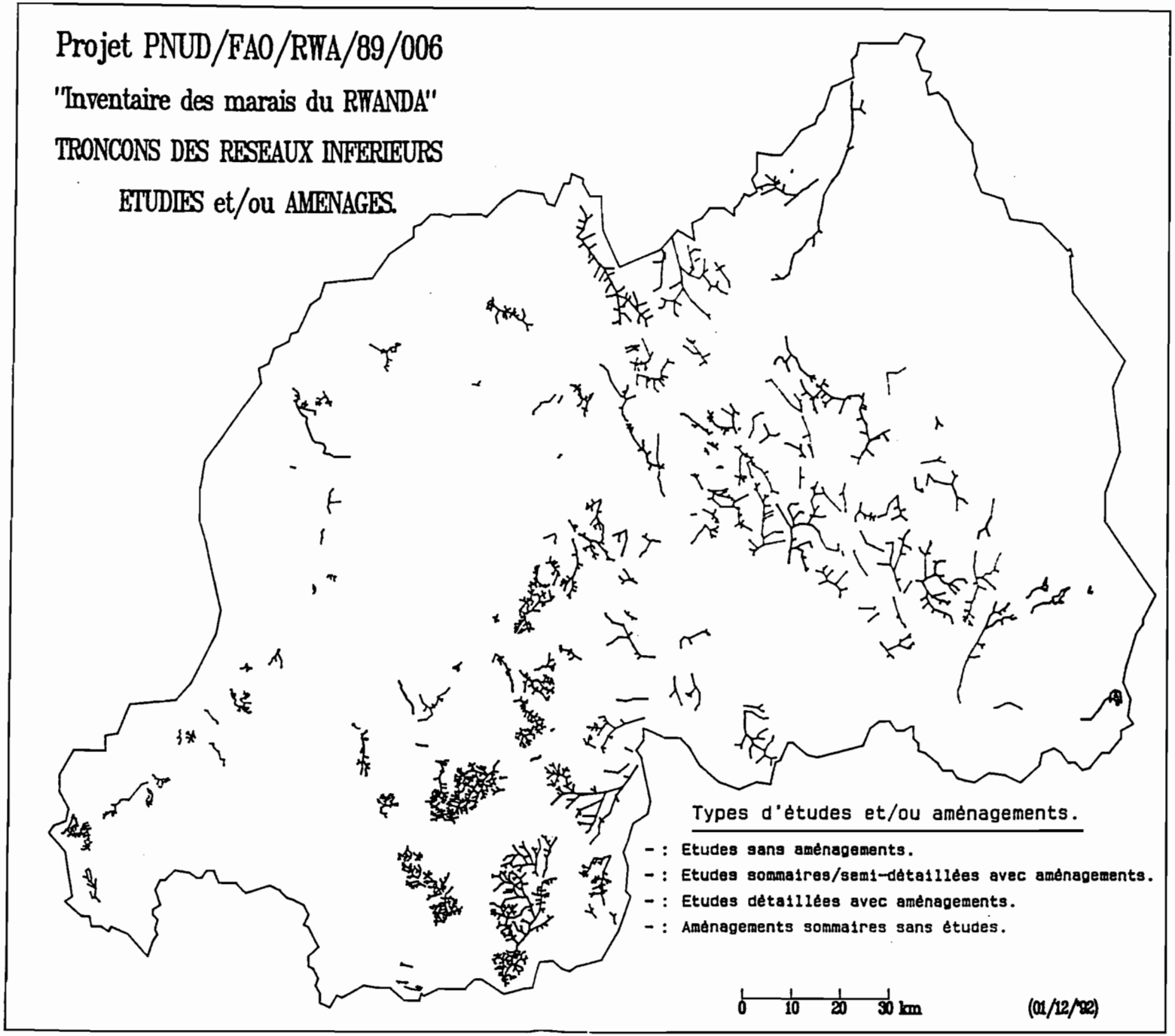
SMALL SCALE AQUACULTURE OPERATION
(U.S. DOLLARS)

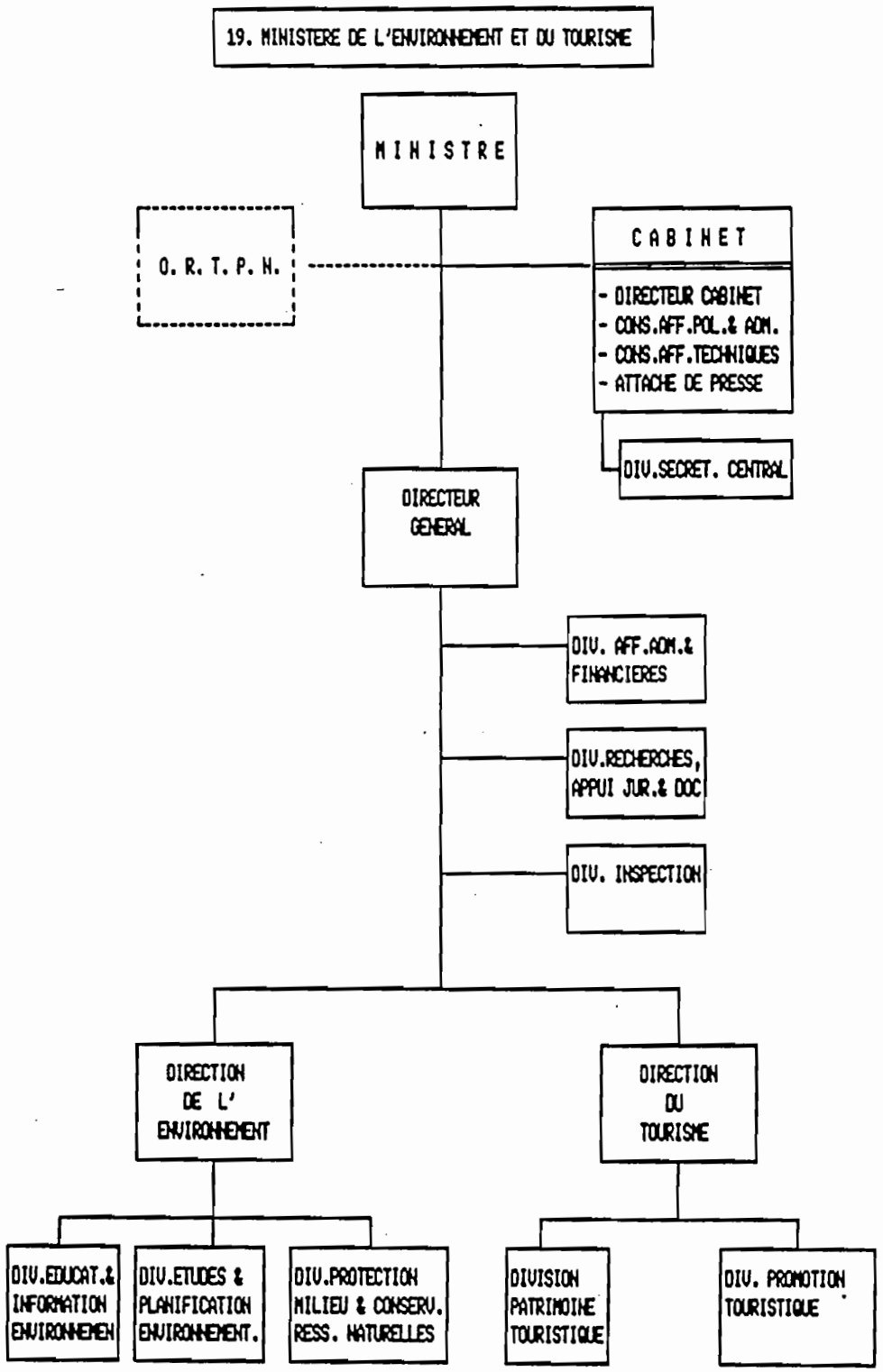
ITEM DESCRIPTION	INCREASE 10%	INCREASE 20%	DECREASE 10%	DECREASE 20%	RESULT GYPA *
Fish Production (FP)	X				5,144.00
		X			9,288.00
				X	**-12,288.00****
Production Costs (PC)	X				- 2,645.00
			X		2,645.00
Combined (FP and PC)	PC			FP	**-14,933.00*****
	FP			F	7,789.00

* GROSS YEARLY PROFIT ADJUSTMENT PRIOR CAPITAL AND INTEREST REPAYMENT AND TAXES.

** BREAK-EVEN POINT
*** NOT SOLVENT FINANCIAL ASSISTANCE NEEDED AFTER 3RD YEAR.
** Break Even Point


Projet PNUD/FAO/RWA/89/006
"Inventaire des marais du RWANDA"
TRONCONS DES RESEAUX INFERIEURS
PAR CLASSE D'ALTITUDE.
Altitude du point aval du troncon.
- : Inférieur à 1250 m.
- : Compris entre 1250 et 1500 m.
- : Compris entre 1500 et 1750 m.
- : Compris entre 1750 et 2000 m.
- : Supérieur à 2000 m.
0 10 20 30 km
(01/12/92)


Projet PNUD/FAO/RWA/89/006
"Inventaire des marais du RWANDA"
TRONCONS DES RESEAUX INFERIEURS
ETUDIES et/ou AMENAGES.
Types d'études et/ou aménagements.
- : Etudes sans aménagements.
- : Etudes sommaires/semi-détaillées avec aménagements.
- : Etudes détaillées avec aménagements.
- : Aménagements sommaires sans études.
0 10 20 30 km
(01/12/92)



28 JUILLET 1992

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